

Radiation protection in diagnostic radiography cannot be over emphasized when the lethal effects of taking excess radiation into the body is taken into cognisance. This is why concerted effort must be made by all the people involved in the use of radiation to ensure that the doses received are as small as possible so that the damage which may occur will not constitute a threat to the health of the irradiated person and succeeding generations. It is also in pursuance of this objective that the "Code of Practice for the protection of persons against ionizing radiations arising from medical and Dental Use" was published in 1964.

Effects of Radiation - The need for radiation protection as mentioned earlier arises from the biological effects of taking excess radiation into the body. These effects are three fold:

1. Prompt personal effect.
2. Delayed personal effect.
3. Genetic effect.

Prompt Personal Effects - These usually manifest themselves a few hours or days after the irradiation. They may be as a result of a very high dose of x-rays absorbed by a localised area of the body which will produce reddening of the skin within a short time, or a fairly high dose applied to the whole body which may result in vomiting and diarrhoea within a few hours after irradiation.

Delayed Personal Effects - These are usually caused by a severe low dose irradiation accumulated over a long period rather than a single high exposure. They may take many years to appear. Delayed personal effects may manifest themselves as **Cancer, Leukaemia,** and Cataract.

Genetic Effects - The most insidious of the biological effects of radiation. While the

prompt and delayed ~~effects~~ will affect the irradiated person, the genetic effects may not affect the health of the irradiated person but his off-springs. This is caused by irradiating the gonads of the affected person. Genetic effects may result in congenital abnormalities mentally and physically. Genetic effects may not even show on the first generation but the second generations.

Maximum Permissible Dose

For the purpose of clarity, people that can be exposed to ionizing radiation are classified as follows:-

1. Occupationally exposed persons (exposed as a result of their work). This group is further classified as (a) Designated (b) Undesignated.
 2. Members of the public.
 3. Patients.
 4. Those exposed for research.
- A designated person is an occupationally exposed person such that his involvement with ionizing radiation as a result of his work is likely to lead to his receiving more than three tenth of the annual permissible dose. Minimum permissible dose is defined as "that dose accumulated radiation over a long period of time or resulting from a single exposure which carries a negligible probability of severe or genetic injuries"

MAXIMUM

Parts of

MAXIMUM PERMISSIBLE DOSE FOR OCCUPATIONALLY EXPOSED PERSONS

Parts of the body	Annual Dose	Quarterly Dose	Planned Exposure Single event	Special Lifetime
1. Gonads, red bone marrow whole body	5 rems	3 rems	10 rads	25
2. Thyroid glands, bone Skin of the whole body	30 rems	15 rems	60	150
3. Hands, ankles, feet and forearm	75 rems	40 rems	150	375
4. Any other single organ except the gonads, red bone marrow and whole body.	15 rems	8 rems	30	75

Addition

Column 1

1-3 per quarter to the abdomen for women of reproductive capacity. Pregnant women - 1 rem to the foetus after the diagnosis of the pregnancy.

Column 2

Children under the age of 16 - 5 rems per qrc.

Annual Permissible dose for members of the public

Gonad, Red bone marrow, whole body. 0.5 rems

Thyroid gland, bone and skin of the whole body. 3 rems (1.5 rem to the Thyroid of children up to the age of 16)

Hand, ankle, forearm and feet 7.5 rems

Any single organ except gonad, red bone marrow and whole body .5 rems

* Rem is the unit of dose equivalent.

PROTECTIVE MEASURES AND MATERIALS

The aims behind radiation protection in diagnostic radiography are:

1. To limit the exposure of the patient to the minimum that will produce the desired result.
2. To protect all other persons from the direct beam and from secondary or scattered and leakage radiation.

To achieve these aims some precautionary measures must be taken:

- (a) The field size of radiation should be limited so that only the required area of the body of the patient is irradiated. This can be made

possible by the use of diaphragms and cones.

