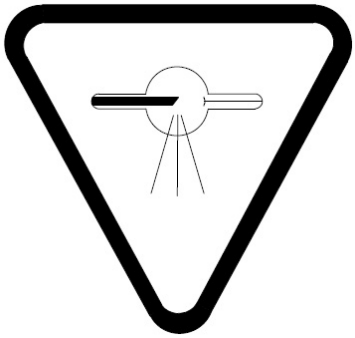
Safe Installation and Use of Medical X-Ray Equipment



Adherence to this radiation safety manual ensures consistent safe use of X-ray emitting devices throughout the lower mainland health authorities including VCHA, FHA, PHC, and Medical Imaging in PHSA. Refer to the LMMI Intranet page for current version.

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1. Policy on Radiation Safety

1.1 Vancouver Coastal Health Authority (VCH), Fraser Health Authority (FH), Providence Health Care (PHC) and Provincial Health Services Authority (PHSA) are committed to conducting operations that involve the use of x-ray ionizing radiation in a manner that ensures the radiological health and safety of personnel, the public, the facility and the environment.

1.2 VCH, FH, PHC and PHSA strive to not only comply with applicable regulations, but be leaders in the development and implementation of radiation safety best practices based on current, internationally recognized standards and practice.

2. Program Scope

2.1 Equipment emitting ionizing radiation, such as the x-ray systems used in Radiology and Cardiology, have valuable applications in clinical diagnosis and intervention.

2.2 Correct procedures must be followed for safe use of x-ray systems. This covers the lifespan of equipment, from planning, installation to disposal to mitigate risk to staff and the public.

2.3 This safety manual provides a framework for core responsibilities, practices and procedures required under Health Canada Safety Code 35, WorkSafe BC Regulations and the Diagnostic Accreditation Program of BC Accreditation Standards.

2.4 This manual applies to the four Health Authorities operating x-ray equipment in the Lower Mainland of BC (Fraser Health, Providence Health Care, Provincial Health Services Authority and Vancouver Coastal Health) which provide x-ray based diagnostic and interventional procedures.

2.5 All departments staff must comply with the practices and procedures documented in this program manual as a minimum requirement. Additional practices and procedures may be maintained at a department level to accommodate specific operational needs.

3. Contractor Safety

3.1 This manual and online radiation safety courses (see Section 12) are available to all contractors.

3.2 All contractors (e.g. physicians and support services) must comply with the practices and procedures documented in this program manual as a minimum requirement. They must ensure that their staff are informed of radiation hazards and are adequately trained to protect themselves against these hazards.

3.3 Contractors must make copies of their work procedures and education and training records available to members of the X-RSC SRSOs or WorkPlace Health upon request.

4. Applicable Agencies, Regulations and Standards

4.1 WorkSafeBC is the provincial authority that administers the *Occupational Health and Safety Regulation* which includes provisions for protecting workers from exposure to ionizing radiation such as those found in *Part 7: Noise, Vibration, Radiation and Temperature*. WorkSafeBC's Internet homepage address is www.WorkSafeBC.com.

4.2 Health Canada, through the Consumer and Clinical Radiation Protection Bureau, regulates the design and performance of all x-ray equipment under the *Radiation Emitting Devices Act* and *Regulations*. This group also prepares safety codes, such as *Safety Codes 30, 35 and 36*. Health Canada's Internet homepage address is www.hc-sc.gc.ca.

4.3 The Diagnostic Accreditation Program (DAP) is a Program of the College of Physicians and Surgeons of British Columbia that is mandated to assess the quality of diagnostic services in the province through accreditation activities. A requirement to meet basic safety standards is included in the accreditation process. The DAP's Internet homepage address is www.cpsbc.ca/programs/dap.

5. Roles, Qualifications and Responsibilities

5.1 Responsible Owner

5.1.1. It is ultimately the responsibility of the Senior Executive Team of the respective Health Authority to ensure the radiation safety of staff, the public, the facility and the environment within their purview.

5.1.2. Responsibilities are delegated to qualified staff as listed below.

5.1.3. Each department that operates x-ray equipment must assign at least one senior manager/director as the "Responsible User."

5.2 Workplace Health

5.2.1. Act as a liaison to internal and external stakeholders for activities that have multi-department and multi-agency implications,

5.2.2. Facilitate sharing of practices between departments and across Health Authorities (HAs),

5.2.3. Develop and implement education and training programs on radiation protection, in collaboration with stakeholders,

5.2.4. Advise and provide support to frontline staff and managers/supervisors in radiation safety matters,

5.2.5. Collaborate with, advise, and provide support to Site Radiation Safety Officers (SRSOs),

5.2.6. Facilitate establishment of X-ray Radiation Safety Committee(s),

5.2.7. Participate in investigations,

5.2.8. Participate in audits to monitor and evaluate implementation and the effectiveness of the Program.

5.3 Responsible User

5.3.1. Monitor and manage the overall implementation and performance of the Program, as well as Quality Control (QC) requirements, within his/her department/portfolio,

5.3.2. The number of SRSOs are chosen based on the scope and complexity of X-ray equipment and activities within the Responsible User's department/portfolio such that the Program and QC requirements can be successfully implemented and managed,
5.3.3. SRSOs may be appointed at the level of a unit department, facility or region depending on the extent to which x-ray procedures are performed and the magnitude of risk associated with these procedures,
5.3.4. Engage the services of a qualified Medical Physicist where required by the Program,
5.3.5. Allocate human, equipment and financial resources in order to support the implementation of the Program as recommended by the SRSO, Workplace Health, Medical Physicists, Regional Radiation Safety Officer and/or X-ray Radiation Safety Committee.

5.4 Site Radiation Safety Officer (SRSO)
5.4.1. Possess specialized Radiation Safety Officer training recognized by the Health Authority,
5.4.2. Assume a lead role at the site or department level to implement and enforce the program, including:
5.4.2.1. Facilitating, in conjunction with Workplace Health and Medical Physicists, the implementation and monitoring of the Program within their site. (Medical Imaging SRSOs will also work in conjunction with Medical Imaging Quality Coordinators).
5.4.3. Engaging, in advance, a qualified Medical Physicist, Biomedical Engineering Radiology Service and Workplace Health in the planning and construction of an installation, or when modifications are planned for an existing facility.
5.4.4. Engaging, in advance, a qualified Medical Physicist and Biomedical Engineering Radiology Service in scheduling Quality Control testing for all radiation emitting devices in their site, as mandated by Health Canada's Safety Codes and the 2010 Diagnostic Accreditation Program (DAP). (Medical Imaging SRSOs will also work in conjunction with Medical Imaging Quality Coordinators).
5.4.5. Ensuring that new equipment is registered with the DAP.
5.4.6. Being involved when new procedures and/or significant increases in workload are planned and/or considered so that potential impacts on staff exposure can be estimated / determined. Engage Workplace Health in advance when required.
5.4.7. Determining the applicability of the Program to the site, and working with managers/supervisors and radiation safety staff to develop additional safety procedures to account for site-specific considerations, where required.
5.4.8. Periodically reviewing the site safety procedures, and updating them as required. Submit requests for updates to the Program to Workplace Health.
5.4.9. Providing and/or facilitating provision of safety information to frontline staff.
5.4.10. Working with managers/supervisors to co-ordinate education and training of staff.
5.4.11. Working with managers/supervisors to ensure that all occupational exposed staff, as defined in the Program, are assigned and wear personal dosimeters.
5.4.12. Working with managers/supervisors/Quality Coordinators to ensure correct selection, use and storage of PPE.
5.4.13. Reviewing dosimetry reports, and initiating investigations of any known or suspected cases of excessive exposure with the assistance of Workplace Heath and/or a Medical Physicist.
5.4.14. Auditing correct personal dosimeter use and storage by monitored staff.

