Local Radiation Protection Rules

放射科 Radiology

2024

QUEEN MARY HOSPITAL

Preface

Local Radiation Protection Rules - Department of Radiology

1. This set of Local Radiation Protection Rules is produced for the protection of staff, patients and members of the public in the Department of Radiology, Queen Mary Hospital. It is a simplified and tailored version the “Code of practice on Radiation Safety 2022" and includes information and explanations on recommended procedures and possible risks pertaining to the safe use of radiation in the Department.

2. It is a requirement of all staff who might be exposed to ionizing radiations in this Department to read this "***Local Radiation Protection Rules 2024 - Department of Radiology, Queen Mary Hospital***” and to complete and sign the declaration record sheet attached at the end of this Local Rules stating that he/she has read and understood the contents and is willing to observe them.

3. Staff are also reminded to read and observe the related sections which affect his/her work and well being, in:

    a) "Local Radiation Protection Rules - Nuclear Medicine Unit, Department of Radiology, Queen Mary Hospital”
    b) "Code of Practice on Radiation Safety 2022” of the Hong Kong Hospital Authority (*http://portal.home/sites/osh/topic/radiation/Safety%20Manual%20%20Guidelines/HA%20Code%20of%20Practice%20on%20Radiation%20Safety%202022.pdf*)
    c) HA Safety Manual (Chapter 9) Ionizing Radiation (*http://portal.home/sites/osh/manual/Document%20Library/Ionizing%20Radiation/HA%20Safety%20Manual%20(Chapter%209)%20-%20Ionizing%20Radiation%20(ENG).pdf*)
    d) “Guidance Notes on Radiation Protection for Diagnostic Radiology” of the Radiation Health Unit, Department of Health, HKSAR (*https://www.rhd.gov.hk/en/pdf/Pub1_english.pdf*)

4. Copies of the Local Rules are available at the X-ray rooms for your reading.

Dr. Stephen CHEUNG

HKWC Service Director (DR), Chief of Service (DR), QMH
Jan 2024

瑪麗醫院
QUEEN MARY HOSPITAL

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Chapter 1

Introduction

1.1 These Local Rules are produced in accordance with the 'Code of Practice on Radiation 2022' (Code of Practice). They include information and explanations on recommended procedures and possible risks which may be encountered in the Department by staff, patients and members of the public who may be exposed to ionizing radiations.

1.2 The administrative responsibility for the protection measures set out in the Code rests, in this Hospital lies with the Hospital Authority (HA), and in the case of persons employed by service agents which provided services to HA hospitals, their employers in addition to the HA.

1.3 The Radiation Protection Adviser (RPA) is appointed by the Chief Executive of the HA. The RPA should normally be a certified medical physicist with appropriate experience. The Chief of Service (COS) or Head of Unit may appoint one or more of his/her staff as Radiation Protection Supervisor (RPS) to assist him/ her on radiation safety and protection measures.

1.4 The ultimate responsibility for the local observance of the protection measures within a Unit, however, rests on the Head of that Unit. In the first instance any matter concerning protection should be referred to the Radiation Protection Supervisor of the Unit involved.

1.5 It is a requirement that every radiation worker should read these Local Rules and those sections of the Code of Practice which affect his/her work and well being. The radiation worker should complete, sign and return the declaration form to the Radiation Protection Supervisor (RPS) stating that he/she has read and understood the contents, and is willing to observe them.

Chapter 2

Principles of Radiation Protection in Diagnostic Radiology

2.1 Protection in diagnostic radiology is based on the following principles:

a) Radiological examination should be carried out only if it is likely that the information obtained will be of benefit to the patient or will improve the overall health of the population;

b) The irradiation of the patient during X-ray examination should be no greater than is necessary to result in a satisfactory examination and care should be taken to reduce to a minimum the irradiation of particularly sensitive tissues, such as the female breast∗, red bone marrow, lung and gonads;

c) Shielding for primary and secondary radiation should be close to the equipment or patient;

d) X-ray equipment should be used only when there is adequate protection∗∗ for all persons in all surrounding areas;

∗*Between the age of 10 and 45 the female breast is more radiosensitive than is implied by the ICRP weighting factor of 0.12 which is an average value for males and females.*

∗∗*"Adequate protection" is defined as protection which is intended to ensure that doses received are as low as reasonably achievable and in any case do not exceed 3/10 of the dose limits which are appropriate for the category of persons exposed. When used continuously (e.g. as a fixed installation) in any room, the radiation dose rate outside the room shall not exceed 3 μSv* h^{-1}*. (Reg. 17, the Radiation (Control of irradiating Apparatus) Regulations, Cap 303, Laws of Hong Kong).*

2.2 Every individual using ionizing radiation has a duty to protect himself/herself and others (including patients) from any radiation hazards arising from his/her work.

2.3 For radiation protection purposes, the hazards may be segregated into two classes:

a) External hazards

These arise from radiation sources outside the body. They can be controlled by:

i) Limiting the exposure time.

ii) Keeping at a distance as far as possible from the source.

iii) Using suitable shielding.

b) Internal hazards

These arise when radioactive materials enter the body through inhalation, ingestion or absorption through the mouth, skin or wound. They can be controlled by:

i) Containment of the radioactive material

ii) Good house keeping and cleanliness.

iii) Use of least radio-toxic and the smallest activity if possible

2.4 The TLD badge or ionization dosimeters, when provided, must be worn at all times when on duty. It should be worn on the trunk at chest or at waist height. In addition, ring badges are to be worn if the unprotected hands and forearms come in close proximity to the beam. TLD badge should be returned monthly and loss of TLD reported as soon as possible. (*Refer to Appendix VII on TLD return flowchart including arrangement before and after vacation leave.*)

2.5 When a protective apron is worn and the unprotected parts of the body are likely to be exposed to more than 1/10 of their dose limits, one or more dosimeters should be placed at collar level or other body parts outside the apron where it may best monitor the dose to the exposed parts of the body. Special devices for checking finger doses would be provided in circumstances. Care should be taken to avoid any dosimeter from becoming wet or damaged.

2.6 All areas where there could be an ionizing radiation hazard or contaminations should be monitored at regular interval, and the results recorded by the Physicist.

2.7 The dose limits for occupationally exposed workers aged 18 years or above are given in Table 1 (page 4). The dose limits apply to the sum of the dose equivalent received from external sources during working hours and the committed dose equivalent due to internal sources entering into the body during the course of work.

2.8 Women of reproductive capacity have a special responsibility in that they must immediately inform either the administrative superior (such as COS, DM, RPS) or the Head of their unit as soon as they know that they are pregnant so that steps can be taken to ensure that the dose to the fetus does not exceed the maximum permissible level specified in Table 1.

Diagnostic X-ray procedures should only be carried out when there is a real need.

Table 1 Dose limits for occupationally exposed workers aged 18 years or over

Limits on effective dose are for the sum of the relevant effective doses from external exposure in the specified time period and the committed effective dose form intakes of radionuclides in the same period.

For adult, the committed effective dose is computed for a 50-year after intake, whereas for children it is computed for the period up to age 70 years.

APPLICATION	ANNUAL DOSE LIMIT	
	Occupational	**Public**
Effective dose	20 mSv	1 mSv
Annual equivalent dose in the lens of the eye	20 mSv	-
Skin* (averaged over any area of 1 cm^2)	500 mSv	-
Extremity	500 mSv	-
Any other organ or tissue	500 mSv	-
Abdomen of Pregnant woman	1 mSv during the pregnancy of the women	
Abdomen of female worker of reproductive capacity	5 mSv in any consecutive 3 months interval	

** The limitation on the effective dose provides sufficient protection for the skin against stochastic effects.*

** An additional limit is needed for localized exposures in order to prevent deterministic effects.*

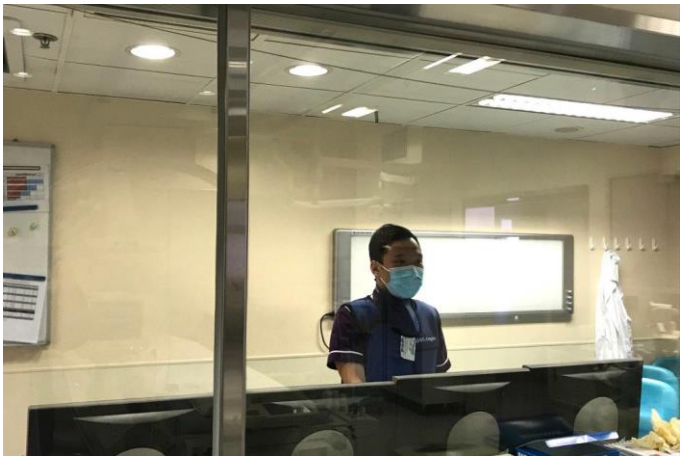
Source : http://www.icrp.org

Chapter 3

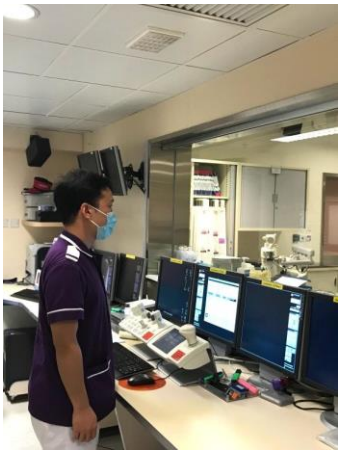
Protection of staff, Members of the Public and Women of child bearing age

3.1 The operator should never expose himself/herself to the direct beam, and must not stand within one meter of the tube or irradiated target while the unit is in operation unless adequately shielded. Make full use of protective lead barriers, whenever possible, to attenuate residual beams and scatters.

3.2 During fluoroscopy or radiography, all staff must either stand in the protective cubicle, observing through the lead glass window, or wear protective aprons. Protective gloves must be worn when handling the patient during fluoroscopy. All protective clothing should be checked for damage regularly.



3.3 The operator should ensure that only essential personnel are present in the x-ray room during examination and that all areas are adequately shielded.



3.4 Make sure the doors of the x-ray room are closed before making any exposure during examination and equipment testing. It may be appropriate to lock certain X-ray room doors, to prevent unauthorized entry when the door is remote from the operator and outside the immediate field of view.

3.5 Where an x-ray room is used for more than one radiology procedure at a time, take adequate protective measures to ensure there is no significant additional exposure, either of one patient from radiography of another or of staff from examination in which they themselves are not engaged.

3.6 The radiographer supervising the examination is responsible for checking the operating conditions such as patient position, radiological technique selected and cassette loading etc. before making exposure.

3.7 Personal dose monitoring devices must be worn at all times when at work. It should be worn on the trunk at chest or at waist height, the latter being recommended for women of childbearing capacity.


Front View


Back View

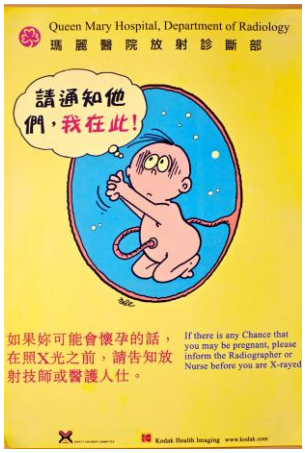
3.8 Pregnant female staff must inform either her Senior or Head of Department as soon as possible (please see 2.8).

3.9 Chief of Service (COS) should appoint one or more of his/her staff as Radiation Protection Supervisor in the X-ray department to ensure that the protection of staff, patient and public on its premises and also the local rules are followed.

3.10 X-ray examination for women of childbearing age

(*Refer to Appendix VI- Flowchart on Radiological Investigation for Women of Child-bearing Age*)

3.10.1 All female patients of childbearing age should be asked whether there is any possibility of pregnancy. When the patient states that there is no possibility of pregnancy, she should be asked the date of commencement of L.M.P. This should be recorded and the examination could proceed. For high dose examinations involving abdomen/ pelvis of a women of child bearing age, the examination should be performed within 10 days from the date of commencement of L.M.P.



3.10.2 There are two rules to, be observed for females of childbearing age whose pregnancy cannot be excluded:

a) ***(28-day-rule)** - If she is not sure about her possibility of pregnancy or pregnancy could not be excluded, she should be asked whether her menstrual period is overdue. If it is not overdue, then observe the 28-day-rule for normal radiological examinations. The patient should be asked to sign a consent form prior to proceeding with the examination. If the L.M.P. is over- due or she has forgot the date of L.M.P., then the radiographer should re- confirm with the referring clinician or Radiologist whether to proceed with the examination or not. If it is considered as an urgent radiological examination that the benefits have out-weighted the risks, the examination could be proceeded after consent form has been signed, otherwise, the examination should be rescheduled or cancelled.

b) ***(10-day-rule)** - If she is not sure about her possibility of pregnancy or pregnancy could not be excluded; she should be asked whether her menstrual period is overdue. If it is not overdue and the date of L.M.P. is within 28 days, then proceed with the examination except for high dose procedures (such as abdominal CT, pelvic CT, barium enema, and any other special x-ray examinations likely to deliver a dose of tens of mGy to the conceptus), in which case the examination may be postponed to the early part of the menstrual cycle - the "limited return to the 10-day-rule".