- (b) The beam should also be directed whenever possible so that the direct beam does not fall on the gonads. Where this cannot be avoided gonad shields should be used to protect the gonads where possible.
- (c) Careful preparation of the patient, the equipment and all other accessories so that the need to repeat examinations is avoided.
- (d) Only the essential staff and persons should be present in the X-ray room during radiological examination and those essential staff should be protected behind the barrier provided in the X-ray room to prevent direct or scattered radiation from reaching them.
- (e) Before a radiographer makes an exposure he should ensure that his co-workers or other persons whose help are not needed during the examination are not in the area of the X-ray room where they may receive direct or scattered radiation.
- (f) The X radiation danger light which is usually outside the x-ray room and which indicates when an exposure is being made be checked from time to time, the bulb being replaced when necessary. Radiographers or any other staff or persons entering the X-ray room should always take notice of the red light to make sure that they are not entering the room when an exposure is being made.
- (g) Sometimes the help of a person who accompanies a patient e.g. a child patient may be needed during the course of examination. Such persons should be given adequate protective wear e.g. lead apron and gloves to wear.

- (h) The inverse square law should also be applied - the greater the distance the smaller the exposure rate.

Protective Materials:

Radiation Barriers

Materials used for radiation barriers must be materials with high atomic number and high density. Examples of such materials are Barium, Lead and Uranium, Lead is commonly used.

However lead cannot be used to build barrier wall on its own since it hasn't got the mechanical strength. It is therefore used together with concrete. The application of the necessary lead equivalent rule must be applied. The thickness of the concrete wall of the barriers must be such that will provide the same adequate protection as the required lead equivalent for such protection.

Incorporated in the barrier wall is the viewing window. The glass of the viewing window is made of lead salt and silicate to form lead glass. The wall of the barrier can all be painted with lead paint or covered with barium plaster.

Door - The door of X-ray rooms should be made of plywood with lead Sand-wiched between the layers to form lead plywood door. Areas which are often neglected are the space between the wall and the door where the door is joined to the wall by hinges and the space where two doors meet in a room with 2 leaf plywood doors in the same place.

Radiation will escape through these spaces. These spaces should therefore be covered with lead to prevent radiation from passing through. Doors should always be closed whenever exposures are being made.

Lead Aprons and gloves: are made of rubber and lead sheets, and must be of sufficient lead equivalent to prevent scattered radiation reaching the wearer.

DEPARTMENTAL SURVEY

REASONS:

1. Protective barriers may not be adequate because they may contain cracks or other errors of construction or design through which radiation can leak.
2. New and more powerful equipment may be installed in a room without any change in protective barriers.
3. Lead aprons and gloves may develop cracks where radiation can leak through.

All installations must therefore be thoroughly surveyed with suitable radiation detectors to confirm that the required protection is provided. Lead aprons and gloves should not be folded as they may develop cracks. There is need for each worker to be monitored regularly to ensure that he/she is not being over irradiated.

A suitable instrument that can be used for departmental survey is an ionization chamber. Film badges are used for personal monitoring. Old equipment should to detect faults or damages of the always be surveyed exposure button.

THE TEN-DAY RULE

Since the genetic effect is the most insidious of all the effects of radiation it is very necessary to take the necessary precautions to protect the next generation. The ten-day rule simply means that the gonads of any woman of child bearing age, i.e. 13 and 45 years should not be irradiated after ten days after the onset of menstruation. Such patients gonads can only be irradiated one to ten days after menstruation. The woman, is not likely to be pregnant since ovulation may occur after ten days following menstruation, only emergency cases may be done outside the (10) Ten Day Rule and then every precaution must be taken to limit the radiation dose to the patient.

Pregnant Women: should be X-rayed only when vitally necessary, every effort must again be made to limit the radiation dose.

CONCLUSION: It is the duty of the radiographers to make sure that himself, the patients and any other persons that may be involved in the use of ionizing radiation for diagnostic purposes are not over irradiated.

He/She must observe the Code of Practice for protection of persons against ionizing radiations arising from medical and dental use. It is therefore necessary that each radiographer knows the rules of the Code of Practice.

The writer would like to suggest that intermitent symposium be held for radiographers to remind them of this important aspect of their profession.