5.4.15. Auditing staff sign-off of dosimetry records.
5.4.16. Setting periodic scheduled inspections for the site.
5.4.17. Ensuring that the established safety procedures are being followed and reporting any noncompliance to the Responsible User.
5.4.18. Exercising authority, with the assistance of a Medical Physicist and Biomedical Engineering Radiology Service, to stop clinical use of equipment if the equipment is deemed unsafe and may put staff or patients at risk.
5.4.19. Coordinating radiation safety surveys of the site as per *section 7*, and working with managers/supervisors to correct any deficiencies identified.
5.4.20. Ensuring that records and reports required by the Program are maintained and submitted as per section 13.
5.4.21. Participating in the investigation of radiation-related incidents/accidents, and assessing the adequacy of corrective measures to prevent recurrence. Report these incidents to Workplace Health and the site X-Ray Safety Committee.

5.5 Medical Physicist
5.5.1. Must be certified to a standard recognized by the Health Authority.
5.5.2. Must be knowledgeable with and apply BC specific regulation and design criteria.
5.5.3. Participate in the procurement of new equipment,
5.5.4. Assist SRSO with documentation required for new equipment registration,
5.5.5. Assess shielding requirements for new equipment installations and/or modifications of current installations,
5.5.6. Perform acceptance testing on all x-ray systems used on humans purchased by the department,
5.5.7. Perform, on a periodic basis, an assessment of room shielding via radiation scatter surveys,
5.5.8. Must exercise authority, with the assistance of a Biomedical Engineering Radiology Service, to stop clinical use of x-ray equipment if the equipment is deemed unsafe and may put staff or patients at risk,
5.5.9. Participate in investigations of high or unnecessary radiation exposure to staff and patients, where required,
5.5.10. Communicate with Federal or Provincial Authorities when required,
5.5.11. Collaborate with Workplace Health and SRSOs on personnel dosimetry matters, where required,
5.5.12. Provide educational sessions for staff,
5.5.13. Participate in site audits.

5.6 Medical Directors
5.6.1. Support the implementation of the Program within their scope of responsibility with regards to medical practices,
5.6.2. Support decisions made by Responsible User, SRSO, Workplace Health, Medical Physicists and/or X-ray Radiation Safety Committee regarding implementation of the Program.

5.7 Operations Directors/Managers/Site Coordinators/Supervisors
5.7.1. Allocate human, equipment and financial resources in order to support the implementation of the Program at the site level as recommended by the Responsible User, SRSO, Workplace Health, Medical Physicists and/or X-ray Radiation Safety Committee. This includes provision of:
5.7.1.1. Personal protective equipment (PPE),

5.7.2. Staff education and training,
5.7.3. Personnel dosimetry,
5.7.4. Quality assurance of x-ray equipment and PPE, and
5.7.5. Calibration of detection equipment.
5.7.6. Work collaboratively with the SRSO, Workplace Health, Medical Physicists and/or X-ray Radiation Safety Committee to implement the Program.
5.7.7. Verify that the control measures to minimize radiation exposure as identified in the Program and by the SRSO are in effect.
5.7.8. Advise the SRSO if a new procedure involving radiation is going to be developed.
5.7.9. Ensure correct selection, use and storage of PPE and personal dosimeters by staff.
5.7.10. Keep staff education and training records as per *section 12*. Make these records available to the SRSO, Workplace Health and Medical Physicists upon request.

5.8 X-ray Radiation Safety Committee (X-RSC)
5.8.1. Departments or sites may choose to establish committees at the level of a department, facility, or region depending on the extent to which x-ray procedures are performed and the magnitude of risk associated with these procedures,
5.8.2. Refer to the Appendix C for the X-RSC reporting structure. The specific roles and responsibilities are listed within the Terms of Reference (TOR).

5.9 X-Ray Equipment Operators
5.9.1. Must be certified, and acquire re-qualification or refresher training, to a recognized standard such as:
5.9.1.1. CAMRT or
5.9.1.2. Royal College of Physicians and Surgeons of Canada
5.9.2. Must carry out radiological procedures in a manner, which does not cause unnecessary exposures to staff,
5.9.3. Have documented training in:
5.9.3.1 The safe operation of the x-ray equipment and accessories used in the facility,
5.9.3.2 The radiological procedure being performed,
5.9.3.3 Patient positioning for accurate localization of regions of interest,
5.9.3.4 All manufacturer-specified quality assurance procedure, if necessary; and,
5.9.4 Radiation protection procedures and measures.
5.9.5 Be familiar with, and have access to, the manufacturer's operator manual for the specific equipment used in the facility.
5.9.6 Recognize the radiation hazards associated with their work and take measures to minimize them.
5.9.7 Have a thorough understanding of safe working methods and appropriate techniques and procedures, including the appropriate use of personal protective equipment.
5.9.8 Have documented clinical training, in accordance to a recognized standard, on new radiological procedures before commencing independent work on patients.
5.9.9 Ensure the safety of staff involved in the procedure and in the x-ray area.
5.9.10 Participate fully in established Quality Control programs.
5.9.11 Report any problems, issues or risks to medical and/or operations management staff, as applicable.
5.9.12 Be familiar with the requirements of this manual and Safety Code 35

5.10 Biomedical Engineering Radiology Service

5.10.1 Must possess qualifications required by any relevant federal and provincial regulations and/or statutes, and by the Health Authority,

5.10.2 Must complete radiation safety training as outlined in section 12. Must wear protective equipment or use a lead barrier when present in a room during equipment operation.

5.10.3 Correctly use assigned personal radiation monitoring devices (personal dosimeters) at all times when working with or near x-ray equipment,

5.10.4 Must possess qualifications or training with specific equipment prior to servicing such equipment without direct supervision from a trained individual,

5.10.5 Should participate in the procurement of new equipment and with site planning,

5.10.6 Perform acceptance testing on all equipment entering the hospital *prior* to first clinical use, and maintain documentation for each piece of equipment,

5.10.7 Must maintain service documentation and preventative maintenance history for all equipment,

5.10.8 Should participate in radiation safety committee(s),

5.10.9 Must service equipment in manner that is safe for themselves, other staff and the public,

5.10.10 Must exercise authority, with the assistance of a Medical Physicist, to stop clinical use of equipment if the equipment is deemed unsafe,

5.11 All Staff

5.11.1 Follow applicable procedures and controls specified in the Program and department safe work procedures, including correct use of protective equipment and personal radiation monitoring devices (personal dosimeters).

