瑪麗醫院
QUEEN MARY HOSPITAL

LOCAL RADIATION

PROTECTION RULES

Nuclear Medicine Unit

Department of Radiology

Queen Mary Hospital

2019

Version 5.1 dated Sep-2019

Queen Mary Hospital

From :	Dr. W Y Ho Consultant in Nuclear Medicine Nuclear Medicine Unit Department of Radiology/ QMH	To :	All Staff Nuclear Medicine Unit, DR/ QMH
Ref :	(2) in NMM/R/LRPR		
Tel :	2255 3864 Fax: 2855 1341	Your Ref:	
Date :	16 Sep 2019	Dated:	

Re: Local Radiation Protection Rules 2019

1. This set of Local Radiation Protection Rules is produced for the protection of staff, patients and members of public in the Nuclear Medicine Unit, Department of Radiology, Queen Mary Hospital. It is a simplified and tailored version of the "Code of Practice on Radiation Safety in HA Hospitals 2011" and includes information on recommended procedures, systems of work and principles on the safe use of radioactive sources in the Unit.
2. It is a requirement of all staff who might be exposed to ionizing radiations in the Unit to read this "***Local Radiation Protection Rules 2019 – Nuclear Medicine Unit, Department of Radiology, Queen Mary Hospital***", and to complete and sign the Declaration Record 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. Furthermore, copies of the Local Rules are available at the CC3 Scan Room, CC4 Scan Room, CC3 NM Reception and my office.

Thank you for your kind attention.

(Dr W Y HO)
Consultant in Nuclear Medicine
Nuclear Medicine Unit
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Chapter 1 Introduction

1.1 These Local Rules are produced in accordance with the 'Code of Practice on Radiation Safety in HA Hospitals, 2011' (Code of Practice). They include information and explanations on recommended procedures and possible risks which may be encountered in the Unit 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 Physicist with appropriate experience. The Chief of Service (COS) or Head of Unit may in consultation with the RPA 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(s) of the Unit involved.

1.5 **It is a requirement that every radiation worker should read these Local Rules which affect his/ her work and well being.** ***All staff in this Unit 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 General Principles of Radiation Protection

2.1 Radiation protection is based on three general principles:

a) Every practice resulting in an exposure to ionizing radiation should be justified by the advantages it produces.

b) All exposures should be kept as low as reasonably achievable, economic and social factors being taken into account.

c) The sum of dose and committed dose received should not exceed the limits recommended in Table 1, which excludes doses from medical exposure and natural environment.

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

The limits apply to the sum of the relevant doses from external exposure in the specified period and the 50-year committed dose (to age 70 years for children) from intakes in the same period.

Application	Annual dose limit	
	Occupational	*Public*
Effective dose	20 mSv	1 mSv
Lens of the eye	150 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.

2.2 Every individual using ionizing radiations 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 radioactive 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 radiotoxic and the smallest radioactivity if possible.

2.4 The TLD badge or ionization dosimeter, when provided, must be worn at all times when on duty. It should be worn on the trunk at chest or waist height. When not being worn, care should be taken to prevent the dosimeter from being exposed accidentally to ionizing radiation or heat. This could affect the assessment of doses.

2.5 Equipment for measuring finger doses could be available if there is any reason to suspect that doses to fingers may exceed 1/10 of the appropriate dose limit. Care should be taken to avoid any dosimeter from becoming wet or damaged and lost.

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

2.7 The dose limits for occupationally exposed workers aged 18 years or above are given in Table 1. 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 in the course of work.

2.8 Women of reproductive capacity have a special responsibility in that they must immediately inform either the administrative supervisor or the Head of their unit as soon as they know 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.

Chapter 3 Duties of Safety Staff (refer to Appendix I)

3.1 Radiation Protection Adviser (RPA)

(a) Advise the HCE and COS/ Head of Unit on radiation safety and protection.
(b) Advise the HCE and COS/ Head of Unit on matters related to the compliance with the Code of Practice.
(c) To conduct, as and when requested by the HCE or COS/ Head of Unit, investigation on incidents involving over-exposure and other matters related to radiation safety and protection.

3.2 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/ unit.
(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) In consultation with the RPA, 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 foetal dose is kept below the relevant limit.
(g) To obtain the necessary approval and licences from the relevant authorities for his/ her department/unit.
(h) To report to the HCE, RPA and Committee on Radiation Safety 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.

3.3 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 to ensure that staff and patient exposures are kept as low as

reasonably practicable.

(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 RPA any incident such as infringement of Local Rules, a suspected over-exposure, equipment malfunction involving radiation hazard, etc.

(h) To report to the 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 and materials.

(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 RPA in carrying out investigation on incidents involving over-exposure and on other matters related to radiation safety and protection.

3.4 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 described in the Local Rules and consult the RPS in case of doubt.

(d) Should have medical examination (ME) prior to work in the Unit. For staff rotating to the Unit temporarily where ME could not be arranged on time, the following rules should strictly be observed:

1. Wearing additional Pocket Dosimeter for monitoring and registering daily doses.
2. Performing Contamination Checks before and after handling of unsealed radioactive sources by survey meter or area monitor.
3. Applying sufficient personal protective equipment (PPE) when handling unsealed sources such as lead syringe shields and vials, lead-lined receptacles, protective lead block, protective lead screens, long tongs and forceps, appropriate working clothes, laboratory coats, protective gowns and

gloves to prevent spillage and contamination.

