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Organization of Radiation Protection Services in Hospitals

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ORGANISATION OF RADIATION PROTECTION SERVICES IN HOSPITALS

INTRODUCTION

International bodies such as International Commission on Radiation Protection, ICRP, and International Atomic Energy Agency, IAEA, have vast experience in radiation protection matters and make valuable recommendations by regularly publishing documents on various topics.

However their role is purely advisory as it is the responsibility of Governments to draw up legislation embracing these recommendations. Once this legislation exists the ultimate responsibility for providing protective measures and complying with the law lies with the employer who may be a company, health authority, hospital board or a self employed person. In addition through legislation responsibility is placed also on the employee to ensure their own safety by adopting agreed working practices and reporting any defect that is discovered.

It is therefore important when considering the organisation of radiation protection in hospitals to establish who is responsible for what, the who being the employer and the what being the legislation.

LEGISLATION

In the UK there are 3 important sets of Regulations.

a) Ionising Radiation Regulations (IRR) 1985.

b) Ionising Radiation (Protection of Persons Undergoing Medical Examination or Treatment) Regulations (POPUMET) 1988.

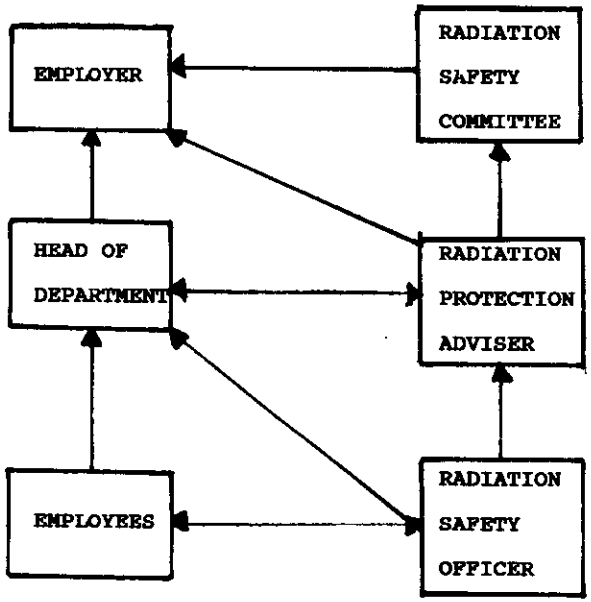
c) Medicines Regulations (Administration of Radioactive Substances) 1978.

These regulations determine what and how things should be done and are accompanied by detailed Guidance Notes which serve as a guide to good radiation protection practice consistent with the requirements of the regulations.

In order to enforce these regulations many countries have arrangements for inspecting premises using ionising radiation. These inspections are carried out in the UK by government inspectors from, for example, the Health and Safety Executive, the Pollution Inspectorate and the Medicines Inspectorate, who ensure procedures and facilities comply with the law and if necessary have the power to close services and impose substantial fines for breaking the law.

It is under these circumstances of legislation and inspection that the following arrangements have been developed in hospitals.

ADMINISTRATIVE ARRANGEMENTS



RADIATION PROTECTION ADVISER

Employers who use ionising radiation must appoint a Radiation Protection Adviser to ensure they are complying with the law. In the UK it is recognised that this person should be a physicist with appropriate experience.

The main role of the RPA is to visit each department using ionising radiations and prepare and review the protective measures in consultation with the Heads of Department as appropriate. The frequency of the visits should be defined by the extent of the hazards involved but normally should be every year.

This the primary role of the RPA is to give advice on the protective measures and procedures in order to comply with the Regulations and also to check and audit procedures and facilities on behalf of the employer. Obviously should the employer not take the advice of the RPA or provide the necessary protective measures then the RPA cannot be held responsible.

In addition the RPA must investigate and report on all accidents or incidents involving over exposure and again where appropriate advise the official inspectors of such incidents.