5.11.2 Review personal dose reports, where dosimeters are assigned.

5.11.3 Participate in training courses on radiation protection, apply knowledge on dose reduction and limitation, and keep informed on developments in radiation safety within the department (refer to section 12),

5.11.4 Immediately report any radiation incident or accident to the supervisor and SRSO. Employee incidents must be documented using the Workplace Health Call Centre, 1-866-922-9464 (toll free).

5.12 Operator Trainees (including students)

5.12.1 May only operate equipment under direct supervision of qualified staff,

5.12.2 Must complete education and training requirements as per this manual (refer to Table 4: Education and Training Requirements for specific job category educational requirements,

5.12.3 Follow applicable procedures and controls specified in the Program and department safe work procedures, including correct use of protective equipment and personal radiation monitoring devices (personal dosimeters).

6. Purchase and Installation of X-Ray Equipment

Selection and Planning Process

6.1 A Medical Physicist and Biomedical Engineering must be consulted prior to all purchases of x-ray equipment to ensure that the equipment meets the design requirements listed in applicable safety codes.

6.2 Before construction of a room intended for x-ray use, or prior to reassigning a room for x-ray use, the shielding and room design requirements must be assessed by a qualified Medical Physicist. This information must be provided to the SRSO.

6.3 Collaboration is required between the Manager/Supervisor, SRSO, Biomedical Engineering Radiology Service, Medical Physicist, Facilities Planning, Facilities Maintenance & Operations and the equipment supplier from the planning stage through installation and start-up.

6.3.1. This serves to:

6.3.1.1. Confirm that the planned site location can accommodate, or can be renovated to accommodate the equipment,

6.3.1.2. Ensure that adequate planning and implementation of downstream activities occurs, including: shielding assessment, design and installation; acceptance testing; purchase of PPE; and education and training of personnel,

6.3.1.3. Ensure optimal quality of staff safety and compliance with applicable provincial regulations.

Room Design for Dedicated X-ray Rooms

6.4 Health Canada Safety Code 35 requires that x-ray rooms must be designed and shielded in such a way that radiation levels in:

6.4.1. Controlled areas will not cause a radiation worker to exceed 20 mSv per year.

6.4.2. Uncontrolled areas will not cause any person to receive more than 1 mSv per year.

A controlled area is defined as a location where staff are routinely monitored for radiation exposure. For example the control booth of an x-ray room is a controlled area.

<u>General Requirements</u>

6.5 Equipment or procedure rooms with stationary X-ray equipment should be equipped with a self-closing door, and must be identified with warning signs incorporating the X-ray warning symbol and the words “Unauthorized Entry Prohibited” (see section 10),

6.6 Mobile X-ray equipment used routinely in one location must be considered as a fixed installation and the shielding needs for the equipment and room must be determined accordingly,

6.7 The X-ray equipment should be positioned in the room in such a way that, during an irradiation, no one can enter the room without the knowledge of the equipment operator,

6.8 The X-ray beam must always be directed toward adequately shielded areas. Particular attention must be paid to the adequacy of shielding for chest radiography using wall-mounted image receptors,

6.9 The primary radiation beam must scatter at least twice before scatter radiation enters the operator’s console.

<u>Shielding Requirements</u>

6.10 Shielding needs must be assessed and designed by a qualified Medical Physicist,.

6.10.1. Managers/Supervisors, in consultation with SRSOs, must work with the Medical Physicist on gathering information on the parameters that govern shielding, which includes:

6.10.1.1. Maximum X-ray Workload (W) = the operational time, or the amount of use, of the X-ray equipment. Also accounted for is workload distribution across a range of operating voltages. Alternatively, the patient throughput and type of exams performed maybe provided.

6.10.2. Occupancy factor (T) = the fraction of time that the area under consideration is occupied by the individual (employee or public) who spends the most time at the location while the X-ray equipment is operating.

6.10.3. Use factor (U) = the fraction of the workload during which the X-ray beam is pointed in the direction under consideration (e.g. walls, floors, ceilings and doors).

6.10.4. All assumptions made when collecting W, T and U information must be explicitly stated.

6.11 New installations, and installations which have undergone modifications, must be surveyed by a qualified Medical Physicist prior to clinical use.

6.11.1. The SRSO must be contacted when any changes made may produce a radiation hazard (such as alteration of protective barriers, equipment relocation, or changes in operating procedures or occupancy factors),

6.11.2. Shielding must be constructed to form an unbroken barrier,

6.11.3. A control booth must be provided for the protection of the operator, if applicable, for the type of equipment. Mobile protective screens must not be considered adequate as a control booth for radiological procedures.

6.11.4. The exposure switch must be placed in the control booth a minimum of 1 meter from the entranceway between the booth and examination room.

Equipment Acceptance Testing

6.12 A qualified Medical Physicist and Biomedical Engineering Radiology Service must perform acceptance testing of new x-ray equipment installations or relocated fixed equipment prior to clinical use,

6.13 Persons performing acceptance testing must be independent from the manufacturer.

7. Radiation Protection Surveys

Objectives

7.1 Radiation Protection Surveys must meet the requirements of Health Canada Safety Code 35.

Co-ordination and Frequency

7.2 It is the responsibility of the SRSO, with the assistance of Quality Coordinators and Medical Physicists to coordinate radiation protection surveys.

Room and Equipment Survey

7.3 Room shielding and adjacent room usage must be assessed at least every four years, or if a significant change has been made to a department or area, or an investigation of a high exposure notification deems it necessary,
7.4 The survey contents must meet the requirements set for in the Diagnostic Accreditation Program Standards, BC College of Physicians and Surgeons.

Lead and Lead-Equivalent Personal Protective Equipment (PPE) Survey

7.5 All PPE surveys must be conducted annually..

7.6 A survey should be conducted on specific PPE when physical damage isuspected,

7.7 The survey will include visual inspection and imaging under x-ray image as per HA protocols,
7.8 PPE that does not meet quality control requirements must be immediately removed from use

Report Record Keeping

7.9 Written survey reports must be maintained by the SRSO,
7.10 Written survey reports must be made available to Workplace Health and front line personnel upon request,
7.11 Each hospital will retain a copy of all survey reports indefinitely.

8. Occupational Exposure Monitoring

WorkSafeBC Action Level

8.1 Under WorkSafeBC's Occupational Health and Safety Regulation, if a worker receives, or may receive, an annual effective dose equal to or greater than the Action Level of 1 mSv over the past 12 months, the employer must develop and implement an exposure control plan.

Occupational Exposure Limits

8.2 Dose limits for radiation workers apply only to irradiation resulting directly from their occupation and do not include radiation exposures from other sources, such as medical diagnosis and background radiation.