4. Reporting any potential radiation incidents to RPS/ RPA.

Chapter 4 Designation of Areas and Persons

4.1 Designation of areas

The followings are controlled areas:

(a) "Hot Laboratory" for handling of samples or doses of activities greater than 1000 MBq, except Technetium-99m of which an activity of 20 GBq under adequate shield is allowed.

(b) "Cold Laboratory" for handling doses or samples of activities not greater than 1000 MBq. Preparation of radiopharmaceuticals may be done in the Cold Laboratory.

(c) "Cell Labelling Laboratory".

(d) "Scan Rooms" for administration of radiopharmaceuticals.

(e) "Consultation/ Injection Room" for administration of radiopharmaceuticals.

4.2 Appropriate radiation warning signs should be posted at the entrance of the controlled areas and the safety cabinets where radiation work is performed, and at the refrigerators and lead safes where radioactive material is stored.

4.3 Designation of classified worker.

Workers who are likely to receive a dose more than 3/10 of annual dose limit or who need to handle unsealed radioactive sources would be designated as classified worker. It is mandatory for workers to have medical examination and a certificate of fitness issued by Radiation Board before designation as classified worker.

If staff is deployed to work in the Unit due to urgent deployment such as replacement for unscheduled leave, sick leave, or a short period of time, whereby prior MEB examination could not be arranged, alternative protective measures would be enforced. Section 3.4 (d) applies.

4.4 When persons, other than classified persons, enter a controlled area, the entry should only be allowed in accordance with a written scheme of work.

Chapter 5 Systems of work: Radiation Operating Equipment

5.1 Rules for handling unsealed sources

There are three main hazards in handling unsealed sources of radioactivity, these are: -

(a) deposition of isotopes into the body.
(b) skin contamination and spread of contamination.
(c) effects of external beta and gamma radiation.

The rules elaborated in the following paragraphs for "Hot Lab", "Cell Labelling Lab", "Cold Lab", "Scan Rooms" and "Consultation/ Injection Room" are based on controlling these hazards.

5.2 Rules for handling unsealed sources in "Hot Lab" and "Cell Labelling Lab"

(a) Protective coats must always be worn in the laboratories.
(b) No eating, drinking, smoking, etc. in the laboratories.
(c) Disposable gloves must always be worn when handling the radioactive substance(s). It should be removed when leaving the laboratories using the surgical technique, checked for the presence of any contamination and then placed in the ordinary waste bin if there is no contamination. Hands should also be monitored for the presence of any contamination by survey meter.
(d) The possibility of transferring radioactivity to the skin, or any inactive region or object, should always be kept in mind, and meticulous care must be exercised.
(e) Tc-99m generators must be placed inside the lead-lined isolator in the Hot Laboratory. Careful consideration should be given to the manipulations and layout of the generator so that opportunities for bacterial and radioactive contamination are minimized during operation. Elution should only be performed by trained staff who are familiar with the procedures to operate the generator properly.
(f) All radiopharmaceuticals must be labeled clearly, stating radioisotope and its radioactivity with reference time, volume and expiry date, date of preparation and staff initial.
(g) Whenever it is possible, disposable containers and instruments should be used. Glassware, polythene-ware, pipettes, etc. which are not disposable, should be marked according to the isotope and activity and date of preparation and staff initial. Pipetting by mouth is absolutely prohibited.

(h) All used syringes should be disposed. Contaminated syringes with needle cover should be placed in the appropriate "active" waste bin. The "active" waste bin is a lead-lined metallic can with stainless steel cover. A hard plastic sharp box is placed inside the bin to avoid leakage. The plastic sharp boxes will be kept inside the decay modules for appropriate time intervals to allow radioactive decay. The Tc-99m sharp boxes will be kept in the short half-life decay module for a minimum time period of three days before disposal. Other radioisotope sharp boxes, namely Tl-201, Ga-67, In-111, I-131, Ra-223 and Y-90 will be kept in the long half-life decay module for a minimum period of two months before disposal.

(i) Prior to disposal, the radioactivity level of sharp boxes should be surveyed with survey meter. They can be disposed when the measured radiation level is less than twice of the background radiation level. Record of disposal should be entered into the "Radioactive Waste Disposal Record" kept by physicist.

(j) No contaminated material of any description must be left unattended on the benches.

(k) Scissors, forceps, etc, which have been used in the laboratories should be monitored for contamination with survey meter to ensure free of radiation contamination.

(l) Tools and equipment used in the laboratories must not be taken for use outside the laboratories.

5.3 <u>Rules for handling unsealed sources in "Cold Lab"</u>

(a) All radiopharmaceuticals must be kept in suitable shielded containers and clearly labeled, stating the name of radiopharmaceutical, the isotope, activity, volume, expiry time, date of preparation and staff initial. This must be done before, or immediately after preparation.

(b) No eating, drinking, smoking, etc, in the Cold Lab.

(c) Disposable gloves must be worn for all procedures involving activities. The possibility of transferring activity to the skin or any inactive region or object should always be kept in mind.

(d) All operations must be carried out in designated areas which should be covered with absorbent paper.

(e) At all times, store all sources in shielded vial of suitable thickness, when the sources are not being used.

(f) Carry out all manipulations as quickly as possible when the source is outside its shielded vial and always keep possible distance from sources by using long tongs or forceps. Never pick up any unsealed source by hands.