(*Refer to the attached table in Appendix-II for Fetal Absorbed Dose of some common diagnostic procedures*). Attention should be paid to ensure minimization of exposure to any embryo or fetus that may be present, whether or not the woman is known to be pregnant.

3.10.3 If a female patient can confirm that she is pregnant and her menstrual period has been clearly missed (also the 10-day-rule & 28-day-rule cannot apply), then any decision to proceed with the examination should be taken by the referring physician in its clinical necessity (e.g. urgent x-ray examinations when benefits are likely to far outweigh any small risk from the irradiation). The examination could be proceeded after the consent form has been signed. Attention should be paid to ensure minimization of exposure to any embryo or fetus.

Remarks:

***28-day-rule for Normal Radiological Procedures**

Day 1 - Day 28 after commencement of menstruation	It is safe to carry out radiological examinations.
Day 29 and onwards	Only urgent radiological examinations to be performed when benefits are likely to far outweigh any small risk from radiation.

28-day-rule, i.e. the examination ***should be done*** within Day 1 to Day 28 of the menstrual cycle.

***10-day-rule for High Dose Radiological Procedures**

Day 1 - Day 10 after commencement of menstruation	It is safe to carry out radiological examinations.
Day 11 and onwards	Only urgent radiological examinations to be performed when benefits are likely to far outweigh any small risk from radiation.

10-day-rule, i.e. ***postpone the examination*** to within Day 1 and Day 10 of the menstrual cycle.

Chapter 4

General Measures for Radiological Protection

4.1 Personal monitoring

a) The personal monitoring for classified persons or persons working under a written scheme of work is required to be dealt with by a dosimetry service approved by the Radiation Board.

b) Where exposure is from external sources (other than low-energy beta emitters with no significant bremsstrahlung emission), personal monitoring should be by means of one or more dosimeters worn on an appropriate part or parts of the body.

c) The length of each monitoring period should depend on the doses likely to be received during the period. Dosimeters should be returned promptly after use for dose assessment and replaced with new ones. Each dosimeter is normally worn for 1 month, but periods ranging from 2 weeks to 3 months can be appropriate in certain circumstances. For TLD badge from the Radiation Health Division, it should be returned monthly. (*Refer to Appendix VII on TLD return flowchart including arrangement before and after vacation leave.*)

d) Persons who are issued with a dosimeter should wear it as instructed all the time while they are at work. Care should be taken to prevent the dosimeter, while not being worn, from being exposed inadvertently to ionizing radiation or subject to other conditions, e.g. heat, which could affect the assessment of doses. A dosimeter should normally be worn on the trunk at chest or waist height; it may then be interpreted as monitoring the dose to the whole body.

e) If a person is wearing a protective apron, then in addition to a dosimeter worn on the trunk under the apron, one or more dosimeters should be worn on the unprotected parts of the body if there are likely to be contributions greater than 1/10 of the effective dose equivalent from their exposure. This is unlikely to occur unless individual organs (or eyes) are exposed to more than 1/10 of their dose limits.

4.2 Persons undergoing examination with ionizing radiations

4.2.1 Examinations or treatment directly associated with illness or injury

a) All diagnostic procedures including exposure to radiation for medical purposes may carry some personal risk. The direct or indirect irradiation of patients' gonads may constitute a risk to future generations and in pregnancy there may also

be a risk to the fetus. It is important therefore that only those medical exposures that are necessary should be undertaken. Alternative methods of obtaining the required diagnostic information should be considered, for example, by the use of non-ionizing radiation.

b) A radiological examination or investigation should be initiated only by a registered medical practitioner responsible for the care of the patient or by the radiologist or nuclear medicine specialist to whom the patient is referred.

c) A person who requests an examination should be satisfied that it is necessary, taking into consideration the benefits expected from the examination and the radiation dose involved. They should ascertain first whether there are records of previous examinations which are relevant to the proposed examination. When an examination is requested, the clinical indications, the provisional diagnosis, and the information required should be stated.

d) To reduce unnecessary examinations, administrative services should provide for the ready availability of previous images taken and for the rapid transfer on request of images from one establishment or practice to another. Access to reports and electronic patient record can help to avoid or limit the need for further examinations. Results of investigations with radionuclides should also be made available.

e) If the person requested to undertake the examination has any doubt about its advisability or about the nature of the examination required, the matter should be resolved by consultation between the medical officers responsible for the clinical and radiological care of the patient. Case discussions attended by clinicians, radiologists, consultants in nuclear medicine and other staff, as appropriate; provide an opportunity for the critical assessment of the value and possible hazards of proposed x-ray examinations and diagnostic radionuclide investigations.

f) To reduce the necessity for repeat examinations, clinicians and nursing staff should co-operate with the radiology and nuclear medicine services to ensure that patients are adequately prepared before the examinations. This is particularly important for x-ray examinations of the abdomen or pelvis.

g) Fluoroscopy should not be requested if the same information could be obtained by radiography. Alternative methods not involving ionizing radiation should be considered for locating metallic foreign bodies at operations.

h) If specific radiographic projections are requested, these should be kept to the necessary minimum. In general, the details of particular examinations including the nature and number of projections to be taken will be determined by the radiologist.

i) It is particularly important to establish that the proposed examination of a woman who is (or who may be) pregnant is necessary where there is a risk that a fetus may be irradiated; also that the same diagnostic information could not be obtained by a different method carrying less risk. The request form should state that the woman is or may be pregnant so that particular care can be taken during the examinations.

j) Before any examination involving the abdomen or pelvis of a woman of child-bearing age, an enquiry should be made about possible pregnancy. She should be treated as pregnant, and the guidance in paragraph i followed if her menstrual period is overdue or clearly missed, unless there is information indicating the absence of pregnancy. In some cases a pregnancy test may be advisable.

4.2.2 Examinations not directly associated with illness or injury

a) Screening programs, e.g. chest radiographs, should be undertaken only if the expected medical benefits to the individuals examined, and to the population as a whole, exceed the economic and social costs, including the risks associated with the radiation dose involved. Since benefits are not always the same for all members of the population, screening should normally be limited to particular groups.

b) Some types of examination result in benefits which are shared by the person who is examined, the employer and a third party (e.g. an insurer). Such an examination should be requested only on specific medical advice and if it is expected to show net benefit to the subject. It should not be requested if the results of a previous examination, giving the required information, could be obtained. A record of the examination should be kept.

Chapter 5

Local Rules for General Radiography X-ray Rooms

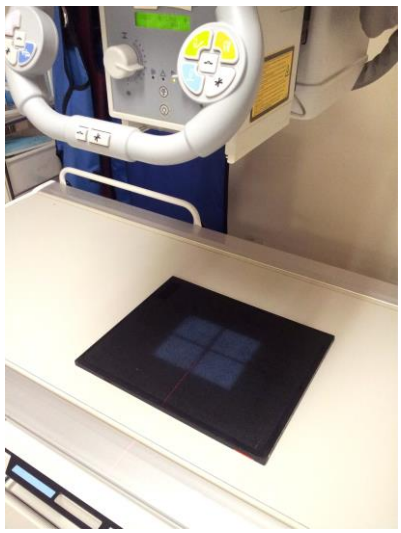
4.1 No examination should be undertaken without an authorized request for the investigation.

4.2 Exposure factors and the selection of receptor (e.g. Horizontal or Vertical) should be checked by the operator on each occasion before an examination is performed.

4.3 Constant potential generator can be used to improve quality of the x-ray beam with a greater proportion of high-energy photons and result in less skin dose to patient and same imaging information.

4.4 Periodic survey of beam quality of all x-ray equipment should be conducted as part of a quality assurance program.

4.5 Make full use of the light-beam diaphragm system to achieve the smallest possible field size necessary for radiography.



4.6 Protective shielding should be used whenever possible. Gonad protection may be used on all patients regardless of age or childbearing capacity.

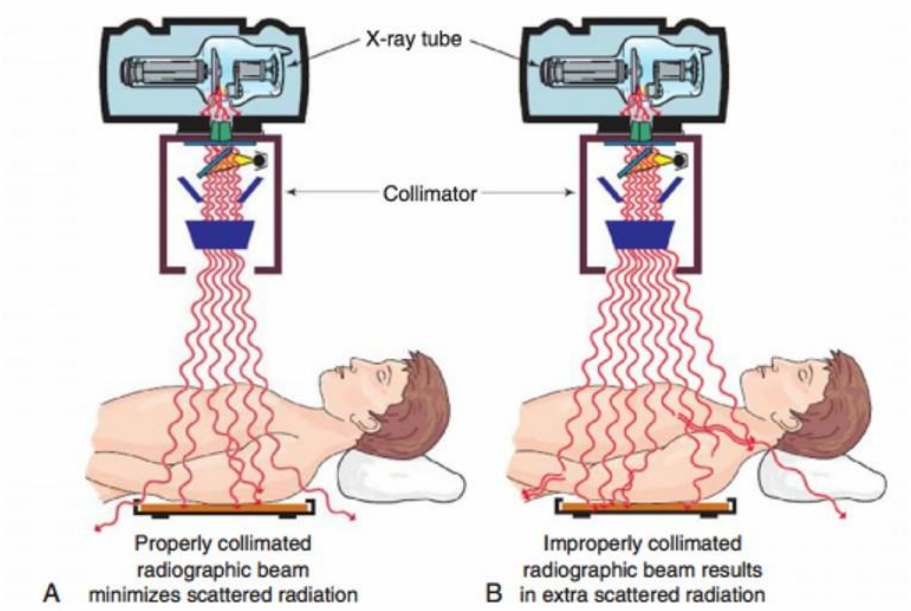
4.7 Care should be taken that the primary beam is not aimed at the gonads; and not to direct x-ray beam at objects other than the patient.

4.8 Any person who is supporting a patient for x-ray examination or who needs to hold a patient in an emergency, should wear a protective apron. Protective gloves should also be worn if the hands are likely to be close to the field. No part of this person's body should be in the useful beam. No person shall be regularly employed to hold patients during exposure.

4.9 Mechanical support devices should be provided to support patients, and film cassettes whenever necessary, and should also ensure that the whole set up is immobilized.

4.10 No patient should wait or change clothes in the x-ray room while another patient is being examined.

4.11 Make sure the door of the x-ray room is closed before making any exposure.



(Source: Sherer, Mry Alice Statkiewicz, et al. Radiation protection in medical radiography. Elsevier health Sciences, 2013)

Radiographers should **NEVER** stand in the primary beam to hold the cassette or restrain the patient.

Chapter 6

Local Rules for Mobile Radiography

6.1 The Radiographer should stand as far as possible from the tube and patient during exposure, and should wear a protective apron, or step behind an adequate shield.

6.2 The Radiographer must wear a protective apron when standing within 2 meters of the x-ray mobile machine; and will preferably wear a protective apron when standing 2 meters away from the x-ray mobile machine.

6.3 During radiography with mobile equipment, an oral warning must be given to allow non-essential staff to leave the vicinity of the tube and patient. If possible, do not make an exposure when any unprotected personnel is standing within 2 meters of the x-ray mobile machine. In addition, do check visually that no visitors are behind curtains.