Table 1: Effective Dose Limits

Person's Status	Period of Time	Effective Dose (mSv)
General Worker, Member of the Public, WorkSafeBC **ACTION LEVEL**	Last 12 months	1
Radiation Workers (including pregnant Radiation Workers)	Last 12 months	20
Pregnant Radiation Workers (at the abdomen)	Balance of the pregnancy	4

Table 2: Equivalent Dose Limits

Organ or Tissue	Person's Status	Period of Time	Equivalent Dose (mSv)
Lens of Eye	Radiation Worker	Last 12 Months	50
Lens of Eye	Radiation Worker	Last 60 Months	100
Skin	Radiation Worker	Last 12 Months	500
Hands and Feet	Radiation Worker	Last 12 Months	500

Pregnant Radiation Workers

8.3 Pregnant workers should notify their supervisors, SRSO or Workplace Health upon knowledge of pregnancy or potential pregnancy so that steps maybe taken to ensure that work duties during the remainder of the pregnancy are compatible with occupational dose limits. Notification in writing, such as via email, is recommended,

8.4 Under Part 7 of WorkSafeBC's *Occupational Health and Safety Regulation*, when requested by a pregnant worker or by a worker intending to conceive a child, the employer must make counseling available with respect to the reproductive hazards associated with exposure to ionizing radiation. Contact Workplace Health for assistance.

Personnel Dosimeters

Personnel Required to Wear Dosimeters

8.5 Personnel that have exposures that exceed, or may exceed, the Action Level of 1 mSv per year must wear a **whole body dosimeter**.

8.6 Personnel that have exposures to the head that exceed or may exceed 5% of the equivalent dose limit to the eye of 150 mSv per year (i.e. ≥ 7.5 mSv/yr) must wear a **collar dosimeter** and use leaded glasses when working around radiation emitting devices.

8.7 **Fetal dosimeters** will be made available to pregnant workers and staff upon request.

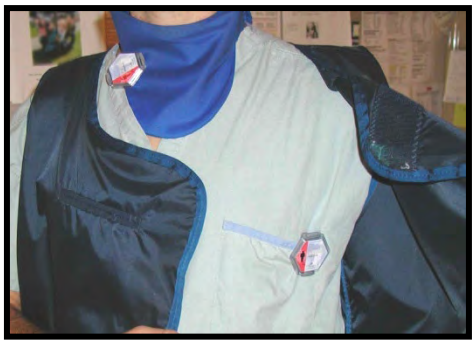
8.8 All persons assigned a dosimeter(s) must wear it at all times when operating x-ray emitting devices and/or standing near x-ray emitting devices while in operation. Wear the dosimeter(s) every shift for the duration of the shift.

8.9 If you are not sure if you should be wearing a dosimeter, contact your supervisor, SRSO or Workplace Health.

Provision of Personal Information

In the event of an atypical badge reading or accidental staff exposure, a review of historical radiation exposure maybe necessary as part of the investigation. The National Dose Registry provides historical exposure data.

Wear Positions



8.10 Whole body dosimeter:
- 8.10.1. Wear on the front of the torso between the waist and shoulder (be consistent).
- 8.10.2. The label must face out (away from the body).
- 8.10.3. The dosimeter must be **under** the apron.

8.11 Collar dosimeter:
- 8.11.1. Wear on the front of the body at the neck.
- 8.11.2. The label must face out (away from the body).
- 8.11.3. The dosimeter must be **outside** the lead apron and thyroid shield.

8.12 Fetal dosimeter:
- 8.12.1. Wear at the waist on the abdomen.
- 8.12.2. The label must face out (away from the body).
- 8.12.3. The dosimeter must be worn **under** the lead apron.

Wear Periods

8.13 Whole body and collar dosimeters are typically worn for 3 months (one quarter of a year) at a time and then exchanged.

8.14 Fetal dosimeters are typically worn for 1 month at a time and then exchanged.

Storage and Handling

8.15 Control dosimeters must be stored in a location away from radiation sources.

8.16 Personnel dosimeters must be stored with the control badge when not in use. Use of appropriately located “badge boards” is recommended.

8.17 Dosimeters are personalized. Under no circumstances may an assigned dosimeter be shared with or loaned to another person.

8.18 Report any lost or damaged dosimeters to the SRSO and supervisor. Where the chain of custody of a dosimeter is disrupted, the dosimeter may not be read, at the discretion of the SRSO in consultation with Workplace Health. This is to ensure that doses assigned to staff are as accurate as possible.

Exposure Review

8.19 Dosimetry result reports must be posted in readily accessible areas when received so that staff can monitor their exposures over time,

8.20 Dosimetry reports must be kept by the departments for the life of the facility.

8.21 Personnel should initial their reading on each report to acknowledge they have reviewed and are aware of their dose.

8.22 Dosimetry reports will be reviewed and compared to occupational dose limits in Table 1 and Table 2.

8.23 Local and regional dosimetry reports will be audited and analyzed by Workplace Health and the RRSO,

8.24 The SRSO, staff, and/or Workplace Health must initiate an investigation where an exposure is found to be above an occupational exposure limit or will potentially be above an exposure limit where a quarterly dose is extrapolated to an annual dose limits,

8.25 A supplementary investigation tool is provided in Appendix A.

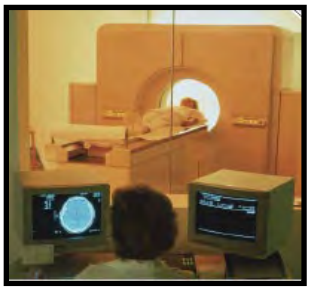
9. Engineering Controls

9.1 When selecting the use of control options for radiation protection, the hierarchy of control model should be utilized. Controls should be selected in the following order:
- 9.1.1. Engineering controls.
- 9.1.2. Administrative controls.
- 9.1.3. Personal Protective Equipment (PPE).

9.2 Engineering controls help to reduce exposure by isolating the hazard (e.g. lead shielding in walls that prevents x-rays from entering adjacent spaces) or the operator (e.g. lead shielded control booths for CT scan rooms).

9.3 Wherever practicable to reduce employee exposure to x-rays, engineering controls must be implemented. All employees are required to use all available engineering controls.

9.4 Examples of engineering control technology include:
- 9.4.1. Lead lined room walls.
- 9.4.2. Control booths (Figure a below).
- 9.4.3. Equipment mounted lead drapes or screens (Figure b below).
- 9.4.4. Ceiling mounted lead screens (Figure c below).
- 9.4.5. Mobile lead screens (Figure d below).



(a)

(b)

(c)

(d)

10. Administrative Controls

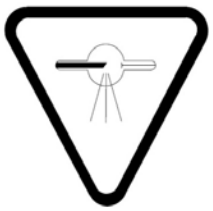
10.1 Administrative controls are work practice controls designed to reduce the likelihood, or amount, of an occupational exposure to x-rays by altering the way a task is performed.

10.2 Work practice controls include:
- 10.2.1. Posting of warning signs on x-ray equipment and at the entrances to x-ray areas to warn personnel and the public about a potential x-ray hazard.
- 10.2.2. Development and implementation of work procedures that incorporate exposure reduction parameters such as time and distance.

