Dose reconstruction and other measures taken after incidental external exposures

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Incident

DOSE?
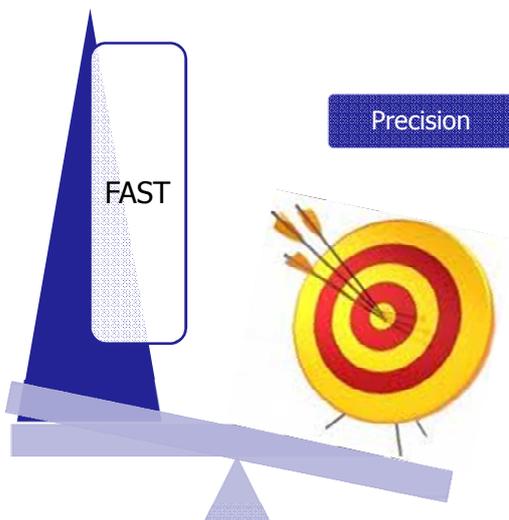
PEOPLE	HOW	WHY	WHEN	PREVENTION	EVALUATION

Incident

FAST

Precision

Incident

The easy part

Accredited dosimetric service + dosimeter in the scope

In 10 minutes:

- Hp(10) and Hp(0.07)
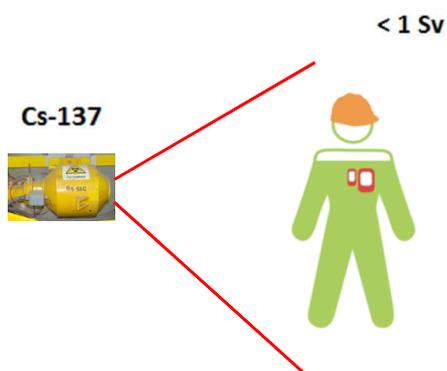- 2 times read
- dosimeter verified with standard dose

The difficult part

PEOPLE

The easy case

- Known situation (witness)

- Whole body irradiation

- Dosimeter (+EPD)

< 1 Sv

Cs-137

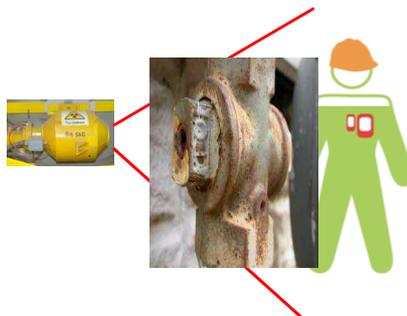# The easy case

= estimate for E

Case closed

= start medical intervention, prevention, evaluation of the technical installation, adaptation procedures…

The not so easy case

- Known situation (witness)

- Partial irradiation

- Dosimeter = or ≠ EPD but not representative

INES 1

EPD = 948 mSv /// passive dosimeter = 1.4 mSv

INES 1

"real dose"
Reconstruction = 350 mSv (worst case)
Biological dosimetry = 360 mSv (range 150 - 500 mSv)

Not so easy case

- Reconstruction of the incident
    - Fast calculation (will we panic or not)
    - Different scenarios

TIME	DISTANCE
- Measure/determine time for acts	- Measure/determine distance
- Directly related to the dose	- Crucial for extremities
	- X^2! Sometimes 1 cm can give an important impact

Not so easy case

- Reconstruction of the incident
  - Worst case
  - Measuring with active and passive dosimeters on phantom
- Calculation of the doses (included body parts)

- Confirmation by biological dosimetry
  (wide range)

The difficult case

HIGH DOSE > 1Sv
(total body or partial)