6.4 Protective aprons and gonad shields should be kept with the mobile equipment and used whenever appropriate.

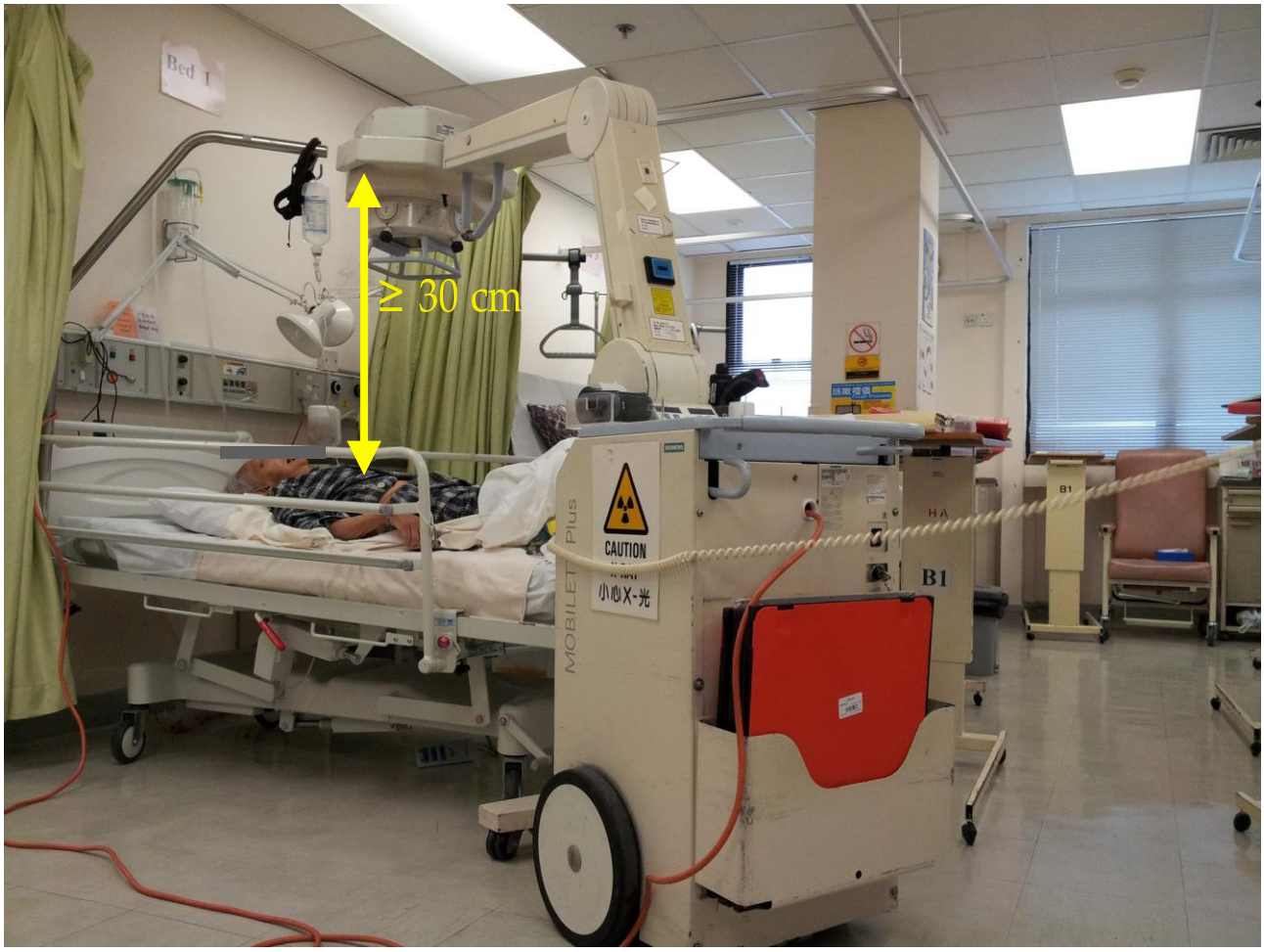
6.5 Whenever using a horizontal beam on wards, always ensure that patients in adjacent beds are not irradiated unnecessary.

6.6 For radiography with mobile equipment, the x-ray tube focal spot to patient skin distance should never be less than 30 cm.

6.7 The Radiographer should use the 2D barcode system for patient identification during mobile radiography with an aim to control the risk of wrong patient identification which may result in unnecessary irradiation to the affected patient.

6.8 Film cassette should be stored in the cabinet provided with the mobile unit, but not outside, to avoid fogging.

6.9 Local Rules 3.10 on page 7 and 8 also apply in this chapter.



Mobile radiographic examinations require a minimum source-skin distance of 30 cm to limit the effects of the inverse square falloff of radiation intensity with distance.

Chapter 7

Local Rules for OT Radiography

7.1 Radiation warning signs should be placed on the doors of the theatre room during fluoroscopy and radiography.

7.2 The mobile C-arm fluoroscopy equipment should only be operated by authorized personnel with valid license for operation of irradiating apparatus.

7.3 Fluoroscopy should not be undertaken if the same information can be obtained by plain radiography.

7.4 Limit fluoroscopy time to the minimum commensurate with good diagnostic results.

7.5 Always use smallest possible collimated field size to reduce patient dose in fluoroscopy, make use of the circular iris collimator if available.

7.6 The operator should keep the X-ray tube at maximum and the image receptor at a minimum distance from patient.

7.7 In prolonged procedures, the operator should reduce the dose to the irradiated skin by changing the angulation of the beam and fluoroscopy pulse rate, providing that it is appropriate and not degrading the image quality.

7.8 Designated dose reduction programs should be applied to paediatric patients.

7.9 Staff should wear lead apron and thyroid shield to reduce absorbed dose.

7.10 Lead glasses could be used to protect the lens of eyes.

7.11 A manually reset, cumulative timing device (5 to 10 min.) which will either sound an alarm, to turn off the fluoroscopy equipment when the total exposure reaches a certain previously determined limit should be used during all fluoroscopic examination.

7.12 The radiographer should ensure that the C-arm of mobile fluoroscopy C-arm equipment is positioned with the X-ray tube underneath the patient and keeping the image receptor closer to the patient whenever it is appropriate and possible. When the C-arm is operating in the lateral plane (or near to horizontal), the operators (e.g. surgeons, nurses and other staff who work close to the patient and C-arm) should stand

on the image receptor side and keep a distance away from the image receptor if it is possible and appropriate to do so. It is because the back scatter radiation is more intense on the x-ray tube/ patient side under this condition.

7.13 The radiographer should visually monitor the tube current and potential of fluoroscopic equipment with image receptor at frequent intervals, because, under automatic brightness control, these variables can rise to high values.

7.14 The key-operated panel in the C-arm must be kept closed before/after fluoroscopy procedure to avoid accidental exposure.

7.15 Staff should investigate patients' possibility of pregnancy for women of childbearing age. For patient under G.A., staff may check the LMP from the patient's clinical files or operation checklist.

7.16 Do not direct the X-ray beam at the windows/door of the OT room or towards the control panel.

7.17 For fluoroscopic examination, radiographer should record the accumulated exposure time and / or dose in the patient's logbook whenever applicable.

Chapter 8

Local Rules for Fluoroscopy and Angiographic/ Interventional X-ray Rooms

8.1 Fluoroscopy should not be undertaken if the same information can be obtained by radiography.

8.2 Limit Fluoroscopy time to the minimum commensurate with good diagnostic results.

8.3 Gonad shields should be used on patients whenever appropriate. Protective shielding should also be used, especially the built-in shielding at the fluoroscopic tower.

8.4 Always use smallest possible collimated field size to reduce patient dose in fluoroscopy, make use of the circular iris collimator if available.

8.5 No patient should wait or change in the x-ray room while another patient is being examined.

8.6 Protective aprons with a lead equivalent thickness of at least 0.35 mm for X-rays up to 100kV should be worn by physicians, nurses, radiographers and all other persons within any room where fluoroscopic equipment is in use. The protective aprons should be long enough to cover the thigh; and the wrap-around aprons should be worn if there is a need to turn one's back to the beam. In addition, the duty radiographers should assist the newly joined colleagues or non-radiology staff or visitors to properly put on radiation PPE whenever necessary.

8.7 The hand of the fluoroscopist should never be placed in the unattenuated useful beam. When the hand is adjacent to the beam, a protective glove of at least 0.25mm lead equivalent for X-rays up to 150kV should be worn when possible.

8.8 The operator should keep the x-ray tube at maximum and the image receptor at a minimum distance from patient.

8.9 The tube current should be kept as low as possible and also selecting a higher tube potential (kVp) in Manual fluoroscopy mode to save patient dose; and providing that the above manual radiation technique adjustment will not degrade the image quality.

8.10 In prolonged IR procedures, the operator should reduce the dose to the irradiated skin by changing the angulation of the beam and fluoroscopic pulse rate, providing that it is appropriate and not degrading the image quality.

8.11 Designated dose reduction programs should be applied to paediatirc patients. Adult fluoroscopic program is not recommended to be used on infant/ paediatric patients.

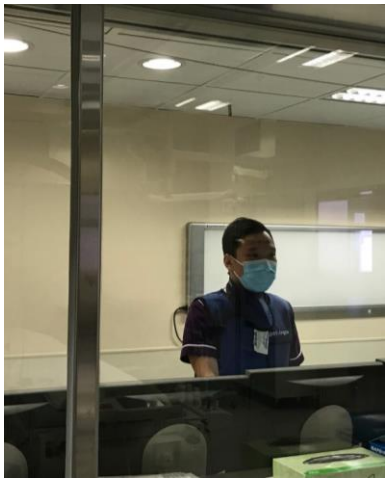
8.12 Staff should wear thyroid shield to reduce absorbed dose.

8.13 Lead glasses of at least 0.5mm lead equivalent material for X-rays up to 100kV and with side shield could be used to protect the lens of eyes whenever they are available and appropriate to do so.

8.14 Lead curtain should be applied during fluoroscopy session.

8.15 Lead aprons should not be folded; when not in use they should be supported in a suitable manner e.g. by draping them over a trail of sufficient large diameter to prevent damage.

8.16 During fluoroscopy examination, all staff not wearing protective aprons should stay in the cubicle.



8.17 Apart from the annual radiation PPE check performed by qualified Physicist and X-ray workshop staff, the duty radiographers are advised to supervise the supporting staff to perform daily visual check on the PPE for any damage/torn. If in doubt, the damaged PPE should be sent to the Physicist's team for further analysis.

8.18 Mechanical support devices should be provided to support patient and film cassette whenever necessary, and should also ensure that the whole setup is immobilized.

8.19 Make sure the door of the x-ray room is closed before making any exposure.

8.20 A manually reset, cumulative timing device (5 to 10 minutes) which will either sound an alarm, or turn off the fluoroscopy equipment when the total exposure reaches a certain previously determined limit should be used during all fluoroscopic examination.

8.21 The radiographer should ensure that the C-arm of mobile fluoroscopy C-arm equipment is positioned with the x-ray tube underneath the patient and the image receptor is as close as possible to the patient whenever it is appropriate and possible.

When the C-arm is operating in the lateral plane (or near to horizontal), the operators (e.g. radiologists, nurses and other staff who work close to the patient and C-arm) should stand on the image receptor side and keep a distance away from the image receptor if it is possible and appropriate to do so. It is because the back scatter radiation is more intense on the x-ray tube/patient side under this condition. Therefore, radiographer should pay attention to the control parameters of the x-ray machine, and should stay on the image receptor side but close to the control panel of the machine if it is possible and appropriate to do so.

8.22 The radiographer should visually monitor the tube current and potential of fluoroscopic equipment with image receptor at frequent intervals, because, under automatic brightness control, these variables can rise to high values.

8.23 In cine radiography (recording of images with a cine camera, e.g. for cardiac catheterization), the tube currents and potentials are higher than those used in fluoroscopy. Thus, special care should be taken to decrease patient exposure.

8.24 For long and complex Interventional Radiology (IR) procedures, more than one projection should be used during the course of the procedure wherever possible to reduce the maximum localized radiation dose to the skin. Dose-reduction features, such as additional beam filtration, pulsed fluoroscopy, cineloop, fluoro-grab and virtual collimation, should be used if available.

8.25 10-day Rule rather than the usual 28-day Rule should be applied to women of child-bearing age for fluoroscopic exams involving abdomen, lower abdomen or pelvis.

8.26 Local Rules 3.10 on page 7 and 8 also apply in this chapter.

Chapter 9

Local Rules for CT Rooms

9.1 During "warm up" and detector calibration procedures, persons should not be allowed to enter or remain in the examination room. Make sure the doors to examination room are closed or locked to prevent unauthorized entry.

9.2 Protection should be provided for those who stay in the CT room during clinical procedure.

9.3 Operator should remain at the control panel when high voltage is applied to the x-ray tube whenever the CT examination is in progress.

9.4 In view of the potential for high patient doses, CT examinations should only be carried out after there has been proper clinical justification for the examination of each individual patient [1]. Examinations on children require a different level of justification to that for adults, since such patients are at greater risk from radiation than are adults. Always apply the paediatric protocols when imaging paediatric patients, for which the scan and technical parameters are tailored to the age and size of the patients, the body region of interest and the clinical question. CT examinations should not be performed on the abdomen or pelvis of pregnant patients without overriding clinical indications and particular attention to low dose techniques. When clinically appropriate, the alternative use of safer non-ionising techniques (such as ultrasound and magnetic resonance imaging (MRI) where available) or of low dose X-ray techniques should be considered.

9.5 Operators should ensure that the minimum number of CT slices necessary to obtain the required diagnostic information are acquired. This is particularly important when scanning contiguous volumes using pre-set scanning protocols.

9.6 The parameters of standard scanning protocols should be modified according to the size of the particular patient to deliver the lowest dose consistent with the required image quality.

9.7 Slice increment (axial scanning) or pitch (helical scanning) together with beam collimation should be chosen with regard to the z-axis sensitively (imaged slice width) and low contrast detectability required, whilst maintaining the lowest practicable patient dose.

9.8 Care should be taken to minimize exposure to the eyes of the patient. Dose to the lens tissue can often be substantially reduced by angulation of the gantry to exclude the eyes from the primary beam during head examinations.

9.9 The necessity for the use of contrast agents should be assessed to reduce the number of regions that are rescanned with contrast.

9.10 Under no circumstance should the X-ray tube be energized for CT fluoroscopy when the person carrying out the examination is not looking at the monitor.