Radiation Warning Symbols

10.3 X-ray warning symbols must be:
- 10.3.1. Displayed in two contrasting colors;
- 10.3.2. Be visible and identifiable from a distance of 1 meter;
- 10.3.3. Be at least 2 cm high and at least 2 cm wide;
- 10.3.4. Bear the words “CAUTION: X-RAYS – ATTENTION: RAYONS X”; and
- 10.3.5. Conform to the diagram shown below:

Only to be used in Nuclear Medicine



Required for X-Rays

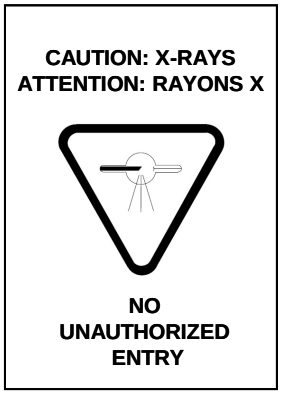
Radiation Warning Labels on X-ray Equipment

10.4 All x-ray equipment (stationary and mobile) purchased or refurbished after 2010 must display on the control panel a warning sign that is:
- 10.4.1. Permanent, in clear view, and legible,
- 10.4.2. Indicates the possibility of hazardous x-ray emission when the equipment is in operation (eg radiation warning symbol), and
- 10.4.3. Prohibits unauthorized use.

10.5 Labels on equipment purchased or refurbished prior to 2010 may have some variation in the specifics listed in this section and 9.2.1 as long as hazard notification is present in some form.

Radiation Warning Signs for Rooms with Stationary X-ray Equipment

10.6 Radiology rooms with stationary X-ray equipment must be identified with warning signs incorporating an X-ray warning symbol and the words “Unauthorized Entry Prohibited” (examples shown below).



Radiation Warning Signs for Rooms with Mobile X-ray Equipment

10.7 Rooms, such as OR theatres, must have a warning sign (as described in *section 10.6*) posted at the points of access to the room when mobile x-ray equipment is in use.

10.8 The equipment operator, as defined in *section 5.9*, is responsible for affixing the sign to the outside of the door(s) prior to the procedure commencing, and removing the sign(s) upon completion.

Work Procedures – Introduction

10.9 Written work procedures are designed to eliminate or minimize staff exposures to radiation while carrying out medical procedures or tasks that may result in staff being exposed to x-ray radiation.

10.10 Time, distance, and shielding are the fundamental methodologies to reduce or eliminate staff exposures and must be incorporated into safe work procedures where practicable.

10.11 Written work procedures (and associated education and training) must be presented to all new staff before they carry out the procedure or task. If new written procedures are developed, they must be presented to all existing staff in a timely manner.

10.12 Site specific written work procedures are updated and approved by SRSOs as per guidelines provided by the BC College of Physicians and Surgeons.

General Practices (All X-ray Equipment)

10.13 X-ray equipment may only be operated by qualified individuals that have been trained on the equipment and the procedures being performed (refer to page 8 for details).

10.14 An x-ray room must not be used for more than one radiological investigation simultaneously.

10.15 X-ray machines which are energized and ready to produce radiation must not be left unattended.

10.16 All entrance doors to an x-ray room must be closed while making an x-ray exposure.

10.17 Except for those persons whose presence is essential, all persons must leave the room when the irradiation is carried out.

10.18 Direct radiation exposure of personnel by the primary x-ray beam must never be allowed.

10.19 Where there is a need to support weak patients, holding devices should be used. Where this is not possible, protective aprons and gloves must be worn and the worker positioned so as to avoid the X-ray beam. No person should regularly perform these duties. See Appendix D.

10.20 Personnel must, at all times, keep as far away from the source of exposure as practicable.

10.21 Deliberate irradiation of an individual for training purposes or equipment evaluation must never occur.

10.22 All personnel must use available protective devices.

Practices with Respect to Third Party Viewing (All X-ray Equipment)

10.23 Except for those persons whose presence is essential, all persons must leave the room when the irradiation is carried out.

10.24 Where it is deemed necessary for a third party viewer to be present in the room, (e.g. an interpreter is required or a parent to comfort a child), these individuals must be provided with protective aprons (and gloves where applicable), and be positioned so as to avoid the primary X-ray beam. No person should regularly perform these duties.

10.25 The X-ray equipment operator must inform all third party persons present in the room during an irradiation of the risks associated with their exposure.

Practices with Respect to Fixed Radiographic Equipment

10.26 When possible, irradiation must be controlled from the control panel located in the shielded area. In the case of special techniques that require control of the irradiation from the side of the patient, protective aprons (and gloves where applicable) must be used.

10.27 The operator must have a clear view of the patient during every x-ray examination and must be able to communicate with the patient and/or attendants without leaving the control booth.

10.28 Operators and assisting personnel must never hold radiographic cassettes by hand during irradiation.

Practices with Respect to Mobile Radiographic Equipment

10.29 Mobile units should be used only if the condition of the patient is such as to make it inadvisable for the examination to be carried out with a stationary unit in the main X-ray department.

10.30 During operation, the x-ray beam should be directed away from occupied areas where possible, and every effort must be made to ensure that this beam does not irradiate any other persons in the vicinity of the patient.

10.31 The equipment operator, and any assisting staff, must not stand in the direction of the direct beam and must be at least 3 meters from the patient unless wearing personal protective equipment or standing behind a leaded shield.

10.32 The equipment operator must alert staff in the area when an x-ray exposure is about to be taken and ensure all staff in the vicinity stand at least 3 meters from the patient. Where this is not possible, protective aprons or a leaded shield must be used.

10.33 In a capacitor discharge unit, after an X-ray irradiation has been made, there is a residual charge left in the capacitors. This residual charge must be fully discharged before the unit is left unattended.

Practices with Respect to Fixed Fluoroscopy Equipment - Full Sized C-arms

10.34 All persons present in the room during radioscopy and spot-film operation associated with radioscopic operation must wear protective aprons and thyroid shields.

10.35 Personnel operating interventional radiology or angiography systems or who will be within 1 meter of the patient's head/trunk (Chest, Abdomen or Pelvis) for the majority of the exam must wear leaded glasses. Other staff should wear leaded glasses. Leaded glasses are not required for staff temporarily entering the imaging suite.

10.36 Full use must be made of the protective devices provided with x-ray equipment such as shielded panels, drapes, and ceiling-suspended lead acrylic screens.

10.37 Without compromising care, all personnel who are not required to be immediately adjacent to the patient during the procedure should stand back as far as possible from the patient.

10.38 All radioscopic examinations must aim to optimize fluoro time, dose rates and x-ray field size in order to minimize patient and staff exposures.

10.39 For each type of radioscopic procedure, an assessment should be made of the physical positions of all personnel to ensure ease of operation of the equipment, visibility of the display, and protection from the radiation field.

10.40 To reduce scatter radiation to the upper body of staff, operate equipment with the tube under the table. If the tube is horizontal, stand on the side of the image receptor. Avoid standing adjacent to the tube during operation.

Practices with Respect to Mobile Fluoroscopy Equipment - Full Sized C-arms

10.41 Mobile C-arms parked inside a room and used for more than 50% of the cases in the room will be considered fixed equipment and must adhere to *Section 9.2.10*.

