Presentation Part II
BRACHYTHERAPY
METHODOLOGY FOR DOSE ESTIMATES IN NORMAL OPERATION.

Internacional Atomic Energy Agency

OBJECTIVE

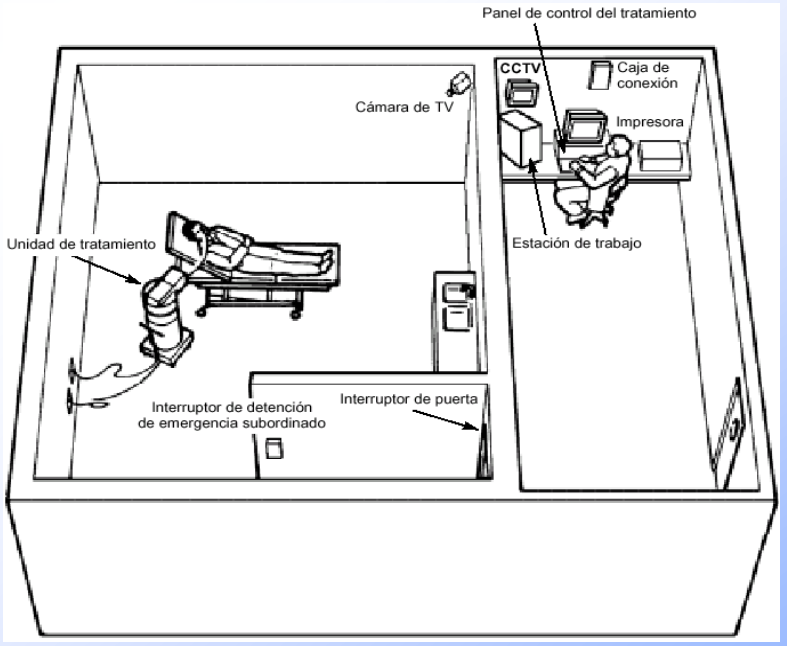
- Methodology for dose estimation in normal operating brachytherapy conditions.
- Example of dose estimation in normal operating brachytherapy conditions.

INTRODUCTION

To estimate doses during normal operating conditions it is necessary to identify the people potentially exposed and the exposure conditions during the daily routines.

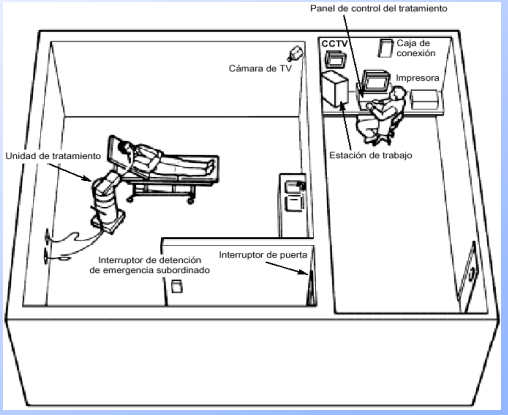
It is required to do estimations for:

1. **Exposed workers.**
2. **Members of the public.**



EXPOSED WORKERS IN THE PRACTICE OF BRACHITHERAPY

Exposed Worker	Assigned tasks	Dose
Brachytherapy Unit operator technician	Operating the unit from the control panel	Y/N
	Positioning the patient at the equipment for treatment.	Y/N
Medical Physicist	Quality control	Y/N
Medical radhiotherapist	Place the implant in the brachytherapy room	Y/N



EXAMPLE OF DOSE ESTIMATIONS HDR BRACHYTHERAPY OPERATOR

1. Control panel located on a Primary barrier (In the brachytherapy practice all barriers are primary)

The instantaneous dose rate (IDR) at the primary barrier can be estimated by the equation:

$$IDR = \frac{DR_0 \cdot B}{d^2}$$

DR_0 : Kerma rate at 1 m from the source.
B: barrier transmission factor. (*)
d: distance at the calculus point.

(*) $$B = 10^{-\left\{1+\left[\frac{S-TVL_1}{TVL_e}\right]\right\}}$$

S: thickness of the barrier.
TVL_1 = TVL_e: Tenth Value Layers (15.2 cm, for Ir-192)

EXAMPLE OF DOSE ESTIMATIONS HDR BRACHYTHERAPY OPERATOR

1.Control panel located on a Primary barrier

The average dose rate that the operator receives in a week can be estimated from the instantaneous doses rate (IDR):

$$R_W = IDR \times \frac{W\ U\ T}{DR_0}$$

DR_0: Dose rate at the isocenter of the equipment.
W: Weekly work load,
U: Use factor
T: Occupation factor.

The annual dose received by a control panel operator is:

$$D_1 = R_w * N_w$$

N_w: Number of working weeks in a year.

EXAMPLE OF DOSE ESTIMATIONS HDR BRACHYTHERAPY OPERATOR

3. Positioning of the patient at the unit for treatment .

Considerations for dose estimation

1. According to the standard IEC 60601-2-17 it is assumed that the dose rate at 1 m from the head of the unit is 0.01 mGy/h
2. N_0 patients a day are treated, assuming that each work shift has 2 technicians and each technician positions half of the patients.
3. In each patient positioning field and placement of guide tubes the technician should take approximately 5 minutes.
4. Technicians work 5 days a week, 50 weeks a year.

EXAMPLE OF DOSE ESTIMATIONS HDR BRACHYTHERAPY OPERATOR

3.Positioning of the patient at the equipment for treatment.

D_2: Annual dose due to the positioning of the patients

$D_2 = N_o/2$ pat/days * 0.0833h/pat * 0.01mSv/h * 50 weeks/year * 5 days/week (mSv/year)

EXAMPLE OF DOSE ESTIMATIONS HDR BRACHYTHERAPY OPERATOR

Annual total dose (D_{ta}) that the operator receives in normal operating conditions

D_1 D_2

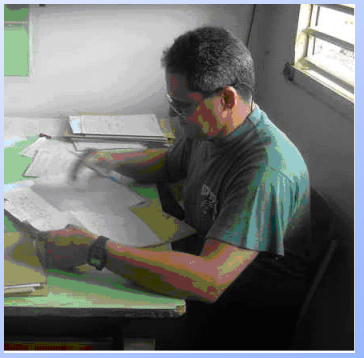
+

$$D_{ta} = D_1 + D_2$$

Conclusion: *D_{ta} must be less than the dose constrain (P)*

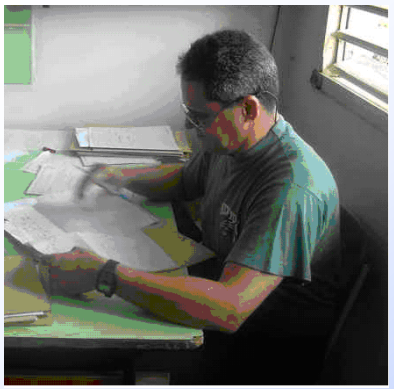
MEMBERS OF THE PUBLIC EXPOSED IN THE PRACTICE OF HDR BRACHYTHERAPY

Members of the Public	Activity	Dose
Patient´s escort	Waiting during treatment	Y/N
	Assistance of the elderly people and children.	Y/N
Hospital workers and other patients	Offices , bathrooms ,halls where the hospital workers are present.	Y/N



EXAMPLE OF DOSE ESTIMATIONS HDR BRACHYTHERAPY FOR THE PUBLIC

To estimate the doses received by the members of the public we use the same equations that are used to estimate the control panel operator doses. Distances, use and occupation factors should be realistic.



Primary barrier:

$$IDR = \frac{DR_0 \cdot B}{d^2}$$