9.11 Physicians and radiologists should ensure that patients are not irradiated unjustifiably.

9.12 With reference to [2] HA Clinical Guidelines, continuous monitoring of the patient with implantable cardiac devices like pacemakers and implantable cardioverter-defibrillator (ICD) by pulse oximetry during the scan is necessary when the device is in or immediately adjacent to the scan ranges. If the device will be in the CT scanning beam for more than 4 seconds continuously (e.g. in CT-guided biopsy/perfusion CT in the vicinity of the implantable device), pre- and post- CT scanning programming should be performed.

9.13 10-day Rule rather than the usual 28-day Rule should be applied to women of child-bearing age for CT exams involving abdomen, lower abdomen and/or pelvis.

9.14 Local Rules 3.10 on page 7 and 8 also apply in this chapter.

Reference

[1] **Radiation dose management in CT** <http://ns-files.iaea.org/training/rpop/ct-e-learning/story_html5.html>

[2] **Clinical Recommendation on Possible Malfunction of Implantable Cardiac Devices Caused by Computed Tomography (CT) Scanning**. *10 May 2013*

Chapter 10

Local Rules for Mammography

10.1 No examination should be undertaken without an authorized request for the investigation.

10.2 All staff must stand behind the protective lead screens during exposures.

10.3 ALARA principle shall be observed when performing mammographic examination.

10.4 For patients of child-bearing age, radiographer must check her L.M.P. (28-day rule to be applied) and/or sign the consent form before the mammographic examination. If pregnancy of patient is confirmed, mammography should be cancelled or proceeded with modifications after the duty radiologist had duly discussed with the referring physician. In case the examination is decided to be proceeded, consent form must be signed by the concerned patient. Proper radiation protection e.g. abdominal shield and thyroid shield should be applied whenever applicable.

10.5 For mammography screening program, examination is performed on asymptomatic patients aged ≧40 while for diagnostic imaging, mammography is performed on patients aged ≧35.

10.6 With reference to the annual screening protocol, the clerical staff would check the date(s) of previous mammogram appointments if any and record this piece of information on the mammogram request form. Based on the information, the radiographer would then issue the appropriate mammogram appointment date to the patient.

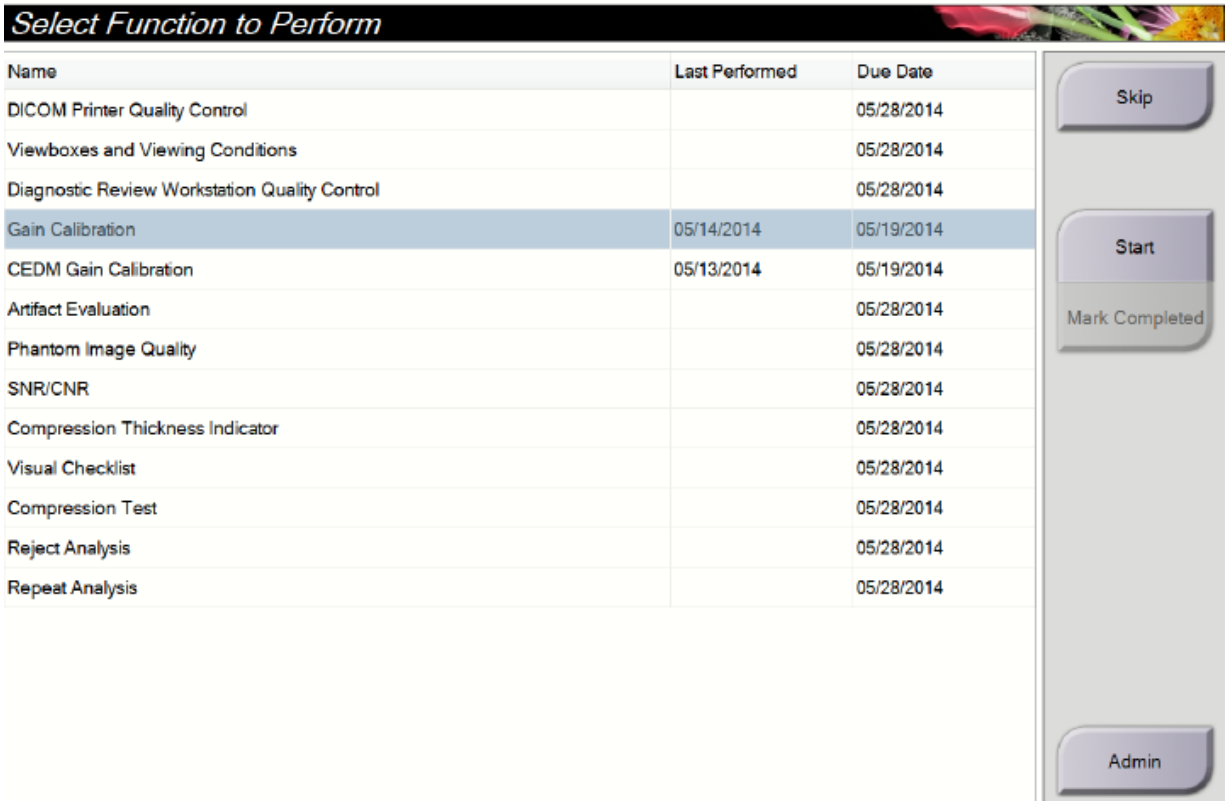
10.6.1 Regarding to the annual screening protocol, on the day of mammogram appointment, availability of previous/ private mammogram shall be counterchecked with the patient to avoid unnecessary mammography examination within a year. Special mammographic views shall only be performed if diagnostically indicated after consultation with duty radiologist. Thorough explanation shall be delivered to the patient before performing special mammographic views.

10.7 For mammographic examination request on young patient who is aged ≦35, ultrasound breast examination is usually performed first. Full/ half set of mammogram would only be added if diagnostically indicated.

10.8 Thorough explanation about the mammographic examination including the use of compression and the positioning technique to the patient is essential to facilitate the

production of high quality images with reasonably low radiation dose and to avoid unnecessary repeat.

10.9 Quality Assurance program should be in place to ensure that the mammographic systems are regularly tested to achieve optimal performance. The test results should be well documented, monitored and evaluated by appropriate personnel. Equipment faults should be properly recorded.



10.10 Quality Control activities at specified frequency should be performed to review the results and request timely corrective action as necessary to ensure the system in optimal performance.

Table 17: User Preventive Maintenance

	Recommended Frequency					
Maintenance Task Description	**Each Use**	**Weekly**	**Biweekly**	**Monthly**	**Bimonthly**	**Semiannually**
Clean & disinfect paddle	x					
Clean & disinfect breast platform	x					
Visually inspect all paddles for damage	x					
Detector Flat Field Calibration *		x				
Artifact Evaluation *		x				
Phantom Image *		x				
Signal to Noise / Contrast to Noise Measurements *		x				
Geometry Calibration (Tomosynthesis Option) *						x
Compression Thickness Indicator *			x			
Visual Checklist *				x		
Compression *						x
* Refer to Quality Control Manual						

10.11 Reject analysis should be conducted as part of Quality Assurance program. Technical repeats of mammogram caused increased radiation exposure to patients. Regular quality assurance program to ensure the standard of performance* in mammography imaging.

10.12 QC test on the accuracy of stereotactic imaging system should be performed before the start of every stereotactic examination session.

10.13 Appropriate training should be provided to Radiographers in order to produce high quality mammograms. Ideally, ≧97% of mammographic examinations performed should be produced with optimal quality for radiological interpretation; with <3% examination repeat rate due to technical reasons.

** The average glandular dose delivered during a single cranio-caudal view of an FDA-accepted phantom simulating a standard breast shall not exceed 3.0 milligray (mGy) (0.3 rad) per exposure, where two views should not exceed 6mGy. The dose shall be determined with technique factors and conditions used clinically for a standard breast.*
https://www.fda.gov/radiation-emitting-products/mammography-quality-standards-act-and-program

Chapter 11

The roles of personnel on radiation safety

11.1 Cluster Radiation Protection Adviser (RPA)

a) Oversee the provision of radiation safety issues, including support the end-users and staff, audit and monitoring of compliance with the Radiation Ordinance.
b) Advise the CCE, HCE and COS/Head of Unit on matters related to the radiation protection and the compliance with the Radiation Ordinance.
c) To conduct, as and when requested by the CCE, HCE or COS/Head of Unit, investigations on incidents involving over-exposure and other matters related to radiation safety and protection.

11.2 COS/ Head of Unit (Local Controlling Authority)

a) Responsible for the radiation safety of the staff, patients and members of the public in the department.
b) Responsible for matters related to the compliance with the Code of Practice in his/her department/unit.
c) To arrange for medical surveillance and radiation monitoring of staff.
d) To arrange for all relevant records to be kept.
e) Appoint suitable RPS.
f) To notify the RPS as soon as a pregnancy has been declared in a member of the staff so that necessary precautions can be taken to ensure that the fetal dose is kept below the relevant limit.
g) To obtain the necessary approval and licences from the relevant authorities.
h) To report to the HCE on incidents involving over-exposure, new radiation work, change of the nature of radiation work and other matters which may affect the radiation safety of the department/ unit.

11.3 Radiation Protection Supervisor (RPS)

a) To draw up local radiological protection rules.
b) To see that the instructions and requirements of the Code of Practice and Local Rules are observed in his/her department/unit/section.
c) To see that any personal monitoring devices issued are used in the correct manner.
d) To instruct departmental staff on safe working practices and any system of work in force in his/her department/unit/section.
e) To establish and maintain operational procedures which ensure that staff and patient exposures are kept as low as reasonably achievable.
f) To ensure that there is adequate protection to cover all changes in procedure, new procedures and new equipment.

g) To report to the COS/Head of Unit and, if necessary, the Cluster RPA any incident such as infringement of Local Rules, a suspected over-exposure, equipment malfunction involving radiation hazard, etc.

h) To report to the Cluster RPA via the COS/Head of Unit any new procedures and/or isotopes being used which may have radiation safety implications, and any deterioration in the state of protection in his/her department/unit/section.

i) Maintain adequate supplies of protective equipment.

j) Keep records of incoming and outgoing radioactive sources.

k) Supervise storage and disposal of radioactive wastes and keep records.

l) Handle declaration forms.

m) Monitor the working areas

n) Assist the COS/Head of Unit or the Cluster RPA in carrying out investigation on incidents involving over-exposure and on other matters related to radiation safety and protection.

11.4 Staff

a) Should take care not to expose himself/herself or any other person to ionizing radiation to an extent greater than is necessary for the purposes of his/her work, and exercise reasonable care while carrying out such work.

b) Should make full and proper use of any personal protective equipment provided.

c) Should follow the procedures as laid down in the Local Rules, and consult the RPS in case of doubt.

d) When any female staff is confirmed to be pregnant and need to work around the radiation controlled area, her supervisor should be informed as soon as possible. Precautionary measures should be taken to minimize the occupational exposure in consideration of the strict dose limit of fetus. Change of duty at non- radiation area may be considered during the pregnancy of staff.

Chapter 12

Contingency Plans

12.1 In case of emergency such as fire, flood, electrical breakdown, or the production of radiation has not been terminated at the intended end of exposure; switch off the machine immediately and shut down the main power supply breaker.

12.2 Emergency shutdown switches should be available in every image room and portable x-ray machine. They should be pressed at once if there are hazards happened to the equipment, patient, operator or other staff.

12.3 In case of reporting radiation hazard or radiation accident, the contact personnel are listed in the following:

Radiation Protection Supervisor :	**Dr. YC Ho**	2255-5485
(Representative of different ranks)	*Associate Consultant, (DR), QMH*	
(Please refer to the complete list of	**Ms. Eva Chan**	2255-3279
RPS on page 52.)	*Physicist, (DR), QMH*	
	Mr. Steve CM LI	2255-4750
	Senior Radiographer, (DR), QMH	
Radiation Protection Advisor :	**Dr. Sherry NG**	2255-4376
	Senior Physicist, (ONC), QMH	
Department Head of Radiology :	**Dr. Stephen CHEUNG**	2255-3284
	HKWC Service Director (DR), Chief of Service (DR), QMH	

Appendix I

Radiation Safety for Performing Radioembolization in Interventional Radiology Facility in DR/QMH

In addition to radiation safety to routine interventional procedures using X-ray, radiation safety procedures for radioembolization to liver cancer patients using unsealed source of ^{99m}Tc-MAA and ^{90}Y-microspheres have been implemented for every patient session using these radiation sources. The aim is to minimize the possibility of radiation contamination and to summarize the procedures to handle radiation contamination if contamination does occur. Because of the significantly higher radioactivity of ^{90}Y-microspheres used in the actual implant, a procedures list, including radiation protection setup, has been followed as guidelines. Some safety measures to minimize the exposure from the unsealed radiation source to interventional radiologists are also implemented according to the ALARA principle.

A: Interventional radiology room radiation protection

Absorbent sheet is placed on the floor area, within which the ^{90}Y-microspheres infusion is performed, to confine any possible leakage during infusion process (Figure 1). The area will also be radiation surveyed to ensure free of radiation contamination after the session.