10.42 All staff present in the room during radioscopy must wear protective aprons and thyroid shields.

10.43 Without compromising care, all personnel who are not required to be immediately adjacent to the patient during the procedure should stand back as far as possible from the patient.

10.44 In the event a patient cannot be safely transported to a single occupancy imaging-safe room from another location within the hospital (i.e. trauma bay in emergency), use of a mobile C-arm is permitted. In this circumstance all efforts should be made to reduce radiation exposure to other patients and staff in the room by:

- 10.44.1. Using mobile lead barriers.
- 10.44.2. Using personnel protective equipment (e.g. covering patients with a protective apron).
- 10.44.3. Maximizing the distance between patients.
- 10.44.4. Moving patients to other locations in the hospital.
- 10.44.5. Alerting staff in the area prior to activating fluoroscopy so that staff can maximize their distance from the patient.

10.45 All radioscopic examinations must aim to optimize fluoro time, dose rates and x-ray field size in order to minimize staff exposures.

10.46 For each type of radioscopic procedure, an assessment should be made of the physical positions of all personnel to ensure ease of operation of the equipment, visibility of the display, and protection from the radiation field.

Practices with Respect to Fluoroscopy Equipment – Mini C-arms

10.47 Equipment operators must wear protective aprons and should wear thyroid shields.

10.48 Assisting staff, or any other personnel positioned within 1 meter of the mini C-arm, must wear protective aprons.

10.49 Equipment operators must alert staff in the area prior to x-ray use and ensure all staff in the vicinity that are not wearing protective aprons are at least 1 meter away.

11. Personal Protective Equipment (PPE)

Equipment Grandfathering

11.1 Equipment already in place is grandfathered and must meet the regulatory standards that were in place at the time of purchase.

Acceptance Testing of New PPE

11.2 It is important to be aware of the fact that the amount of ionizing radiation blocked by personal protective equipment is dependent on:
- 11.2.1. The x-ray tube voltage (kVp), and
- 11.2.2. The material composition of the apron.

11.3 To ensure PPE attenuates radiation to design specifications, it must undergo acceptance testing prior to use. All new aprons and thyroid shields:
- 11.3.1. Must undergo transmission testing as per recommendations from the RRSO
- 11.3.2. Should be no more than -10% of nominal thickness at each kVp tested.
- 11.3.3. Must be no more than -10% of nominal thickness at the kVp range for which the apron is to be worn.
- 11.3.4. Refer to LMMI Medical Physics for more information.

PPE Usage Requirements

Table 3: Aprons and Thyroid Shields

Peak kVp	Procedure	Lead Equivalency	Other Specifications
≥ 100	Fluoro procedures during which the worker's back or side may be turned toward the patient. (e.g. interventional radiology and angiography)	0.5 mm front 0.25 mm back	Full wrap-around style must be used.
	Other procedures*	0.5 mm front	
< 100	All procedures (e.g. mini C-arm)	0.25 mm front	

*Purchase of full wrap-around aprons is recommended so that aprons can be used for any type of procedure (e.g. a front only apron is not accidently used in an angiography case).

11.4 Protective gloves used for immobilizations must provide attenuation equivalent to at least 0.25 mm of lead throughout, including the fingers and wrists.

11.5 Leaded eye protection must be worn where the dose measured on a collar dosimeter is ≥ 7.5 mSv in a year.

11.6 Ceiling-mounted lead acrylic screens and moveable shields must provide attenuation equivalent to at least 0.5 mm of lead at 100 kVp.

11.7 If it is suspected that a shield has been damaged, a radiation attenuation assessment should be conducted.

Labelling

11.8 The lead equivalent thickness of the protective material used (and kVp tested) must be permanently and clearly marked on all protective equipment and apparel.

11.9 The attenuation value must be marked on all protective screens and shields.

Ergonomic Considerations

11.10 Apron fit is important. Apron size and style selection must be considered when apron purchases are made in order to maximize both personnel safety and comfort.

11.11 It is acknowledged that there may be individuals for whom the weight of an apron is problematic due to personal ergonomic factors. SRSOs and managers/supervisors will work with Workplace Health to determine individual apron fit and usage parameters where required (see Appendix B).

Care and Quality Control Requirements for Leaded Aprons

11.12 Aprons must be handled and stored with care to prevent the shielding material inside from becoming damaged:
- 11.12.1. Always store aprons on the assigned hangers or hooks when not in use.
- 11.12.2. Do not fold or bend aprons.

11.13 To ensure that aprons remain in good condition and do not have cracks or holes that would compromise the protection provided, they must be tested using fluoroscopy annually and when damage is suspected.

12. Education and Training

Staff Education and Training Requirements

12.1 Managers/supervisors are to keep a record of all education and training for their staff as listed in Table 4 below. This information must be made available to the SRSO, Workplace Health and Medical Physicists upon request.

12.2 Online radiation safety courses are available through the PHSA LearningHub (learninghub.phsa.ca/)

Table 4: Education and Training Requirements

Job Category	What	When	Refresher/ Renewal	Mandatory (M) or Recommended (R)
Physicians using fluoroscopy (all specialties)	Accredited by the Royal College of Physicians and Surgeons or equivalent.	Prior to unsupervised work	N/A	M
	Fluoroscopy: Practical Radiation Protection online course with a test score of at least 80%	Prior to unsupervised work	Every 3 years	M (VCH/PHC/FH) R (PHSA)
X-ray Technologists	Diploma in X-ray Technology and CAMRT Certification	Condition of employment	N/A	M
	Radiation Safety Basics online course with a test score of at least 80% *Radiation Safety for Nurses* online course with a test score of at least 80% *Fluoroscopy: Practical Radiation Protection* online course with a test score of at least 80% *X-ray Radiation Safety Quiz - Safe Installation and Use of Medical X-Ray Equipment* online course with a test score of at least 80%	Prior to unsupervised work	Every 3 years	M R M M
Nurses regularly assisting with X-ray procedures	*Radiation Safety for Nurses* online course with a test scores of at least 80%	Prior to unsupervised work	Every 3 years	R (VCH) M (FH)
Biomedical Engineering Technologists in Radiology Service	Diploma in Biomedical Engineering	Condition of employment	N/A	M
	Radiation Safety Basics online course with a test score of at least 80%	Prior to unsupervised work	Every 3 years	M

Medical Physicists	*Radiation Safety Basics* online course with a test score of at least 80% *Radiation Safety for Nurses* online course with a test scores of at least 80% *Fluoroscopy: Practical Radiation Protection* online course with a test scores of at least 80%	Prior to unsupervised work	Every 3 years	M
Other staff that works near x-ray areas (clerical, housekeeping, porters, security, facilities)	*Radiation Safety Foundations* online course with a test score of at least 80%	Prior to unsupervised work	Every 3 years	M

Continuing Education

12.3 The SRSOs, Workplace Health, and Medical Physics will communicate and provide education to personnel on any new regulations, changes to the Program, and "hot topics", as required.

Non-Clinical Contract Personnel

12.4 Housekeeping and security services are contracted to external organizations. Online education and written safety procedure guidelines are made available to the management staff of contract personnel. Implementation and management of education for contract staff is done by their employer**S**. It is recommended that all personnel take the online *Radiation Safety Basics* course.

