Focussing on workers

Choices for the content and for the way to present the content

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The items

1 Introduction: my own background

2 Focussing on workers

3 The chapter-subdivision of the theory

4 The theory: hazard, risk, existing measures

5 Their own measures

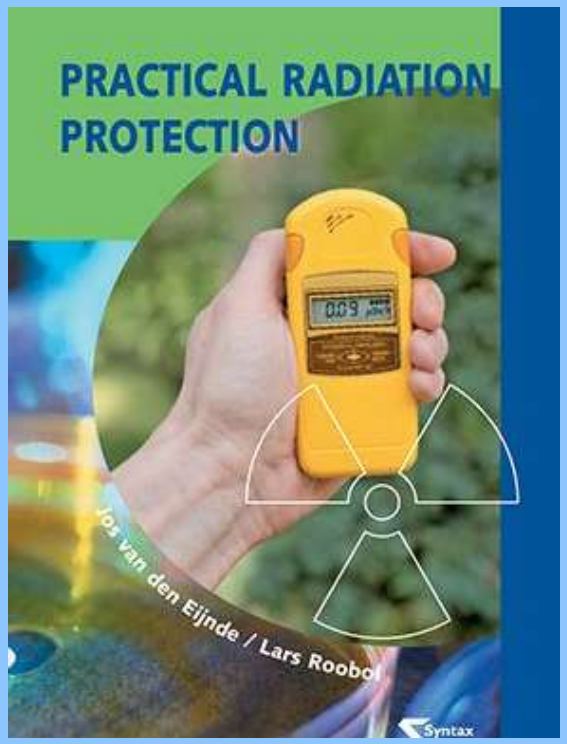
1. Introduction: my own background

1970-1979	Study biophysics
1980	Research on β-dosimetry at Army research
1980-2018	- Radiation Protection Expert, - Certified Safety Professional, - Head of Health and Safety Department at - Leiden University, - Erasmus University Rotterdam, - Academic Medical Centre Amsterdam
1992-now	Co-author ‘Practical Radiation Protection’

Practical Radiation Protection

- https://www.syntaxmedia.nl/practical-radiation-protection

- For workers on high vocational level
- also used for lowest level rpos



2. Focussing on workers

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  -e.g. no powers of e, but
  -math sections for interested reader and rpo.

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  - understand hazards, risks and measures
  - how to work safe themselves, e.g. in fume hood, beware of latex gloves, etc

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- Style directed at workers
  - - e.g. not a section with ‘tasks of rpo’ but with ‘what to expect from a rpo’.

3. The chapter-subdivision of the theory

- The normal way of coping with risks is to start an activity and take measures along the way.
- But applying ionising radiation, this is too dangerous; the risk must be controlled before starting.
- How to control a risk: **the risk assessment**

In a ***risk assessment***:

- the ***hazards*** are inventarised,
- the ***measures that are already*** taken to control these hazards are inventarised,
- the ***resulting risk*** is estimated and assessed.

As a result, extra measures can be formulated to get an ***acceptable risk.***

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Structuring the chapter-subdivision of the theory with the model of the risk assessment connects to the way the hazards are controlled.

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Then, the structure is

- Hazards: physics, biology, quantities/units)
- The level of acceptable risk
- Measures already taken

4.1. Hazards (physics)

- $T_{1/2}$ swith simple multiplication, and $(1/2)^{t/T1/2}$,
- α, β, γ, X-radiation, EC, positrons, (neutrons)
- Interaction (Compton, etc); range; $d_{1/2}$
- warning for Build-up

Maths for interested reader/rpo:

- λ and μ,
- reduced range,
- Build-up

4.2. Hazards (quantities and units)

- X, D, H_T, w_T, E, E(50), H*(10),
- orders of magnitude,
- background radiation.

For interested reader/rpo:

- xx

No Kerma

4.3 Hazards (biology)

- DNA-damage and repair,
- harmful tissue reactions,
- stochastic effects (LNT-discussion)

For interested reader/rpo:

- xx

4.4. Risks

- concepts hazard, risk and acceptable risk
- comparison with other risks
  -carcinogens: limit 2,5 mSv/y, target 25µSv/y
  -10 µSv ≈ 1 cigarette
- Risks versus benefits
  -10 µSv ≈ flight to Madeira

For interested reader/rpo:

- perception

4.5. Measures already taken

- ICRP justification, ALARA, limits,
- Euratom, radiation law, licence, house rules,
- rpo, rpe, RPU,
- exemption, clearance,

- rules directly relevant for the worker

……..

Rules directly relevant for the worker

- risk assessment,
- classification of workers and areas,
- pregnancy,
- badges,
- security,
- disposal,
- training (also obliged on local implementation).

For interested reader/rpo

- basics of transport rules,
- basics of waste rules.

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5 Their own measures

5. Their own measures
5.1 A job risk assessment

Assessing the expected and calamity dose, with

- $E(50) = e(50) \cdot A$
- $\dot{H}^*(10) = 2 \cdot A$ (30 cm, MBq)
- inverse square law

This can be a separate chapter.

For interested reader/rpo

- formulae with B, with ICRP-figures,
- tables with h(10).

5. Their own measures:
5.2 Control exposure

- principles of radiation detection
  - mechanisms (ionisation, scintilation)
  - Applications (identication,contamination,exposure)
- section with recommendations for measurements

This can best be a separate chapter.

For interested reader/rpo

- counting statistics

5. Their own measures
5.3 Use the ‘source oriented strategy’

In following order

1. Reduce the amount of activity/X-rays
2. Enclose the ‘source’
3. Remove airborne contamination
4. Individual Protection

Obliged and normal practice when working with chemical or biological agents.

The source oriented strategy

Different chapters for the different activities, for instance

1. closed sources
2. X-ray equipment
3. open sources/laboratories
4. medical facilities
5. nuclear installations
6. specialities like NORM, EC-detector, high activity sources, etc

The source oriented strategy

For instance **open sources**

Reduce:
-without radionuclides?, more counting time

Enclose
-splash trays, avoiding aerosols

Remove with ventilation
-how to work in fume hood/biohazard cabinet (!)

Individual protection
-how to use gloves

The source oriented strategy

For instance **X-ray equipment**

Reduce:
-good medical justification, ALADA
- low kV/mAs,

Enclose/Remove
- time, distance, shielding,
(e.g. discussion on perspex)

Individual protection
-lead apron (e.g. necessary?)

Conclusion (1)

- The text can best be written in a style that has the worker in mind.
- The theory can best be presented with a chapter-division of a risk assessment (hazard, risks, existing measures).

Conclusion (2)

- The worker can best be empowered by
  - a chapter explaining the measuring instruments,
  - a chapter on the expected dose and
  - by chapters on the different activities, using in these chapters the ‘source oriented strategy’ as a section-subdivision.