(g) The drawing-up of radiopharmaceutical for intravenous injection or oral tracer should be done inside the lead-lined biological safety cabinet.

(h) To reduce finger dose to a minimum, use syringe shield when handling any radiopharmaceuticals and never fill the syringe more than 50% of its volume.

(i) Disposable ware should be used whenever possible. All contaminated syringes should be placed in the "active" waste bin. Non-disposable contaminated wares should be put inside lead container to allow for decay to background radiation level. Prior to reuse, the radiation level should be checked.

(j) No contaminated material should be left lying on benches.

(k) The benches in the Cold Lab must be regularly monitored.

(l) Hands must be monitored immediately after handling any radioactive substances, and also before going home and going to meals.

5.4 <u>Rules for handling unsealed source in "Scan Rooms" and "Injection Room"</u>

(a) No eating, drinking, smoking, etc, in the rooms.

(b) Any syringe filled with radiopharmaceutical must be covered with syringe shield and placed in a suitable lead container for transportation to the place of injection.

(c) Disposable gloves should be worn for all procedures involving radiopharmaceutical injection, handling sources or spills.

(d) Special attention must be rendered to avoid spills during intravenous injections.

(e) After injection of radiopharmaceutical, unit dose syringe should be put in the lead pigs for return to suppliers. Contaminated flushing syringes should be put in sharp box inside the "active" waste bin. The waste will be transferred to the appropriate decay modules inside the "Hot Lab" to allow radioactive decay prior to disposal. The minimum storage time period being three days for Tc-99m and being two months for long half-life radionuclides such as Tl-201, Ga 67, In-111, I-131, Ra-223 and Y-90 before disposal.

(f) Contaminated syringes and other wastes should be removed from scan rooms as soon as possible.

(g) Radiographers and other staff are advised to work behind the mobile lead screen, if situation permits. Keeping a safe

distance from patient injected with radiopharmaceuticals is also a way to reduce external irradiation.

(h) No manipulation of radioactive material must be carried out in the rooms.

(i) Any unused or partially used "unit doses" should be returned to the suppliers.

5.5 Rules for routine radiation protection measurement

(a) Contamination Survey
Daily survey with portable survey meter to check the background radiation level of the working environment should be performed in the morning before patient service. Results should be registered in the "Daily Contamination Survey Record".

(b) Wipe Test Counting
Weekly wipe testing should be performed to check for the presence of any removable surface contaminants. Results should be registered in the "Weekly Wipe Test Record".

(c) Dose Calibrators Quality Control
Daily QC should be performed with Co-57 vial calibration source while weekly QC should be performed with Co-57, Co-60, Ba-133 and Cs-137 vial calibration sources for both dose calibrators in the Cold Lab and Consultation Room. After QC has been finished, the sources should be locked in the Lead Safe inside Hot Lab. Compare the results with the theoretical set of data to ensure QC is passed for clinical service. The results should be entered into the "Radionuclide Dose Calibrators Quality Control Record".

(d) Gamma Cameras Daily Quality Control
Daily QC should be performed with the Co-57 flood source. Four million counts are acquired for each of the three gamma cameras. Run the uniformity analysis in each camera respectively to ensure QCs are passed for clinical service.

(e) Syringe Shield Integrity Weekly Check
Count the number and check the integrity of all lead glass, lead, tungsten syringe shields to check for physical damage and enter the results in the "Syringe Shield Checklist".

(f) Current Sealed Radioactive Sources Daily Check
Check the total number of spot markers, pen markers and flood sources and enter the results in the "Radioactive Sealed Sources Checklist". This should be performed after the last patient each day.

Chapter 6 Storage, Transport and Waste Disposal

6.1 Storage

(a) Staff should ensure that any radioactive material that is not in use or being moved, transported or disposed of:
(b) is kept in a suitable lead-lined receptacle; and
(c) is kept in a suitable lead-lined store; or
(d) is kept in a lead-lined refrigerator.
(e) The following special precautions should be observed:
    i) Active residues of low activity must be stored in air sealed glass vial with adequate lead shield.
    ii) Special care should be taken in opening vials storing radioactive materials for long time to minimize the danger from frothing.
(f) Sealed radioactive check sources should be kept in lead-lined safe in the "Hot Lab".

6.2 Transport

(a) A radioactive material to be transported beyond controlled areas must be stored in a suitable lead-lined receptacle.
(b) The receptacle should carry a radiation warning sign.
(c) Radioactive materials should be transported by, or under the supervision/ advice of a qualified radiographer or physicist.
(d) Care should be taken that radioactive materials are not moved inadvertently.

6.3 Waste Disposal

The disposal of radioactive waste (patient's excreta excluded) in HA hospitals is governed by "The Code of Practice on Radiation Safety 2011 in HA Hospitals".

(a) Waste with an activity which is too large for immediate disposal must be stored. Care must be taken not to mix short- and long- lived radionuclides as time required for the radioactivity to decay to an acceptable low level is different. For radionuclides of half-life longer than one year, the RPA shall be consulted.
(b) It is essential that all radioactive wastes awaiting disposal, or stored to allow decay, are kept in suitable containers to prevent any dispersion of the contents. Such containers include lead-lined waste bins and lead-lined decay modules. Short half-lives radioactive wastes such as Tc-99m and I-123 should be stored for at least three days, whereas long

half-lives radioactive wastes such as Tl-201, Ga-67, In-111, I-131, Ra-223 and Y-90 must be stored for at least two months. The name of radionuclides and method of disposal must be recorded before disposal.