12.5 Contractors must make copies of their staff lists and education and training records available to SRSOs, Workplace Health, and Medical Physics upon request.

13. Records and Record-Keeping

13.1 Each department must assign record keeping duties to a specific individual(s).

Table 5 – **Record Keeping Requirements**

Record		Saved For
Survey reports		Lifetime of equipment + 10 years
Dosimetry reports		Lifetime of organization
PPE QC		Lifetime of equipment + 10 years
Equipment maintenance records (internal and external agencies)		Lifetime of equipment
Education records		Duration of employment + 10 years

14. References

Children's & Women's Health Centre of BC. *Radiation Safety Manual*. June 2009. Fraser Health. *Ionizing Radiation (X-Ray) Exposure Control Plan.* 2007.

Health Canada. *Safety Code 35.*

ICRP Publication 60, *Recommendations of the International Commission on Radiological Protection.*1990.

ICRP Publication 103, *Recommendations of the International Commission on Radiological Protection.*2007.

ICRP Publication 75, *General Principles for the Radiation Protection of Workers*. 1997. International Electrotechnical Commission Standard, *Medical Radiology Terminology*. Publication 788, First edition, 1984.

ICRP ref 4825-3093-1464, *Statement on Tissue Reactions.* 2011.

St. Paul's Hospital. *Radiation Safety Manual*. April 2009.

Vancouver Coastal Health. *Radiation Safety Manual Part 1: Safe Installation and Use of Medical X-ray Equipment.* September 2004.

WorkSafeBC. *Occupational Health and Safety Regulation.*

Appendix A Checklist for Occupational Exposure above an Action Level or Regulatory Limit (X-rays)

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Checklist for Occupational Exposure above an Action Level, Regulatory Limit or an Unusual Exposure

Use this checklist when a worker has a reading on his/her dosimetry report that exceeds an occupational exposure limit or unusual dose as determined by the SRSO. It is to be completed together with the worker during an interview. After completion, provide a copy to Workplace Health.

As typical doses vary by site and department, it is at the discretion of the SRSO to determine what an unusual dose is for a worker. For example: if a worker typically gets 0.10mSv/quarter chest (whole body) and receives >0.25 mSv/quarter an exposure review may be appropriate.

Is a radiation survey required? (If there is an unusually high dose a radiation survey MAY be required – contact Workplace Health and Medical Physics)

- ☐ Yes
- ☐ No

Site:	Department:	Date:
Wear Period:	SRSO:	Worker:
Typical Dose:	Dose under Investigation:	Dosimeter type: ☐ Chest ☐ Collar

Type of Worker	Dose Type Under Review/Investigation (check one)
General Worker:	Whole Body Dosimeter ☐ ≥1 mSv/year
Radiation Worker:	Whole Body Dosimeter ☐ ≥ 20 mSv/year Collar Dosimeter ☐ ≥ 7.5 mSv/quarter ☐ ≥ 150 mSv/year
Pregnant Radiation Worker:	Fetal Dosimeter ☐ ≥ 2 mSv/duration of pregnancy
Unusual Dose: **(i.e. > than usual dose)**	Dose Under Investigation:_____ ☐ mSv/quarter ☐ mSv/year Dosimeter type: ☐ Chest ☐ Collar

A. Work Conditions	
1. Any accident/incident during the period?	Applicable (Yes/No) Comments:
2. Any relationship with workload? *For example: Increase in number of exams performed; frequency of rotation on high exposure tasks, etc.*	Applicable (Yes/No) Comments:
3. Any relationship with room layout and work flow design?	Applicable (Yes/No) Comments:
B. Safe Work Practice and Exposure Control	
1. Wearing PPE (PPE is appropriate and properly worn)	Applicable (Yes/No) Comments:
2. Application of distance and time	Applicable (Yes/No) Comments:
3. Sufficient shielding at imaging workstation	Applicable (Yes/No) Comments:
C. Personnel Dosimetry	
1. Any dosimeter handling accident/incident during the period (YTD)?	Applicable (Yes/No) Comments:
2. Dosimeter worn correctly: a. Torso dosimeter worn under lead apron. b. Collar dosimeter worn with the label facing the correct direction.	Applicable (Yes/No) Comments:
3. Dosimeter stored properly a. Badge not left in a radiation area when not in use. b. Returned to storage board after shift. c. Badge Board placed in a low radiation area together with control dosimeter.	Applicable (Yes/No) Comments:
D. Other Findings/Comments	
If cause or source of high dose exceeding the exposure limit has not been identified using the checklist above, a radiation survey may be required. Contact Workplace Health and Medical Physics.	
Update of National Dose Registry required? ☐ No ☐ Yes	

Worker: _____
(Signature)

SRSO: _____
(Signature)

Appendix B Lead Apron/Apparel Accommodation Form

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Lead Apron/Apparel Exemption Form – *[Insert Name and Job Title]*

Background: Staff working with x-rays must be provided with lead or equivalent protective apparel (aprons, or vest/skirt combinations, and thyroid shields) as described in sections 10 and 11 of the *Safe Installation and Use of Medical X-ray Equipment* manual. The required lead equivalency and styles vary based on the peak output from the radiation emitting equipment used and are outlined in the table below:

Peak kVp	Procedure	Lead Equivalency	Other Specifications
≥ 100	Long fluoro procedures during which the Worker's back or side may be turned toward the patient. (e.g. interventional radiology and angiography)	0.5 mm front 0.25 mm back	Full wrap-around style must be used.
	Other procedures	0.5 mm front	
< 100	All procedures (e.g. mini C-arm)	0.25 mm front	

It is acknowledged that there may be individuals for whom the weight of an apron is problematic due to personal ergonomic factors. As per section 11.13 of the radiation safety manual, in these instances SRSOs and managers/supervisors will work with Workplace Health to determine individual apron fit and usage parameters where required and develop minimum use criteria that are specific to the individual. Changes in the PPE requirements may result in the employee receiving increased radiation doses. Radiation doses will be monitored.