For workers and the general public the dose limits that require reporting by the RPA are

a)	whole body dose for a worker	15 mSv
b)	dose to any organ for a worker	150 mSv
c)	dose in pregnancy for a worker	3 mSv
d)	whole body dose for a member of the public	5 mSv

With respect to patients there has been much debate as to what constitutes over exposure or exposure greater than intended which recently has been resolved with the following recommendations

Types of Diagnostic Investigation	Multiplying Factor
Barium investigations IVU's Angiography Other Fluoroscopy C.T. Nuclear Medicine > 5 mSv	3
Lumbar spine Abdomen Pelvis Mammography Nuclear Medicine > 0.5 mSv < 5 mSv	10
Extremities Skull Chest Dental Nuclear Medicine < 0.5 mSv	20
Beam Therapy	1.1 whole course
Brachytherapy	1.2 any fraction
Radionuclide Therapy	1.2 any administration

With the recent publishing of the POPUMET regulations it is now beholden on every head of department to ensure that radiation doses to patients are as low as reasonably achievable (ALARA). In order to check this RPA's have to organise and where necessary undertake dosimetry measurements on all diagnostic procedures. This constitutes a considerable undertaking but has resulted in the identification of malfunctioning equipment, poor techniques and lack of calibration.

RADIATION SAFETY OFFICERS

A radiation safety officer (RSO), currently known as a radiation protection supervisor (RPS) in the UK, should be appointed wherever radiation sources are used and should preferably be one of the full time employees of the department concerned.

The prime responsibility of the RSO is to ensure that the advice of the RPA is carried out and to keep all relevant records within the department.

In particular he must be involved in the preparation of the Local Rules with the Head of Department and the RPA and make sure they are being adhered to. Any problem should be reported to the Head of Department to take appropriate action. If no action results he should inform the RPA accordingly.

The RSO must also ensure that staff are regularly monitored, that dosemeters are worn and exchanged at regular intervals and that they are returned for processing. He must keep a record of the dose received by individuals and make the initial investigation of any unusually high reading.

In a nuclear medicine department the RSO should also keep records of all stocks of radionuclides and all disposal of activity, as waste both solid and liquid. A full list of duties of a RSO in a Nuclear Medicine Department is given as Appendix 1.

HEAD OF DEPARTMENT

The Head of Department or Clinical Director has the management responsibility to ensure that the advice of the RPA is implemented and that all aspects of legislation are met. However the ultimate responsibility rests with the employer who has to provide the necessary facilities and staff as recommended by the Head of Department to meet the requirements.

RADIATION SAFETY COMMITTEE

The function or usefulness of a Radiation Safety Committee within a hospital is to ensure that there is uniform practice throughout and to provide an effective communication system for both the RPA and the employer. Changes and updates in legislation, safety information and problems can be discussed and consensus reached on appropriate action.

Membership of the committee will obviously vary between establishments but certainly should include senior managers, heads of departments and the RPA.

RADIATION PROTECTION SERVICE

In order to support the RPA in discharging his duties and the Heads of Departments using ionising radiation, it is important that a Scientific and Technical service is available capable of undertaking, for example

Personal Dosimetry service for both staff and patients;

Calibration service for dose meters, calibrators, etc;

Departmental surveys;

Commissioning checks on new equipment;

Decontamination facilities;

Specialist quality control measurements on diagnostic departments.

BASIC COMPONENTS OF RADIATION SURVEY

1. **GENERAL RECORD**

   (i) TAKE DETAILS OF EQUIPMENT

   (ii) MAKE PLAN OF ROOM NOTING

   WALLS (CONSTRUCTION)

   WINDOWS

   DOORS

   PROTECTIVE SCREEN

   (iii) NOTE DIRECTIONS OF PRIMARY BEAM

   (iv) NOTE WORKLOAD

2. **NEW ROOMS**

   (i) MEASURE LEAD EQUIVALENT OF

   PROTECTIVE DOORS

   PROTECTIVE SCREENS

   USING TC-99M SOURCE AND DOSE METER

3. **ITEMS REQUIRED BY UK IRR 85**

   (i) INSPECT:

   a) WARNING SIGN AND WARNING LIGHT OUTSIDE ROOM

   b) WARNING LIGHT ON CONTROL PANEL

   c) EXPOSURE SWITCH WITHIN SCREEN

   d) EXPOSURE SWITCH IS BIASSED OFF

   e) LEAD EQUIVALENT OF SCREEN IS STATED

   f) FILTRATION OF TUBE IS STATED

   (ii) MEASURE

   a) LEAKAGE FROM TUBE (DIAPHRAGMS CLOSED MAX kV_p - 100 mAs)

   b) LIGHT BEAM - X-RAY BEAM ALIGNMENT (CONDITIONS 70 kV_p 100 mAs AT 1 METRE USING NON SCREEN CASSETTE)

   c) TOTAL FILTRATION

   c) TABLE TOP ATTENUATION

QUALITY CONTROL MEASUREMENTS

1. **GENERATOR PERFORMANCE**

MEASUREMENT OF kV_p USING METER

a) **ACCURACY**

MEASURE kV_p AT DIFFERENT kV_p SETTINGS

(USE DIFFERENT mAs SETTINGS EACH TIME)