(c) Prior to disposal, the radioactivity level of containers should be checked with survey meter. Practically, they can be disposed when the measured radiation level is less than twice of the background radiation level. Record of disposal should be entered into the "Radioactive Waste Disposal Record" logbook with signatures from RPS.

(d) Spent Tc-99m generators should be returned to the suppliers for disposal.

Chapter 7 Emergency Procedures

7.1 Notification of Emergencies

7.1.1 Notices should be posted at places where foreseeable accidents may occur, they should show:

(a) How to contact the RPS or an alternative person who should be notified immediately of any emergency;
(b) How to call the fire brigade and medical services; and
(c) the location of emergency equipment.

7.1.2 All emergencies should be notified to the RPA, who should subsequently review the contingency plan with the Head of Department in the light of any lessons learned, and to the appropriate authorities according to the notification requirement given below:

(a) any incident in which radioactive material which is under his control and of activity exceeding that shown in column 2 of Appendix III has been released or spilled other than by a route specified by this code to dispose of radioactive waste;
(b) if a quantity of a radioactive substance which exceeds the quantity for that substance specified in column 3 of Appendix III and which is under his control is lost or has been stolen;
(c) all cases involving the exposure of employees or members of the public to doses exceeding the annual dose limits;
(d) any accident involving injury of people by sources of ionizing radiation;
(e) any violation of these Local Rules;
(f) if for any reasons, a patient has been exposed to a much greater extent than that intended and that the event results in adverse health effects worse than expected for the normal range of exposure prescribed for the procedure.

7.2 Decontamination Procedures

Spills may be divided into two categories:

(a) Minor spills (i.e. those involving μCi level)

These spills are not serious but require careful handling to avoid spreading contamination. The following procedures should be adopted: -

i) Gloves and overshoes must be put on before dealing

with the spill.

ii) If personnel are involved, any contaminated clothing must be removed immediately and put in a suitable container for monitoring. If any of the radioactive material is on the skin, the area should be mopped up with absorbent gauze or cotton wool ball and cleaned with radioactive decontaminant, before washing thoroughly with soap and tap water (taking care to avoid the spread of contamination, particularly to the eyes).

iii) The spill should also be mopped up with absorbent paper, and the paper placed in a polythene bag.

iv) The contaminated area must be monitored before it is released for use.

v) If contamination occurred at locations where access by staff and patients are unlikely, the area could be covered by absorbent papers, enclosed by radiation signage tape, and denoted the date and time of spillage and the type of radioisotopes involved. On the next working day or session, the area could be opened after checking for residual radioactivity by RPS or his/her delegates.

vi) Log the incident in the "Radioactive Materials Spillage Log Book".

(b) Major spills (i.e. those involving mCi level)

Millicurie amounts of short-lived isotopes are often used in trace investigations and imaging. It is essential that decontamination of personnel takes priority over clearing up the spill. Confine the area of contamination and prevent the spill from spreading if possible. The following procedures should be adopted to deal with major spills: -

i) Assistance must be called, and the head of the Unit or its Deputy, and the R.P.A. informed at once.

ii) The affected area must be screened off. Anyone entering this area must wear overshoes, protective gowns and gloves, all of which must be removed on leaving the area and placed in a polythene bag.

iii) All non-contaminated persons should be removed from the area.

iv) All contaminated persons should be kept in a separate screened off area, all contaminated clothing must be removed and placed in the bag provided. If the spill is on the skin, decontamination measures as in 7.2(a, ii) apply. The skin should be monitored for residual

activity level.

v) The actual material spilled must be mopped up with disposable paper, which should be put in a polythene bag.

vi) The contaminated surface must be washed with radioactive decontaminants until the activity can no longer be further reduced. If this cannot be achieved the area must be covered with polythene sheeting and lead sheeting.

vii) Log the incident in the "Radioactive Materials Spillage Logbook".

Chapter 8 Local Rules for Dual Energy X-ray Bone Densitometer Scan Room

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

8.2 All staff should carry TLD badge or ionization dosimeter and must be worn on the trunk at chest or waist height at all times when on duty.

8.3 All staff must stand behind the control console during exposures.

8.4 Do not handle patient or calibration phantom when the shutter is opened. Do not stay within 1 meter of the beam area when the beam is on.

8.5 Do not allow laser light to reach the eyes either directly or by reflection.

8.6 Patient shall be properly positioned before the X-rays are "on" and shall not be exposed to the radiation beam for longer than necessary time to carry out the diagnostic test.

8.7 Any person who is supporting a patient for examination should wear a lead apron. No part of this person's body should be in the useful beam.

8.8 For patient of child-bearing age, radiographer must check her last menstrual period (28-day rule to be applied) and/or sign the consent form before the examination. If pregnancy of patient is confirmed, the examination should be cancelled or proceed with justification.

8.9 Make sure that the doors of the scanner room are closed before making any exposure, and the doors should be kept closed during X-ray on.

8.10 Warning sign indicating ionizing radiation, together with any appropriate words should be posted in a prominent position.

8.11 A red light X-ray indicator is located above the entrance doors. Do not enter the room when the red light is on. Periodic check should be conducted for the red lights to ensure the functionality.