Investigation:

DATE: _____

Description of employee's current work tasks associated with radiation exposure:

Employee's personal dosimetry records from the last 2 years worked (where available):

Year	Quarter	Chest Reading	Collar Reading
	4th		
	3rd		
	2nd		
	1st		
	4th		
	3rd		
	2nd		
	1st		

Description of employee's apparel fit and usage parameters:

Recommendations:

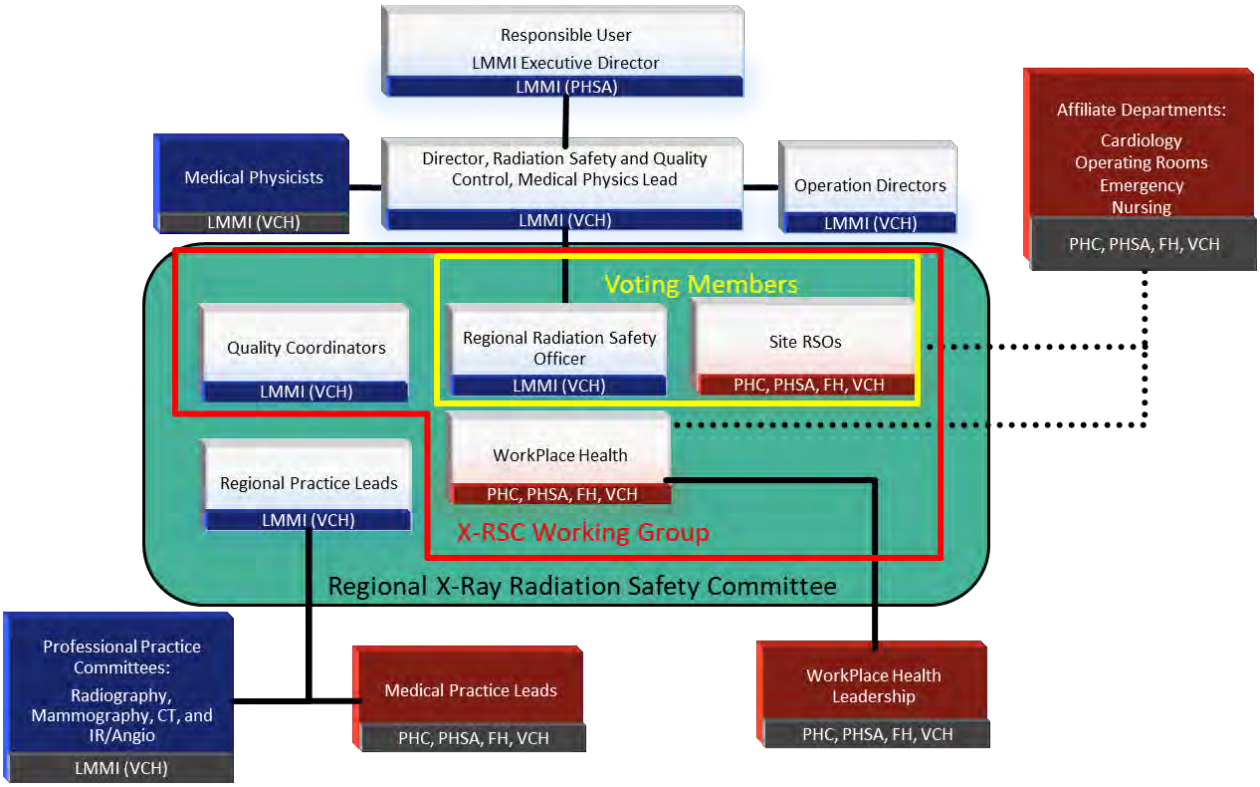
Signatures:

Employee:_____ DATE:_____

SRSO: _____ DATE

Workplace Health: _____ DATE:

Appendix C X-RSC Reporting Structure



Appendix D Guidelines For Holding Patients

Preferential Voluntary Holding Hierarchy:

1. 1st choice: Non-medical imaging staff: Family member, Guardian or Care giver or patients nurse
2. 2nd choice: Medical Imaging staff –last resort due to lifetime occupational exposure

Person Holding should:

1. Be 17 years of age or older,
2. Not pregnant,
3. Verbally consents to hold the patient,
4. Not routinely perform this task;
5. Wear personal protection equipment (PPE) including lead apron, thyroid shield and gloves;
   NOTE: ONLY use lead gloves when and if the lead gloves DO NOT obscure the area being imaged.
   Adorn disposable NON latex gloves prior to using the lead gloves.
6. MRT confirms using collimation light field that leaded gloves are out of irradiated field of view (FOV).
7. Stand as far as possible away from the radiation source and patients irradiated area.

Imaging Technologist Must:

1. Provide the holder with appropriate PPE.
2. Instruct and demonstrate to the holder, how to hold patient with the least amount of restraint, for the shortest duration practical and with least amount of stress. Advise when it is safe to release the hold.

Documentation when Exam or procedure complete

1. Document on the paper requisition prior to scanning into PACS and or, into the RIS system in the comment fields either:
   I. Parent or Guardian or Nurse who held patient for imaging,
   II. MRT held patient for imaging.

Appendix E Revision Log

Effective Date:	06-OCT-2022			
Posted Date:	06-OCT-2022			
Last Revised:	07-SEP-2022			
Last Reviewed:	07-SEP-2022			
Approved By:	Lower Mainland Medical Imaging Executive Committee 07-SEP-2022			
Owners:	Medical Physicist Lead, LMMI Regional Radiation Safety Committee			
Revision History:	**Version**	**Date**	**Description/ Key Changes**	**Revised By** (Name and Position)
	1.0	JUL-2013	Initial release	WPH
	2.0	2016	5.8 Removal of detail regarding Xray Safety Committee function and structure with reference to the committee TOR 7.4 Requirement for High Exposure notification 8.22 Addition of language regarding loss of chain of custody of dosimeters 8.27 - 8.30 Requirements for investigation/review of high and unusual doses Appendix C added Appendix D added Formatting and numbering changes	WPH (VCH, FHA, PHC, PHSA), Medical Physics & Quality Control, LMMI
	3.0	APR-2018	Numbering system changed Glossary modified Removed reference to patient throughout body Appendix E added	Yogesh Thakur, Medical Physicist Lead
	4.0	MAY-2018	Changes adopted from Radiation Safety Committee Meeting	Yogesh Thakur, Medical Physicist Lead
	5.0	SEP-2018	7.5 1 removed - regarding eyewear Headers updated in appendices 7.7 modified to remove eyewear	Yogesh Thakur, Medical Physicist Lead

	6.0	JUN-2020	Table of contents modified Table 2 updated to reflect WorkSafe limits Appendix E – modified org chart 10.35 modified to clarify use of leaded glass PPE 10.19 modified to reference for patient holding guidelines	Yogesh Thakur, Medical Physicist Lead
	7.0	NOV-2021	Formatting changes, removed sections Added education requirements to align with new courses and NM safety manual Reporting structure updated Appendix A (glossary) and B (quantities and units) Appendixes changed due to removal of Appendix B (quantities and units)	Yogesh Thakur, Medical Physicist Lead
	8.0	APR-2022	Glossary of Terms removed – Appendix numbering adjusted due to removal of A&B Appendix C - update org structure **Removed**: 2.3-2.9 (site applicability), 4.4 (international standards) 5.21-5.2.2 (WPH ownership of program) 5.5.8 (rad surveys conducted by physicist) 5.5.13 – assist WPH to implement the program 5.10.9 – biomed to provide safe equipment training 5.11.2 – requirement for staff to initial their dosimeter readings 6.7 – rooms requires adequate space from manual 6.14 – equipment is testing prior to use, this is a DAP requirement 8.2 – statement related to WorkSafeBC levels 8.4 - reference to quantities and units **Added:** 5.4.2.1 – need for collaboration Table 1 and 2 – updated to WorkSafeBC standard 10.3 – xray warning sign from “preferred” to “required” for xrays Table 4 – updated educational requirements	Yogesh Thakur, Medical Physicist Lead