PLOT MEASURED kV_p SET

b) **CONSISTENCY**

MEASURE kV_p SEVERAL TIMES AT SAME mAs

REPEAT AT DIFFERENT kV_p SETTINGS

2. **TUBE OUTPUT**

MEASURE DOSE SEVERAL TIMES AT CONSTANT kV_p AND mAs

3. **TIMER**

MEASURE TIME SEVERAL TIMES AT CONSTANT kV_p AND mAs

4. **TOTAL FILTRATION**

MEASURE DOSE AT 80 kV_p AND 100 mAs WITH DIFFERENT THICKNESSES OF ALUMINIUM PLACED ON CHAMBER

PLOT DOSE VERSUS ALUMINIUM THICKNESS ON SEMI-LOG PAPER

CALCULATE H.V.L. (HALF VALUE LAYER)

FROM CHART LOOK UP TOTAL FILTRATION FOR MEASURED H.V.L.

DUTIES OF THE RADIATION PROTECTION SUPERVISOR FOR UNSEALED SOURCES IN NUCLEAR MEDICINE

The duties of the RPS are to supervise work with ionising radiation within the area for which you have managerial responsibility in order to ensure that the requirements of the IRR 1985 are met and to ensure that local rules are observed. These duties will include,

1. To ensure that the Local Rules are read and understood by those persons to whom they apply, and as far as possible to ensure compliance.

2. To keep a list of any Classified Persons in the department.

3. To supervise the use of personal monitors, ensuring that all staff to whom they are issued wear their personal monitors in an approved manner and return them at the end of the prescribed period to the dosimetry laboratory. To maintain a radiation dose record for non-classified department staff which must be kept for at least 2 years.

4. To be aware of any modification to or maintenance of the apparatus which might affect the patient dose or radiation protection of the staff and, where it might have a significant effect, to inform the department staff and the Radiation Protection Adviser.

5. To inform the Radiation Protection Adviser of any new techniques or the installation of any new equipment that have implications for the radiation protection of patients or staff.

6. To supervise the monitoring of working areas for contamination.

7. To supervise the decontamination of staff, patients or working areas where required.

8. To supervise the storage, movement and transport of radioactive material in the area for which you have responsibility.

9. To ensure that records are kept of the accumulation and disposal of gaseous, liquid and solid radioactive waste and that these are within the limits authorised by HMIP for the site.

10. To ensure that a record of radioactive waste is provided to hospitals that send inpatients to your department for diagnosis or treatment with unsealed sources.

11. To ensure that a register is kept of closed sources in the department and a stock record of unsealed sources and that these are within the limits authorised by HMIP for the site.

12. To ensure that leak tests are carried out on any sealed sources kept in the department.

13. To inform the RPA and the hospital management in the event of a loss of radioactive substance in excess of Column 2 of Schedule 2, or in the event of a spill or release of substance, in excess of Column 7 of Schedule 2 of the IRR 1985 so that an investigation may take place and the HSE notified where appropriate (Reg. 31).

14. To report to the Radiation Protection Adviser and hospital management the details of any incidents in which abnormally high exposures have occurred or might have occurred to patients or operators so that an investigation may be carried out and, where appropriate, the HSE informed. **NB** patient doses greater than intended that arise due to equipment malfunction are notifiable to the HSE (Reg. 33). In this context "greater than intended" means,

3 times	for a	nuclear medicine	examination	giving a patient dose > 5 mSv
10 times	"	"	"	" > 0.5 mSv and < 5 mSv
20 times	"	"	"	" < 0.5 mSv

1.2 times for a radionuclide therapy procedure.

15. To ensure that all equipment used for measuring radionuclide activity (such as radioisotope calibrators and contamination monitors) are calibrated regularly.

16. To ensure compliance with IRR 1988; i.e. that examination techniques conform with accepted practise, that patient doses are as low as reasonably practicable in order to achieve the required diagnostic result and that physical and clinical directors have the appropriate training.

17. To ensure that procedures undertaken in the department are covered by an ARSAC certificate issued by the Department of Health for your hospital.