The difficult case

<u>Why?</u>

Possible direct effects

Thus need to know the dose accurately

<u>How?</u>

… some dosimetry concepts

Some dosimetry

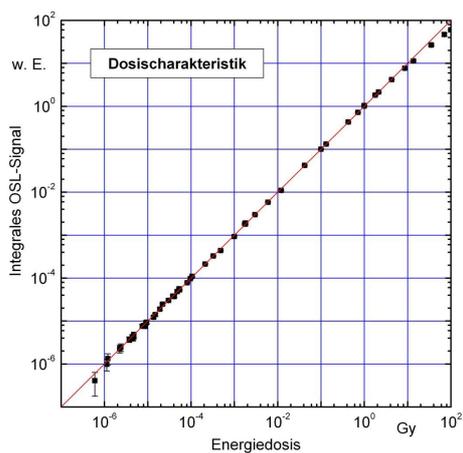- IEC 62378 : international standard for dosimeter performance
  Ranges!
  – Energy and angle dependence :
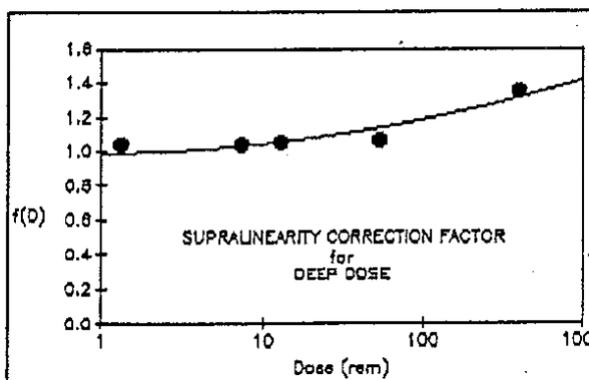   -29% +67%
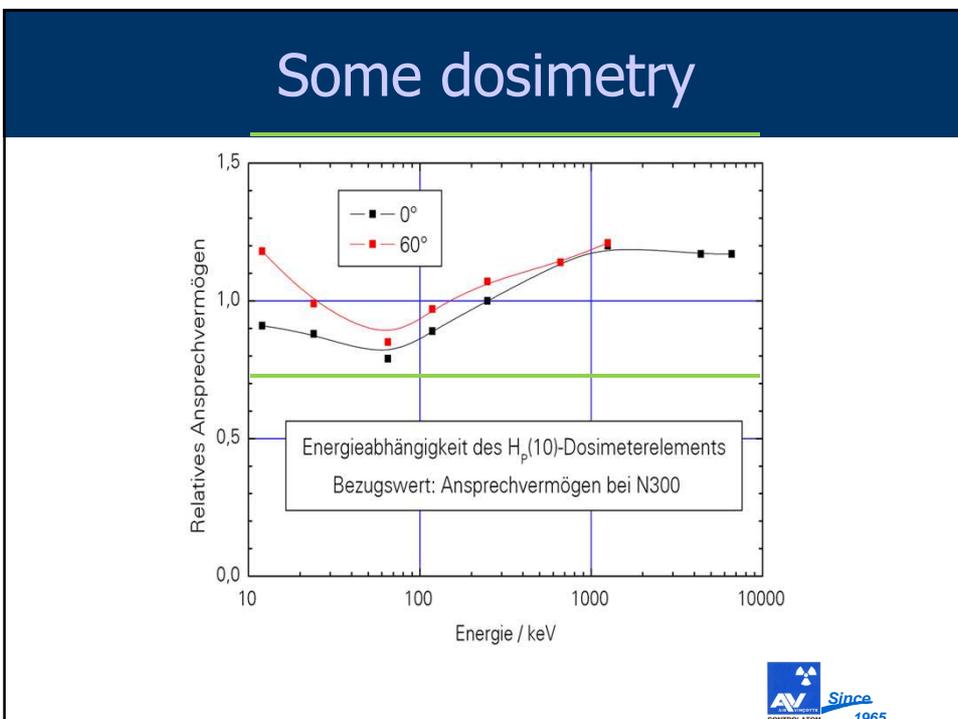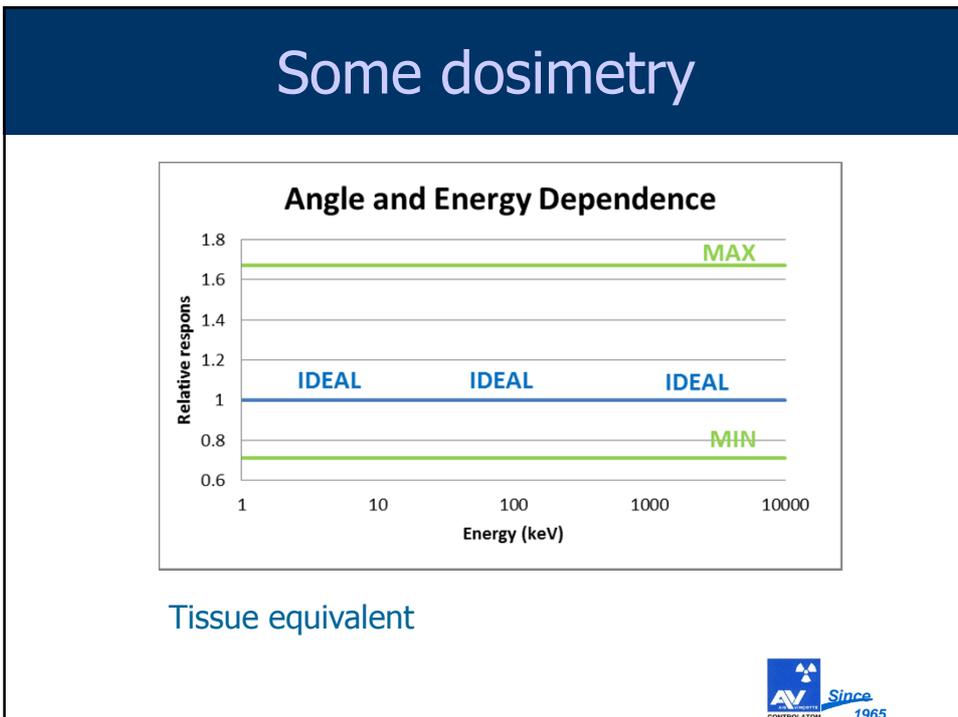- Dosimeter correction factors