8.12 Lead aprons and lead shield should be available and used whenever appropriate.

8.13 The radiation level of the control console should be monitored by an ionization dosimeter at regular interval.

8.14 Daily QC test should be performed before the start of every examination session.

8.15 Quality Assurance program should be in place to ensure that the systems are regularly tested. The test results should be well documented, monitored and evaluated.

Chapter 9 Performing radio-pharmaceutical injection outside the NM unit (Inside the QMH premises)

9.1 The general principles on NM radiation protection, waste disposal, decontamination mentioned in this Local Rules are applicable. (Please refer to the corresponding chapters for details)

9.2 The performance of the injection of radio-pharmaceutical outside the NM unit must be exercised with justifications and approval from the NM radiologists.

9.3 The radio-pharmaceuticals to be transported within the QMH premises must be contained in a well-sealed lead lined receptacle.

9.4 The receptacle should carry a radiation warning sign.

9.5 A stable trolley should be used for transportation.

9.6 On the transportation trolley, there should be a radiation warning sign, a set of decontamination kit, a radiation dose detector and a suitable receptacle for temporarily storing of the radioactive clinical waste.

9.7 Radiation materials transportation should be performed under the supervision/ advice of a qualified radiographer or physicist.

9.8 Before the injection of the radio-pharmaceutical, clear explanation should be given to the patient. Verbal consent must be obtained. Otherwise, there should be a valid written consent from the authorized person, e.g. clinician of the referral unit, guardian, etc.

9.9 Also, the chance of pregnancy of women within the child bearing age must be clarified. (Applied to all people close to the procedure performing site)

9.10 Double checking on the type, dosage, time and injection route of the radio-pharmaceutical must be done before the injection.

9.11 Care must be taken to avoid spill.

9.12 The spill (minor or major) should be handled by a qualified staff. In case of radiation incident, prompt report through the proper channel should be done.

9.13 Wasted materials should be properly handled.

Appendix I Name of Safety Staff

Chief of Services
Dr. Tina LAM
Chief of Services
Department of Radiology/ QMH
Tel.: 2255 3284

Head of Nuclear Medicine Unit
Dr. HO, Wai Yin
Consultant in Nuclear Medicine
Nuclear Medicine Unit
Department of Radiology/ QMH
Tel: 2255 3863

Radiation Protection Adviser
Dr. Francis TANG
Senior Physicist
Clinical Oncology Department/ QMH
Tel: 2255 4072

Radiation Protection Supervisors

Ms. CHAN Yee Wah Eva
Medical Physicist i/c
Department of Radiology/ QMH
Tel: 2255 3279

Mr. CHAN, Tze Chung
Radiographer I
Nuclear Medicine Unit
Department of Radiology/ QMH
Tel: 2255 3870

Appendix II Decontamination Kit

Contents:

1) Disposable gloves
2) Large coverall
3) Overshoes
4) Toilet soap
5) Liquid detergent decontaminants
6) Scrubbing brush
7) Plastic sponge
8) Cotton wool
9) Absorbent paper
10) Polythene bags and sheet
11) Forceps
12) Scissors
13) Radioactive warning tape and signs
14) Rope
15) 12" Tongs
16) Respirators

Locations:

1) Scan Room (Rm 302), 3rd Floor, Cancer Centre, Queen Mary Hospital, Pokfulam, Hong Kong.
2) Cold Laboratory (Rm 303), 3rd Floor, Cancer Centre, Queen Mary Hospital, Pokfulam, Hong Kong.
3) Cell Laboratory (Rm 304), 3rd Floor, Cancer Centre, Queen Mary Hospital, Pokfulam, Hong Kong.
4) Consultation/ Injection Room (Rm 306), 3rd Floor, Cancer Centre, Queen Mary Hospital, Pokfulam, Hong Kong.
5) Isotope Waste Storage Room, Medical Physics Unit, G/ F, Professorial Block, Queen Mary Hospital, Hong Kong.

Appendix III

Notifiable quantities and annual limits on intake for radionuclides commonly used in nuclear medicine

1	2	3
Radionuclide	Notification of occurrences (Bq)	Annual Limit on intake (Ingestion) (Bq)
Barium-133	1×10^{11}	2.0×10^{7}
Caesium-137	1×10^{10}	1.6×10^{6}
Chromium-51	1×10^{12}	5.4×10^{8}
Cobalt-57	1×10^{11}	1.1×10^{8}
Cobalt-60	1×10^{10}	8.0×10^{6}
Gallium-67	1×10^{11}	1.1×10^{8}
Indium-111	1×10^{11}	6.9×10^{7}
Iodine-125	1×10^{10}	1.3×10^{6}
Iodine-131	1×10^{10}	9.1×10^{5}
Iron-59	1×10^{10}	1.1×10^{7}
Molybdenum-99	1×10^{11}	1.7×10^{7}
Selenium-75	1×10^{11}	4.9×10^{7}
Strontium-89	1×10^{10}	8.7×10^{6}
Technetium-99m	1×10^{13}	9.1×10^{8}
Thallium-201	1×10^{12}	2.1×10^{8}
Xenon-133	1×10^{11}	-
Ytterbium-169	1×10^{10}	2.8×10^{7}
Yttrium-90	1×10^{11}	7.4×10^{6}

Appendix IV: Radiological Investigation of Women of Child-bearing Age, Nov/16.