Figure 1: Absorbent sheet large enough to cover area within which possible radiation leakage during infusion of ^{90}Y-microspheres is confined.

B: Interventional radiologist exposure minimization

After infusion of ^{99m}Tc-MAA or^{90}Y-microspheres, a lead lined blanket is placed on the patient abdomen area (Figure 2) to reduce the amount the radiation emitted from the patient and therefore to reduce the exposure to personnel handling the patient. The size and weight of this blanket is tolerable to the comfort of most patients. A pressure compressor is used by the interventional radiologist to press the puncture site (Figure 2). This avoids direct contact of radiologist's hands with the puncture site where residual radioactivity may remain.

Figure 2: A lead lined blanket is placed onto the patient abdomen to reduce the radiation emission from patient after radioembolization procedure. The radiologist is using a pressure compressor to press the puncture site to avoid direct hand contact with the residual radioactivity within the site.

C: Personnel and room radiation survey after radioembolization session

After each session, catheter and items that have been used during radiation infusion are collected by the medical physicist. Personnel radiation survey is also performed at the end of session. After the patient has left the room, medical physicist will perform radiation survey around the room to ensure that the entire facility is free from radiation contamination.

Appendix II

Fetal Absorbed Dose of some common Diagnostic Procedures

A table of fetal doses for some common diagnostic procedures (adopted from Protection of pregnant patients during diagnostic medical exposures to ionising radiation 2009) is listed below for reference:

EXAMINATION/ PROCEDURE	TYPICAL FETAL DOSE RANGE (mGy)
Plain/ Special examinations	
Abdomen	0.1 -1.0
Barium enema	1.0 - 10
Barium meal	0.1- 1.0
Chest	0.001 -0.01
Intravenous urography	1.0 - 10
Lumbar spine	1.0 - 10
Pelvis	0.1 -1.0
Skull	0.001 - 0.01
Thoracic spine	0.001 - 0.01
Computed Tomography:	
Abdomen	1.0 - 10
Chest	0.1 - 1.0
Head	0.001 - 0.01
Lumbar spine	1.0 - 10
Pelvis	1.32 - 17.06
Pelvimetry	0.1 - 1.0

Reference: Radiological investigation of women of child-bearing age operations circular No. 29/2016, Hospital Authority Head Office

Fetal radiation risk

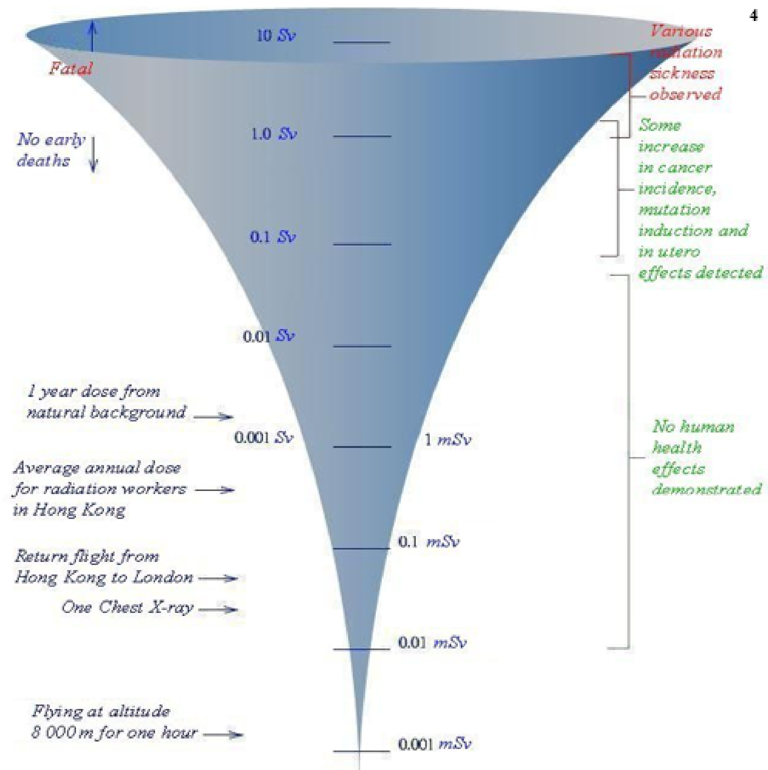
Fetus stage	Dose Effects
Week 0-2	>100 mGy : death of embryo or no effects
Week 2-8	>100 mGy : organ malformation, mutation
Week 8+	>300 mGy : mental retardation effects become obvious 30 IQ/Gy, i.e. 0.03 IQ/mGy

Source: ICRP 103 Table A.3.4

Appendix III

(Adult) Typical effective dose, Equivalent to 7-hour flight and Excess cancer risk estimation from diagnostic medical exposures

Examination / procedure	Typical effective dose (mSv)[5,6]	Equivalent to 7-hour flight (0.05 mSv)[2]	Excess cancer risk estimation (parts per million)[3]
Plain X-Ray			
Chest (single PA)	0.02	0.4 time	1.1
Spine	1.5	30 times	82.5
Upper GI tract	6	120 times	330
Lower GI tract	8	160 times	440
Computed Tomography (CT)			
Head			
Plain	2	40 times	110
With and without contrast	4	80 times	220
Spine	6	120 times	330
Chest	7	140 times	385
Coronary CT Angiography	12	240 times	660
Abdomen and pelvis			
Plain	10	200 times	550
With and without contrast	20	400 times	1100
Colonography	6	120 times	330
Nuclear Medicine			
Whole body FDG PET-CT scan	25	500 times	1375

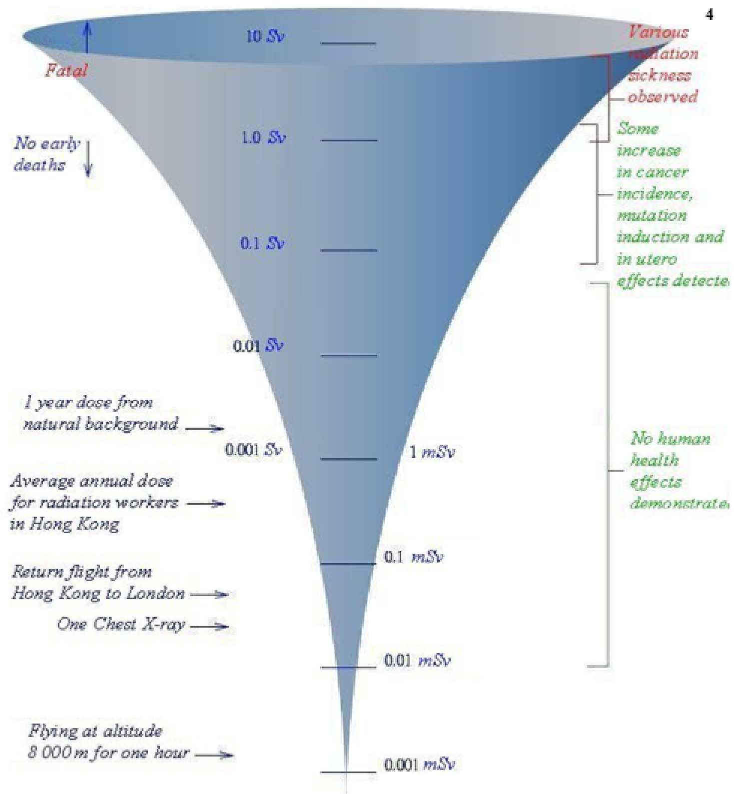


Reference:

1. Cancer screening, early detection and prevention guidelines for health professionals. https://www.hkacs.org.hk/ufiles/CancerScreeningprofessionals_2ndedition.pdf. August 2011
2. Radiology Clinician Fact Sheet Radiation Information, NSW Agency for Clinical Innovation. September 2012
3. ICRP 103 Table A.4.4 Detriment adjusted nominal risk coefficients for cancer and heritable effects
4. Effect of radiation, Radiation Health Unit, Department of Health. http://www.info.gov.hk/dh-rhu/english/html/understand_rad_english.htm
5. Radiation Dose to Adults from Common Imaging Examinations. RadiologyInfo, RSNA, ACR Radiology. July 2016
6. Communicating radiation risks in paediatric imaging: information to support health care discussions about benefit and risk. WHO Library Cataloguing-in-Publication Data 2016

(Paediatric) Typical effective dose, Equivalent to 7-hour flight and Excess cancer risk estimation from diagnostic medical exposures

Examination / procedure	Typical effective dose (mSv)[5]	Equivalent to 7-hour flight (0.05 mSv)[2]	Excess cancer risk estimation (parts per million)[3]
Plain X-Ray			
Chest (single PA) 5-years-old	0.02	0.4 time	1.1
Fluoroscopy			
MCU 5-years-old	0.33	7 times	18.2
Computed Tomography (CT)			
Brain			
New born	6	120 times	330
1-year-old	3.7	74 times	203.5
5-year-old	2	40 times	110
10-year-old	2.2	44 times	121
Chest			
New born	1.7	34 times	93.5
1-year-old	1.8	36 times	99
5-year-old	3	60 times	165
10-year-old	3.5	70 times	192.5
Abdomen			
New born	5.3	106 times	291.5
1-year-old	4.2	84 times	231
5-year-old	3.7	74 times	203.5
10-year-old	3.7	74 times	203.5
Nuclear Medicine			
FDG PET CT 5-year-old	15.3	306 times	841.5
Tc-99m cystogram 5-year-old	0.18	3.6 times	9.9
Tc-99m bone scan 5-year-old	6	120 times	330



Reference:

1. Cancer screening, early detection and prevention guidelines for health professionals. https://www.hkacs.org.hk/ufiles/CancerScreeningprofessionals_2ndedition.pdf. August 2011
2. Radiology Clinician Fact Sheet Radiation Information, NSW Agency for Clinical Innovation. September 2012
3. ICRP 103 Table A.4.4 Detriment adjusted nominal risk coefficients for cancer and heritable effects
4. Effect of radiation, Radiation Health Unit, Department of Health. http://www.info.gov.hk/dh-rhu/english/html/understand_rad_english.htm
5. Communicating radiation risks in paediatric imaging: information to support health care discussions about benefit and risk. WHO Library Cataloguing-in-Publication Data 2016

Appendix IV

Doses in Interventional Procedures

ICRP Publication 85

Table 3.1
Potential effects of fluoroscopic exposures on the reaction of skin and lens of the eye

Effect	Approximate threshold dose (Gy)	Time of onset	Minutes of fluoroscopy at typical normal dose rate of 0.02 Gy/min (20 mGy/min =2 rad/min)[c]	Minutes of fluoroscopy at typical high dose rate of 0.2 Gy/min (200 mGy/min =20 rad/min)[c]
SKIN[a]				
Early transient erythema	2	2–24 hours	100	10
Main erythema reaction	6	≈1.5 weeks	300	30
Temporary epilation	3	≈3 weeks	150	15
Permanent epilation	7	≈3 weeks	350	35
Dry desquamation	14	≈4 weeks	700	70
Moist desquamation	18	≈4 weeks	900	90
Secondary ulceration	24	>6 weeks	1200	120
Late erythema	15	8–10 weeks	750	75
Ischaemic dermal necrosis	18	>10 weeks	900	90
Dermal atrophy (1st phase)	10	>52 weeks	500	50
Telangiectasis	10	>52 weeks	500	50
Dermal necrosis (delayed)	>12	>52 weeks	750	75
Skin cancer	none known	>15 years	N/A	N/A
EYE[b]				
Lens opacity (detectable)	>1-2	>5 years	>50 to eye	>5 to eye
Lens/cataract (debilitating)	> 5	>5 years	>250 to eye	>25 to eye

[a] Potential effects of fluoroscopic exposures on the reaction of the skin. Adapted from Wagner and Archer (1998) with reference to Hopewell (1986).

[b] Potential effects of fluoroscopic exposures on the lens. Indicates the doses that can produce detectable but non-symptomatic radiogenic changes and those doses capable of causing significant visual impairment or debilitation.

[c] Without knowing the actual dose rate(s) of various modes of operation, an interventionist can inadvertently reach the thresholds. Columns 4 and 5 show the impact of typical (realistic) dose rates in terms of minutes required to reach the thresholds. This emphasises the importance of knowing the dose rates being delivered by specific equipment. Any 'rule of thumb' e.g. 100 minutes, should not be used, unless it represents the impact of actual dose rates.

Reference:

Valentin, Jack. "Avoidance of radiation injuries from medical interventional procedures, ICRP publication 85." Annals of the ICRP 30.2 (2000): 7 - 7

Interventional Procedures - Avoiding Radiation Injuries

1. Controlling dose to patient

a) Keep beam-on time to a minimum.
b) Dose rates will be greater and dose accumulates faster in larger patients.
c) The tube current should be kept as low as possible and also selecting a higher tube potential (kVp) in manual fluoroscopy mode to save patient dose; and providing that the above manual radiation technique adjustment will not degrade the image quality.
d) Keep x-ray tube at maximum and the image receptor at minimum distance from patient.
e) Always collimate closely to the area of interest.
f) Prolonged procedures: reduce dose to the irradiated skin e.g. by changing angulation of the beam.
g) Minimize: fluoro time, high dose rate time & number of acquisitions.
h) Don't over-use geometric magnification.
i) Remove grid for small patients or when image receptor cannot be placed close to patient.