(HAHO Operations Circular No. 29/2016)

Ref: HA 752/10/2 24 November 2016

To: All Cluster Chief Executives (CCEs), Hospital Chief Executives (HCEs), Chiefs of Service (COSs), Head of Departments and all clinical staff

Hospital Authority Head Office
Operations Circular No. 29/2016

Radiological Investigation of Women of Child-bearing Age

Issued by:	*Clinical Effectiveness & Technology Management Department, Quality and Safety Division, HAHO*
Should be read by:	*All CCEs, HCEs, COSs, Head of Departments and all clinical staff*
Circular superseded:	*HAHO Operations Circular No.14/99*

Purpose

The purpose of this circular is to update the information on the radiation dose for "Radiological Investigation of Women of Child-bearing Age" to be promulgated and implemented in all HA institutions. It supersedes HAHO Operations Circular No. 14/99 dated 23 November 1999.

Background

2. When a female of child-bearing age presents for a radiological examination using X-ray or radioactive substance involving direct irradiation of the abdomen or pelvis, she should be asked whether she is or might be pregnant. If the patient cannot exclude the possibility of pregnancy, she should be asked whether her menstrual period is overdue. If it is overdue, consideration should be given to postpone the examination — the "28-day rule".

3. If the possibility of pregnancy is excluded, the radiological examination can proceed.

4. If pregnancy cannot be excluded but the period is not overdue, the radiological examination can proceed except for high dose procedures, such as abdominal Computed Tomography (CT), pelvic CT, barium enema, and any other special radiological examinations or nuclear medicine procedures likely to deliver a dose of tens of milligray 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". Exception would include urgent radiological examinations when benefits are likely to far outweigh any small risk to the fetus from the irradiation.

5. If pregnancy is established, the concerned officer should review the justification for the proposed examination, consider alternative investigation technique, and decide whether to defer the radiological examination until after delivery.

6. 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	10 – 50
Pelvimetry	0.1 – 1.0

7. For Nuclear Medicine procedures using radioisotopes, 10-day rule should also be observed for those procedures likely to deliver a dose more than 10 mGy to the conceptus. Such procedures include:

Radiopharmaceutical	**Nuclear Medicine Procedure**	**Injected Dose (mCi)**
Ga-67 Citrate	Gallium Infection / Tumor	≥ 3.0
I-131 Norcholesterol	Adrenal Cortex	≥ 0.13
In-111 Octreotide	Octreotide	≥ 3.3
Tc-99m Sestamibi	Parathyroid / Myocardial Perfusion	≥ 18.0
Tc-99m Tetrofosmin	Parathyroid / Myocardial Perfusion	≥ 18.0
Tl-201 Chloride	Myocardial Perfusion	≥ 2.8
F-18 FDG	Tumor Imaging / Metabolic Imaging	≥ 11.0

8. In the advent of new technology, like Single Photon Emission Computed Tomography / Computed Tomography (SPECT / CT) scanners and Positron Emission Tomography / Computed Tomography (PET / CT) scanners, the radiation dose delivered to the uterus will be the sum of dose from both radiopharmaceuticals and CT scans. All routine PET / CT tumor scans and SPECT / CT abdominal or pelvic scans will likely

contribute more than 10 mGy to the conceptus. The 10-day rule should be observed for those procedures.

9. For the bone mineral density measurements with dual x-ray absorptiometry, the radiation dose to the conceptus is normally below 1 mGy.

Enquiry

10. Enquiries on this circular should be directed to Ms Stella TAM (Secretary of Coordinating Committee in Radiology) at 2300 6212.

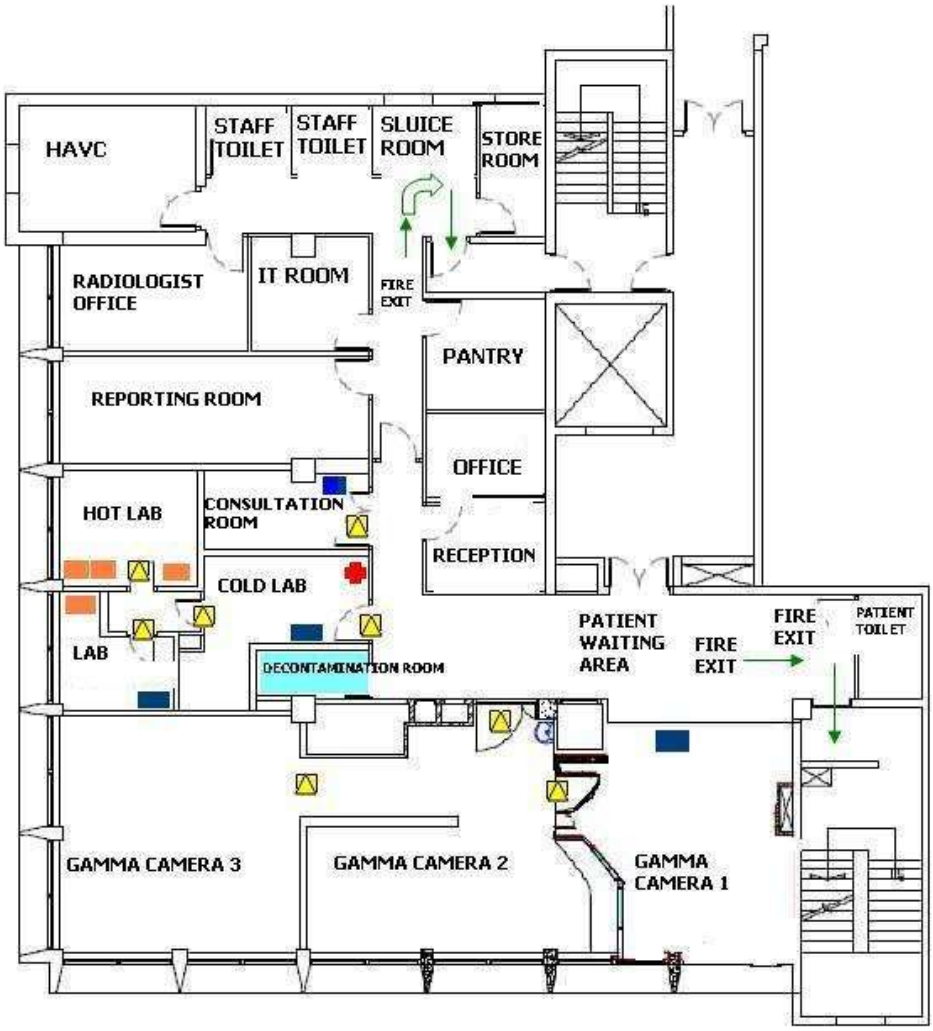
(Dr Rebecca LAM)
for Director (Quality & Safety)

Reference Sources:
HPA, RCR and CoR: Protection of Pregnant Patients During Diagnostic Medical Exposures to Ionising Radiation 2009
Russell JR, et al. Radiation absorbed dose to the embryo / fetus from radiopharmaceuticals. Health Phys 1997; 73(5):756-769
Russell JR, et al. Placental transfer of radiopharmaceuticals and dosimetry in pregnancy. Health Phys 1997; 73(5):747-755
ARSAC Notes for Guidance on the Clinical Administration of Radiopharmaceuticals and Use of Sealed Radioactive Sources 2006

Appendix V

Department Layout indicating radiation and emergency facilities

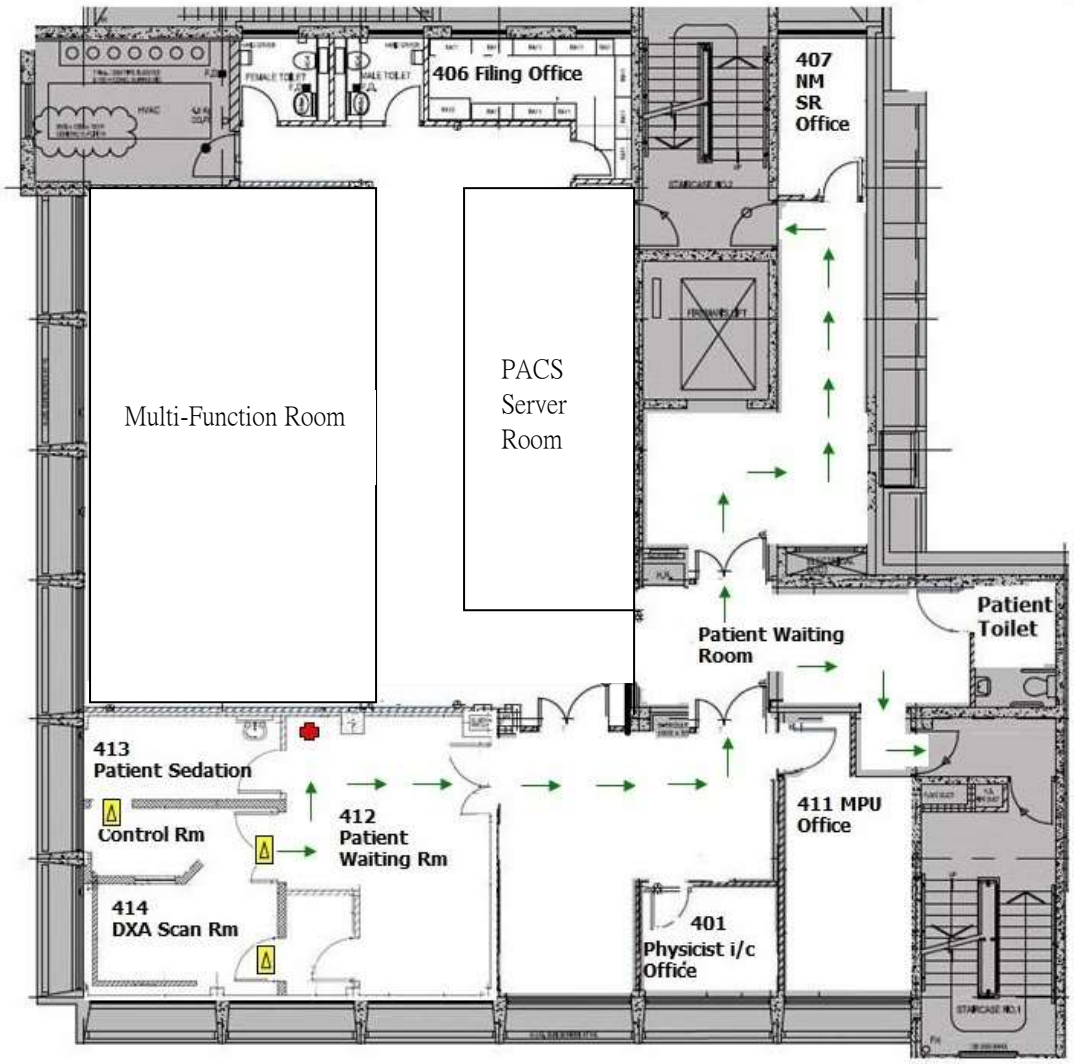
Nuclear Medicine Unit, Department of Radiology
3/F, Cancer Centre, Queen Mary Hospital