2. Controlling dose to staff

a) REMEMBER: **Controlling dose to patient will help control dose to staff**.
b) Wear protective apron & glasses, use shielding, monitor doses – hand dose is often important.
c) Correct positioning to machine to minimize dose.
d) If beam is in the vertical plane (or near to vertical), keep the x-ray tube underneath the patient and the image receptor as close as possible to the patient whenever it is possible and appropriate to do so.
e) If beam is in the horizontal plane (or near to horizontal), the operators (operators can be clinicians, nurses and other staff who work close to the patient and C-arm) should stand on the image receptor side and keep a distance away from the image receptor if it is possible and appropriate to do so. It is because the back scatter radiation is more intense on the x-ray tube/patient side under this condition. Therefore, radiographer should pay attention to the control parameters of the x-ray machine; and should stay on the image receptor side but close to the control panel of the machine if it is possible and appropriate to do so.

3. Other factors in controlling doses

a) Ensure all staff are appropriately trained.
b) Use dedicated interventional equipment with correct specification.
c) Ensure comprehensive maintenance and quality assurance programmes are in place.
d) Obtain advice from a qualified radiation expert.

4. Informed consent and records

a) Patients are entitled to know the risks of radiation injury if likely to be high.

b) A written record should be kept if skin doses are estimated to be >3 Gy (1 Gy for repeated procedures).

c) Not all skin reactions are due to radiation; e.g. contrast medium allergy.

5. Follow-up

a) Radiation skin injury may be present later, but the association would not be considered if there is no documentation.

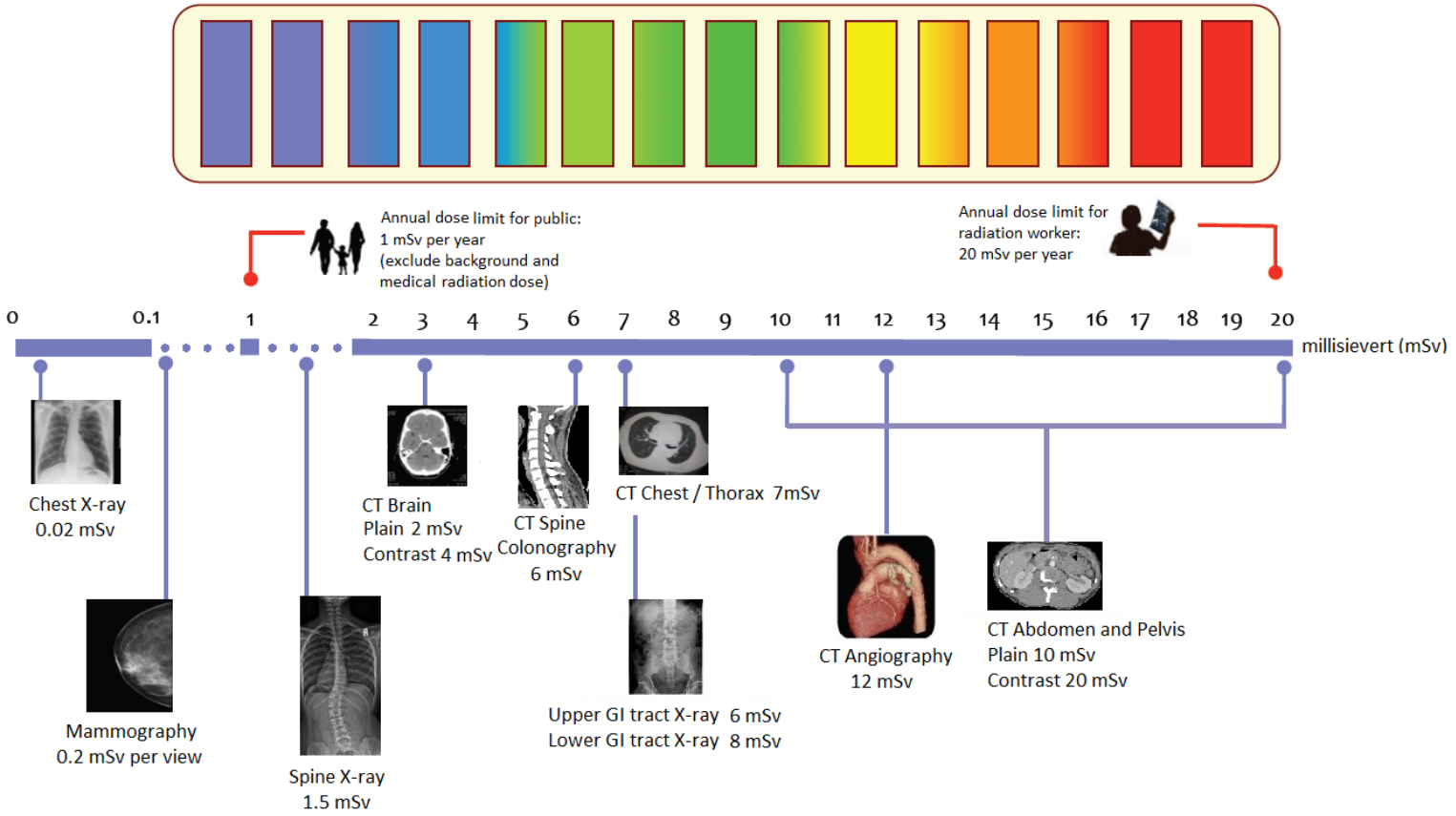
b) All patients with estimated skin doses of 3 Gy should be followed up 10-14 days after exposure.

c) A system to identify repeat procedures should be set up.

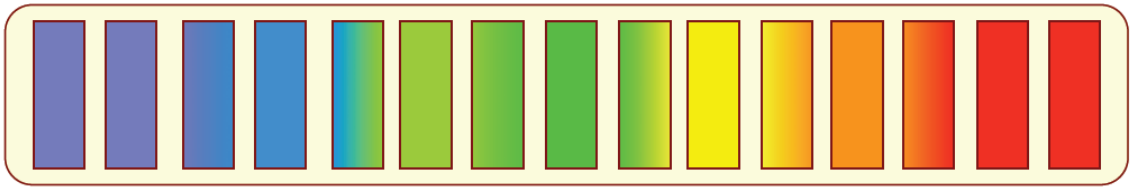
Appendix V

Medical effective radiation dose spectrum

Medical Effective Radiation Dose Spectrum



醫療輻射有效劑量比較圖

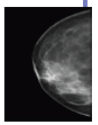


一般市民年劑量限值
1毫希沃特/年
(不包括天然背景輻射及醫療劑量)

輻射工作人員年劑量限值
20毫希沃特/年

0 0.1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 毫希沃特(mSv)

肺部X光檢查
0.02 mSv



乳房造影檢查
每張照片
0.2mSv

脊柱X光檢查
1.5 mSv

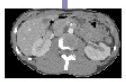
腦部電腦掃描
平片 2 mSv
注射顯影劑前後
4 mSv

脊柱電腦掃描
結腸造影
6 mSv

胸部電腦掃描 7 mSv

上消化道X光檢查 6 mSv
下消化道X光檢查 8 mSv

冠狀動脈電腦掃描造影
12 mSv



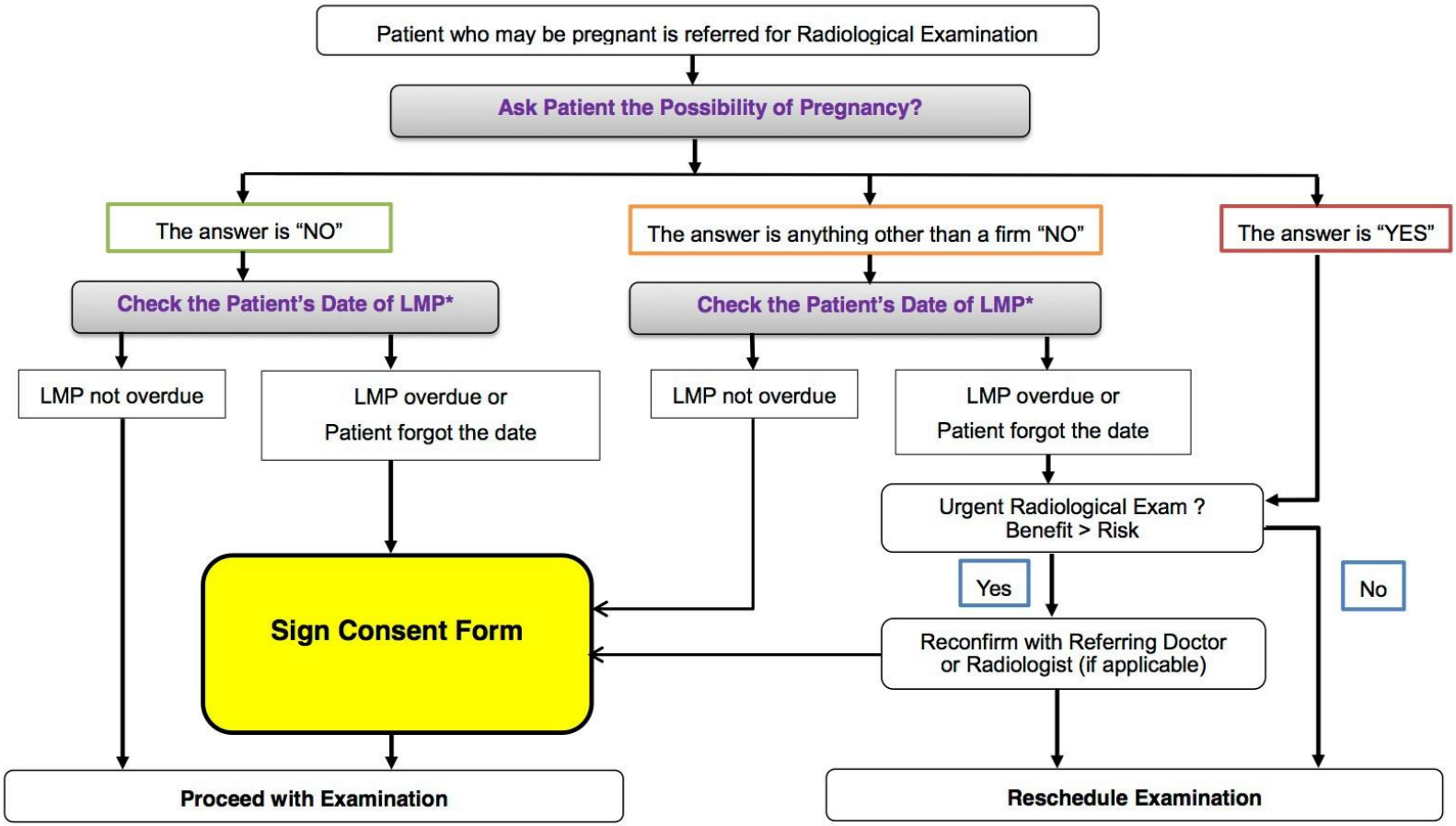
腹部電腦掃描
平片 10 mSv
注射顯影劑前後 20 mSv

Appendix VI

Flowchart on Radiological Investigation for Women of Child-bearing Age

(FOR INTERNAL REFERENCE ONLY)

Flowchart on Radiological Investigation for Women of Child-bearing Age
Department of Radiology, Queen Mary Hospital, HKWC



*Observe the 28-Day Rule for normal radiological examination or the 10-Day Rule for high dose examination involving the abdomen / pelvis of a woman of child-bearing age. High dose examination include (1) Abdominal CT, (2) Pelvic CT, (3) Barium Enema, (4) HSG, (5) IVU, (6) Abdominal / Pelvic Angiogram , (7) TACE / SIRTEX.

References: (1) HA Code of Practice on Radiation Safety 2011, (2) Local Radiation Protection Rules (DR), QMH, (3) Radiation and the early fetus, Ref No. BFCR(13)4, The Royal College of Radiologists, May 2013

DR, QMH

(Endorsed in CEC Meeting held on 9 September 2013)

Appendix VII

Flowchart on Monthly Return of TLD Badges for Radiographers in DR, QMH

Flowchart on Monthly Return of TLD Badges for Radiographers / PCAs in DR, QMH

Radiation Protection Supervisor to deliver reminder message to TLD Badge holders via email on 1st working day of each month

Scenario 1

Radiographers/PCAs on 5 day work week or shift duty.

Radiographers/PCAs to
(1) exchange the new TLD from the collection box
and
(2) sign the record sheet by themselves.

Scenario 2

Radiographers/PCAs ' leave period overlapped with the TLD collection period.

Before commencement of leave
Radiographers/PCAs to return the TLD to H1-Office

Immediately after leave
Radiographers/PCAs to collect the new TLD before duty resumption.