Radiation and Emergency Facilities

1. Controlled Area
2. Decay Modules
3. Decontamination Kit
4. Decontamination Room
5. First Aid Kit
6. Fire Exit

Nuclear Medicine Unit, Department of Radiology
4/F, Cancer Centre, Queen Mary Hospital

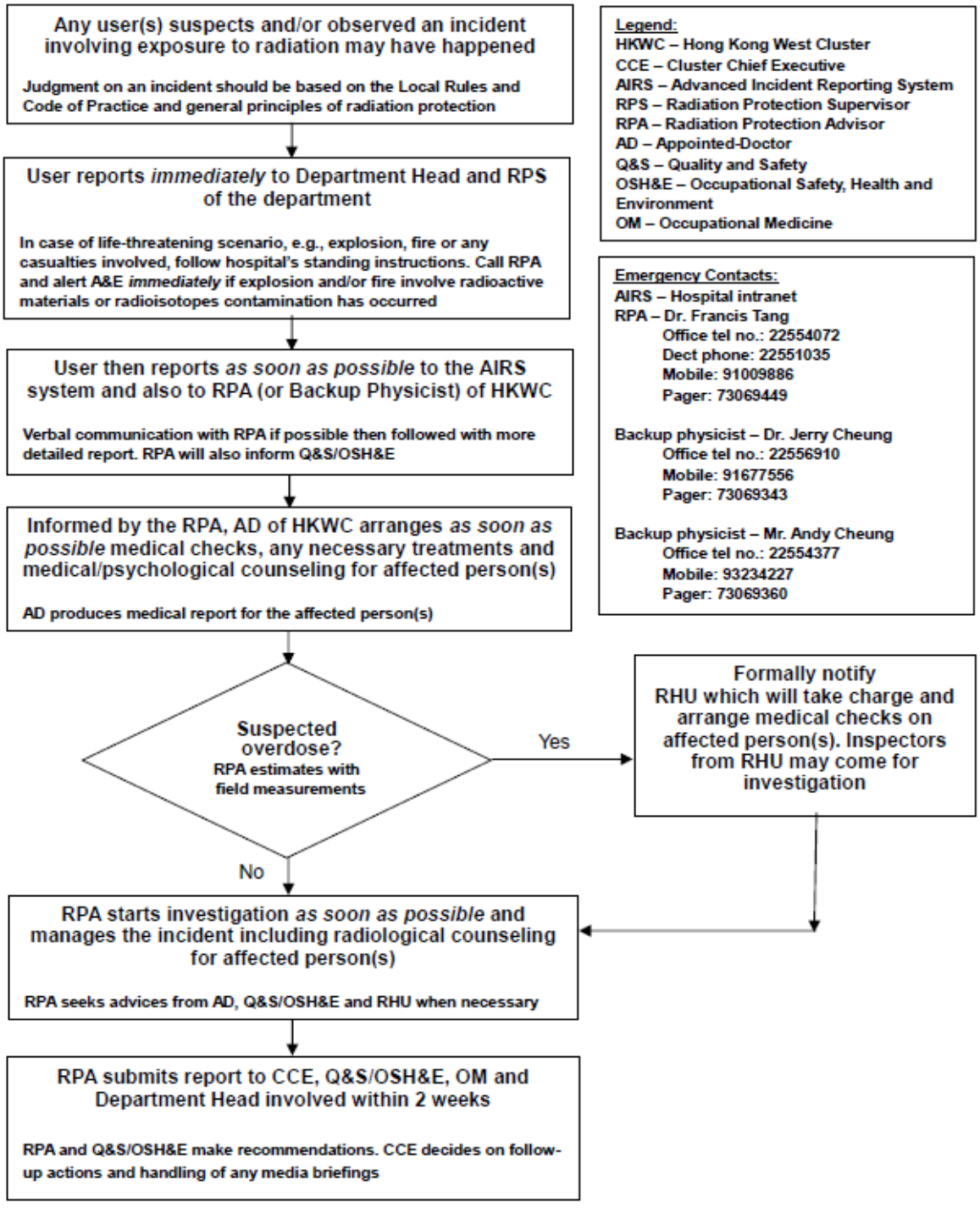


Radiation and Emergency Facilities

1. Controlled Area
2. First Aid Kit
3. Fire Exit

Appendix VI Workflow in Radiation Incidents Reporting and Handling

Reporting and Handling of Radiation Incidents in HKWC



Appendix – VII **(A): <u>Radiographic Staff Declaration Record</u>: 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 –VIII (A): 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 –VIII (B): <u>Medical Staff Declaration Record</u>: 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 VIII (C): <u>Nursing Staff Declaration Record</u>: 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 –VIII (D): <u>Supporting Staff Declaration Record</u>: 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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