Collection box kept in H1-Office (Ext. no 3648) from 1st to 10th of each calendar month.

Radiation Health Division, Department of Health

Appendix VIII

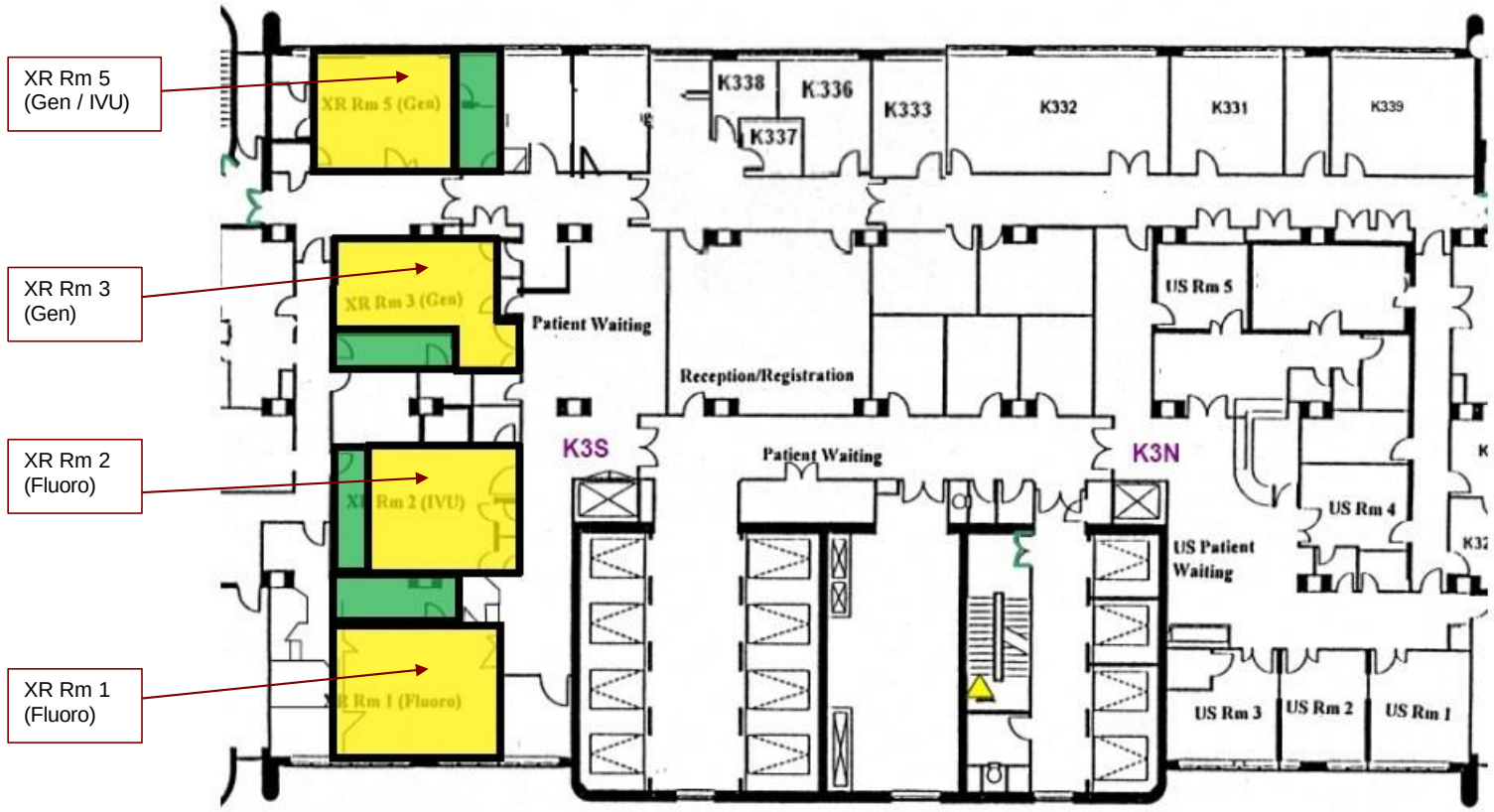
Designation of Radiation Areas for Radiology Department at Block H-1, Block K-3 and A&E X-ray & CT Scan unit

Designation of Radiation Areas: 1/F, Block H, Department of Radiology, QMH

Controlled Area This is a work area (exam room) in which the annual radiation doses may exceed 3/10 of the annual maximum permissible doses or 6 mSv for exposed workers. A yellow radiation warning sign should be attached to the entrance of controlled area. The exam room is designated as controlled area only when the red radiation warning light outside the door of that room is "on".

Supervised Area This is the work area (operator console) where the person might receive more than one-tenth but less than three-tenths of the annual dose limits dose (between 2-6mSv).

Designation of Radiation Areas: 3/F, Block K, Department of Radiology, QMH

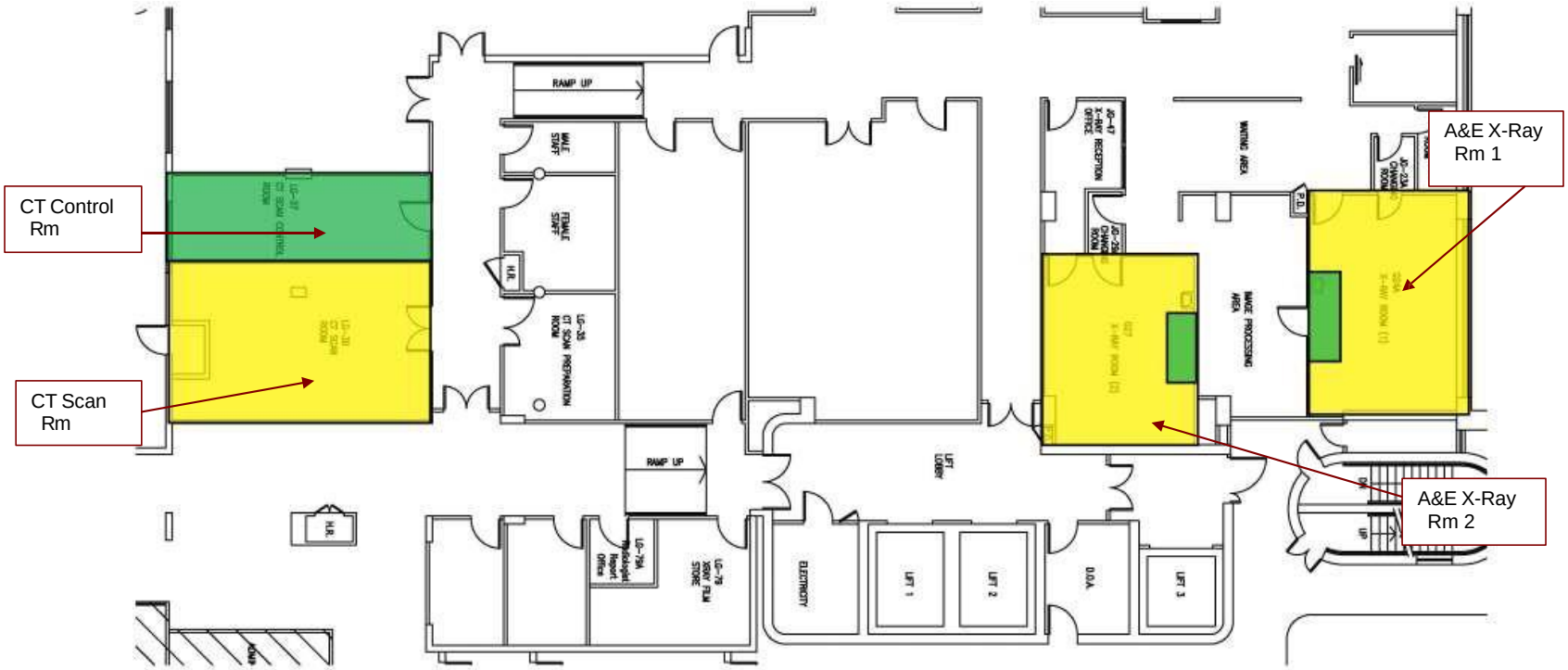


Controlled Area This is a work area (exam room) in which the annual radiation doses may exceed 3/10 of the annual maximum permissible doses or 6 mSv for exposed workers. A yellow radiation warning sign should be attached to the entrance of controlled area. The exam room is designated as controlled area only when the red radiation warning light outside the door of that room is "on".

Supervised Area This is the work area (operator console) where the person might receive more than one-tenth but less than three-tenths of the annual dose limits dose (between 2-6mSv).

(As of 15th February 2021)

Designation of Radiation Areas: A&E X-Ray and CT Scan Unit, Department of Radiology, QMH



Controlled Area This is a work area (exam room) in which the annual radiation doses may exceed 3/10 of the annual maximum permissible doses or 6 mSv for exposed workers. A yellow radiation warning sign should be attached to the entrance of controlled area. The exam room is designated as controlled area only when the red radiation warning light outside the door of that room is "on".

Supervised Area This is the work area (operator console) where the person might receive more than one-tenth but less than three-tenths of the annual dose limits dose (between 2-6mSv).

Appendix IX

List of RPS, DR, QMH

大口環根德公爵夫人兒童醫院
三東院華 SINCE 1870
馮堯敬醫院
葛量洪醫院
麥理浩復康中心
瑪麗醫院
三東院華 SINCE 1870
東華醫院
賀育醫院
醫院管理局 HOSPITAL AUTHORITY

10 July 2023

The Secretariat,
HKW Cluster / QMH Radiation Safety Committee,
Room 10-03,
10/F Administration Block,
Queen Mary Hospital.

Dear Sir / Madam,

Appointment of Radiation Protection Supervisor(s)

To comply with the Hospital Authority Code of Practice on Radiation Safety (2011), the following staff is/are appointed as the Radiation Protection Supervisor(s) of our department with effect from 10 July 2023:

Hospital	Dept	Name	Rank	Contact Tel. No.
QMH	Radiology	Dr. Y C HO	AC	2255 5485
QMH	Radiology	Ms. Eva CHAN	Physicist	2255 3279
QMH	Radiology	Ms. Candy MUI	Physicist	2255 3371
QMH	Radiology	Dr. Daniel LAM	Resident Physicist	2255 4215
QMH	Radiology	Mr. Vincent LEE	Resident Physicist	2255 3461
QMH	Radiology	Mr. C M LI	SRD	2255 4750
QMH	Radiology	Ms. W C WONG	SRD	2255 5483
QMH	Radiology	Mr. W H LEE	SRD	2255 6695
QMH	Radiology	Mr. K C HO	SRD	2255 5472
QMH	Radiology	Ms. Irene WONG	SRD	2255 3860
QMH	Radiology	Mr. W P CHENG	SRD	2255 6375
QMH	Radiology	Ms. P M WONG	APDR	2255 4643
QMH	Radiology	Ms. M L YIP	APDR	2255 3870
QMH	Radiology	Ms. Lisa WONG	APDR	2255 5500
QMH	Radiology	Mr. W K CHAN	APDR	2255 4900
QMH	Radiology	Mr. T C CHO	APDR	2255 4615

The appointed Radiation Protection Supervisor(s) is/are authorized to play the roles stipulated in the Code of Practice on Radiation Safety (2011):

(a) To draw up local radiological protection rules
(b) To see that the instructions and requirements of the Code of Practice and Local Rules are observed in our department / unit / section
(c) To see that any personal monitoring devices issued are used in the correct manner
(d) To instruct departmental staff on safe working practices and any system of work in force in our department / unit / section
(e) To establish and maintain operational procedures which ensure that staff and patient exposures are kept as low as reasonably achievable
(f) To ensure that there is adequate protection to cover all changes in procedure, new procedures and new equipment
(g) To report to the COS / Head of Unit and, if necessary, the Cluster Radiation Protection Advisor (RPA) and incident such as infringement of Local Rules, a suspected over-exposure, equipment malfunction involving radiation hazard, etc.
(h) To report to the Cluster RPA via the COS / Head of Unit any new procedures and / or isotopes being used which may have radiation safety implications, and any deterioration in the state of protection in our department / unit / section
(i) To maintain adequate supplies of protective equipment
(j) To keep records of incoming and outgoing radioactive sources
(k) To supervise storage and disposal of radioactive wastes and keep records
(l) To handle declaration forms
(m) To monitor the working areas
(n) To assist the COS / Head of Unit or the Cluster RPA in carrying out investigation on incidents involving over-exposure and on other matters related to radiation safety and protection

Signature : 
Name : Dr. C W CHEUNG
Rank : Chief Of Service
Department / Unit : Radiology
Hospital : Queen Mary Hospital

c.c. The Chairman of HKWC / QMH Radiation Safety Committee
All Appointed Radiation Protection Supervisor(s) listed above

與民攜手 Helping People Stay Healthy 保健安康

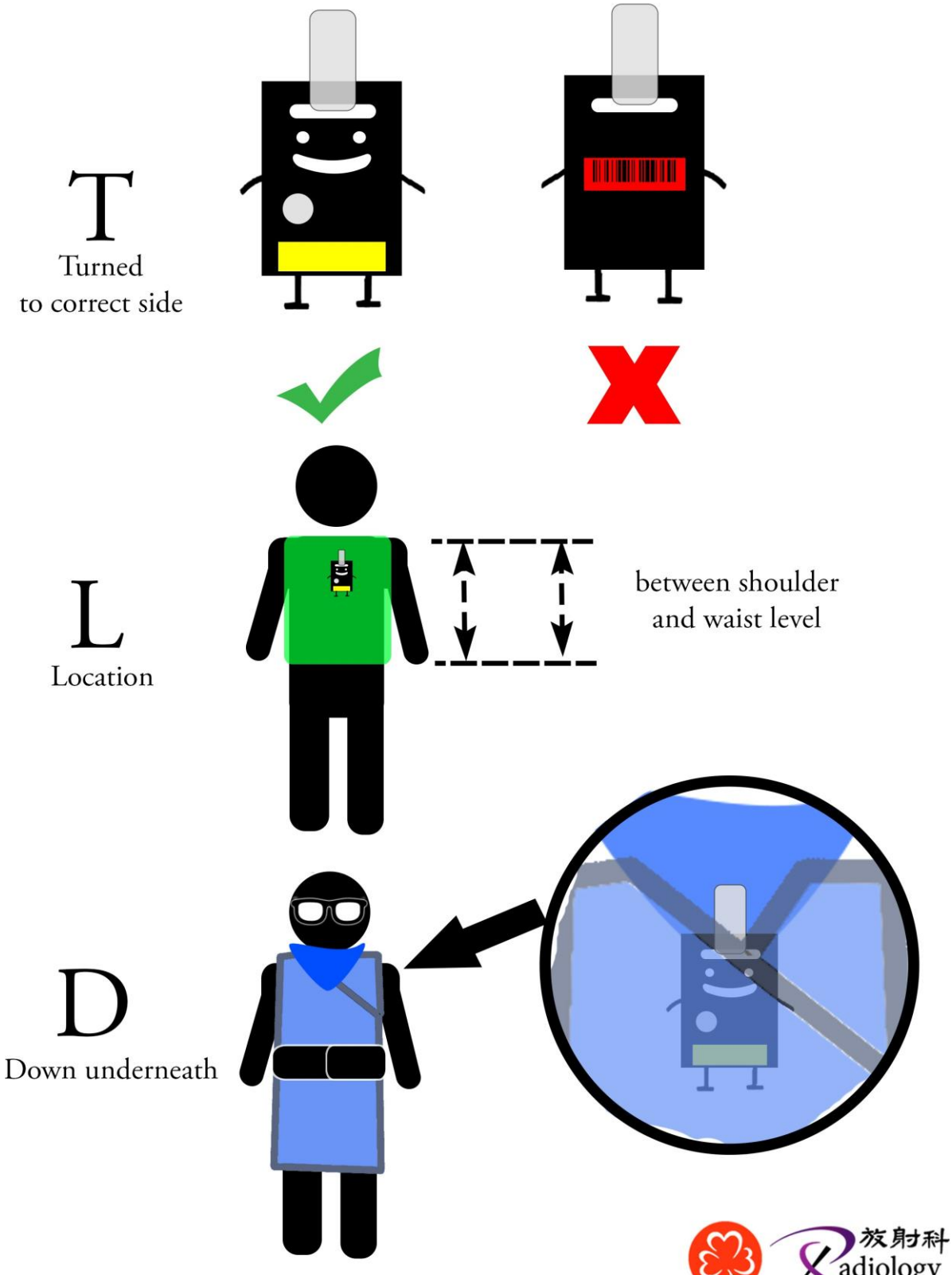
Hong Kong West Cluster
Hospital Authority
102 Pok Fu Lam Road
Hong Kong
Tel: (852) 2255 3111
Fax: (852) 2817 5496

港島西醫院聯網
醫院管理局
香港薄扶林道 102 號
電話：(852) 2255 3111
傳真：(852) 2817 5496

Appendix X

Proper management of TLD

1. Correct way to wear your TLD



Chapter 2.3, Guidance Notes on Radiation protection for Diagnostic radiology
Radiation Health Division, Department of Health

HA code of Practice 2022

Local Radiation Protection Rules – Department of Radiology, Queen Mary Hospital

放射科 Radiology

2. Lost, Broken, Accidental exposed TLD badges

Practical tips on the usage of Thermoluminescent Dosimeter (TLD) badges

Do:

1. Wear TLD badge while on duty.
2. Wear TLD badge on the truck at chest or waist height.
3. Wear TLD badge with personal name facing towards the body.
4. Wear your own TLD badge with correct name label.
5. Wear TLD badge under the lead apron, if any.
6. Keep TLD badge away from radiation area when not performing radiation work.
7. Must return TLD badge to Radiation Health Division (RHD) on or before15th of each month. Arrange with your supervisor when taking long leave. Otherwise, the dose of that month will be missed out in your TLD report.
8. Report any loss or damage to RHD as soon as possible.
9. Make any necessary arrangement with RHD when you transfer to another department or hospital.
10. Return your TLD badge and inform RHD when you quit your job or permanently cease working with radiation.
11. For classified radiation workers only: Copy the annual H[10] or H_p[10] reading (i.e., a deep-sited dose) from your TLD record to a report form prior to medical examination.

Don't:

1. Don't vandalise TLD badge.
2. Don't try to open TLD badge.
3. Don't put TLD badge above the lead apron or in the unshielded outer pocket of the lead apron.
4. Don't expose TLD badge to excess heat.
5. Don't bring along your TLD badge on air travel.
6. Don't put on your TLD for personal X-ray or CT examination.
7. Don't take your TLD away from the workplace.

Reference:

1. Code of Practice on Radiation Safety 2022; Hospital Authority
2. Instruction on the Use of Thermoluminescent Dosimeter; Radiation Health Division, Department of Health

3. Practical Tips on Online Personal Dose History Inquiry

Step 1: Go to https://www1.erls.gov.hk/dherl/components/Action/home in web browser.

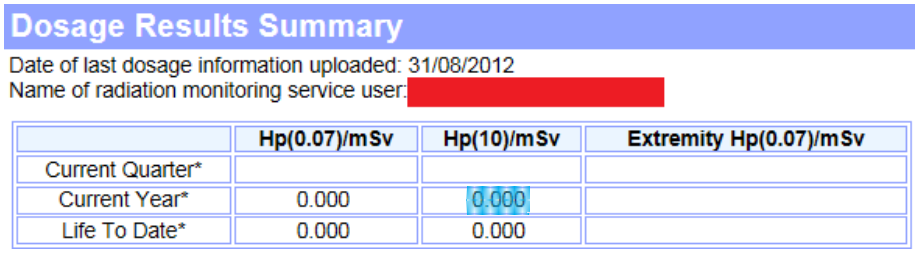
Step 2: Click on “Log on”.

Step 3: Select “Radiation Monitoring Service Person” in Account Type, then click “Confirm Account Type”.

Step 4: Enter your User ID and Password, then click “Submit”. User ID is your ID card number (without the digit or alphabet in brackets). Password is the same as User ID. Use capital letter for alphabet, if any.

Step 5: Click “RMS Personal Dosage Enquiry” on left column. Select the year of enquiry, then click “Search”.

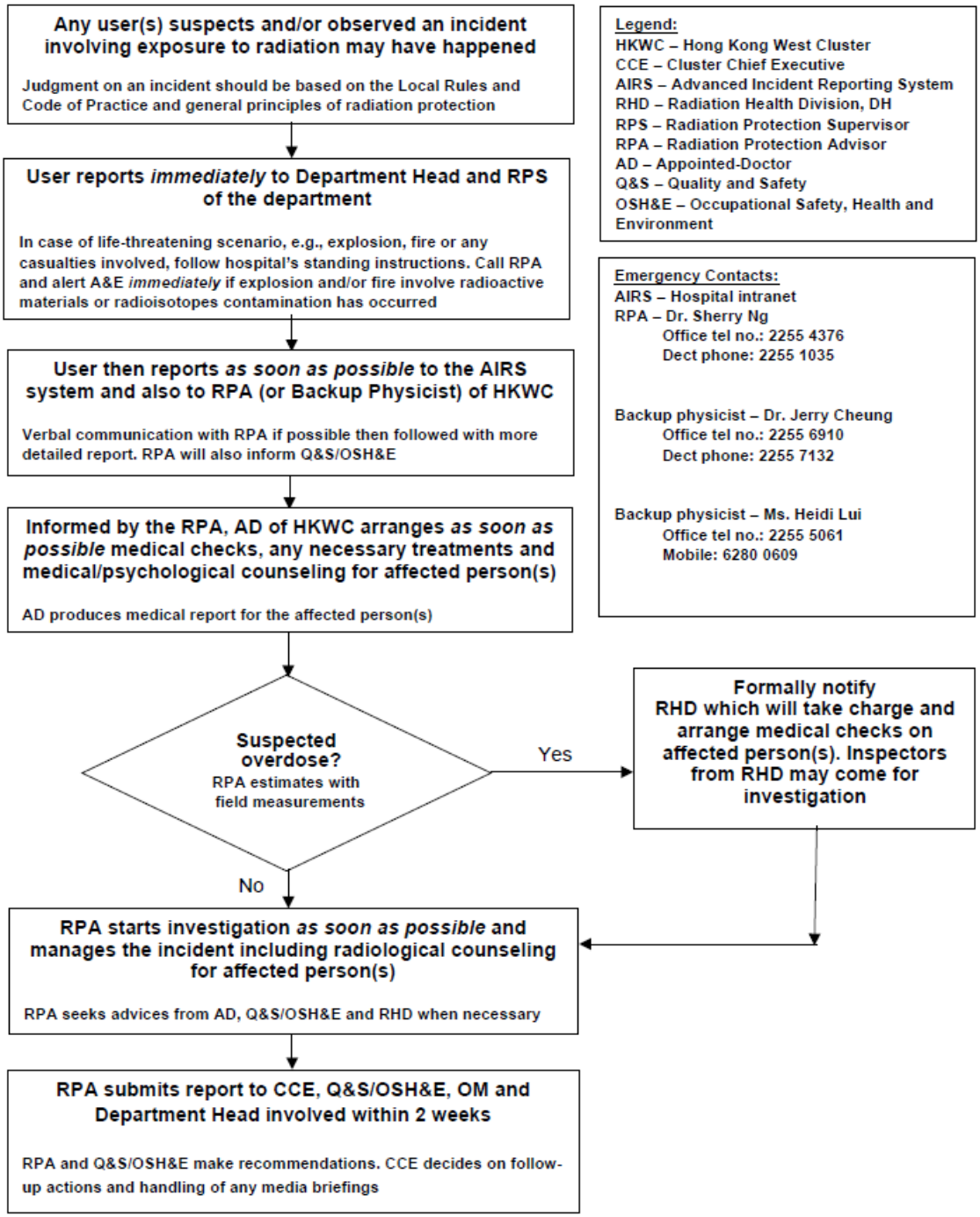
Step 6: Copy the $H_p(10)$/mSv reading (i.e., a deep-sited dose) of Current Year and the monthly doses to the dose report form prior to medical examination.



Appendix XI

Workflow in Radiation Incidents Reporting and Handling

Reporting and Handling of Radiation Incidents in HKWC



Appendix XI

a) Medical Staff Declaration Record: 1

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

	NAME (IN BLOCK LETTER)	RANK	SIGNATURE	DATE
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Appendix XI

a) Medical Staff Declaration Record: 2

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

	NAME (IN BLOCK LETTER)	RANK	SIGNATURE	DATE
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Appendix XI

a) Medical Staff Declaration Record: 3

Please sign your name in the below form to indicate that you have read and understood the contents of this "Local Radiation Protection Rules", and is willing to observe them.

	NAME (IN BLOCK LETTER)	RANK	SIGNATURE	DATE
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Appendix XI

b) Radiographic Staff Declaration Record: 1

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

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Appendix XI

b) Radiographic Staff Declaration Record: 2

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

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Appendix XI

b) Radiographic Staff Declaration Record: 3

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

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Appendix XI

b) Radiographic Staff Declaration Record: 4

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

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Appendix XI

b) Radiographic Staff Declaration Record: 5

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

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Appendix XI

b) Radiographic Staff Declaration Record: 6

Please sign your name in the below form to indicate that you have read and understood the contents of this "Local Radiation Protection Rules", and is willing to observe them.

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Appendix XI

c) Nursing Staff Declaration Record: 1

Please sign your name in the below form to indicate that you have read and understood the contents of this “Local Radiation Protection Rules”, and is willing to observe them.

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Appendix XI

c) Nursing Staff Declaration Record: 2

Please sign your name in the below form to indicate that you have read and understood the contents of this "Local Radiation Protection Rules", and is willing to observe them.

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