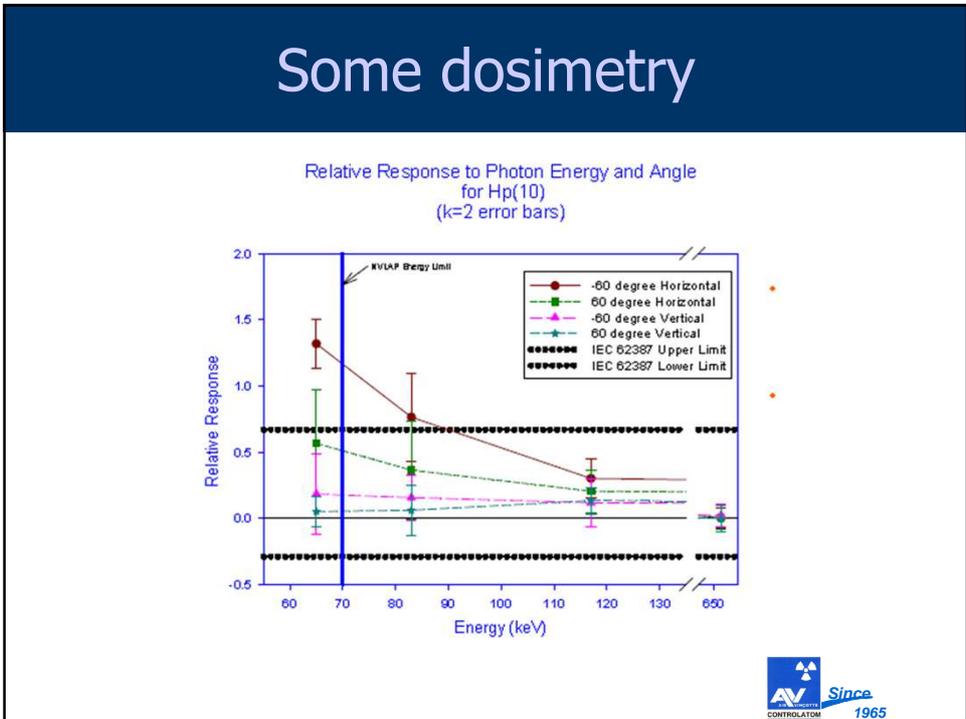# Some dosimetry

Linearity BeO

Some dosimetry

Supra-Linearity TLD LiF   > 1 Sv

10/8/2013

Some dosimetry

Angle and Energy Dependence

MAX

IDEAL   IDEAL   IDEAL

MIN

Tissue equivalent

Some dosimetry

Energieabhängigkeit des $H_p(10)$-Dosimeterelements
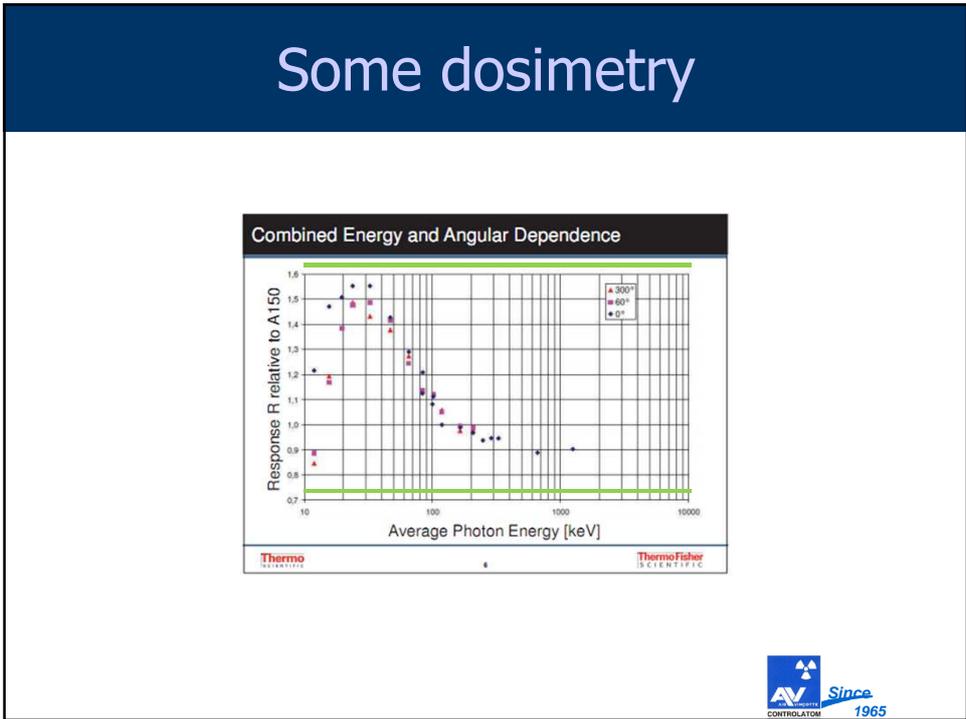Bezugswert: Ansprechvermögen bei N300

10

Some dosimetry

Some dosimetry

INES 1

- Finger exposure
- 65kV, 1.8 mA (no extra filtration)

- Ringdosimeter: 512 mSv
- Worst case : 3 minutes in field : 30 Sv
  (< 25 Sv, necrosis)
- Scenario exposures : 15 Sv
- Filming of procedure (timings, distances)
- Calculation : 6.5 Sv (right) and 5.5 Sv (left)

The difficult case

- > 1Sv
- Correction of Hp(10)
- Irradiation parameters have to be known (energy/quality of beam)

→ Better estimate of E
→ Better "diagnose"

The very difficult case

- Inhomogeneous exposure (body part)
- No exposure on the dosimeter
- Person is NOT aware of the accident
- Direct effects

→Health Physics + occupational physician + employer + worker work together to reconstruct the case

→Dose by biological dosimetry

The impossible case

- Inhomogeneous exposure (body part)
- No exposure on the dosimeter
- Person is NOT aware of the accident
- No direct effects

→ We will never know!

Conclusions

- Dosimetry = balance between risk / needs / urgency
- EPD : ALARA, but what in incidents?
  energy respons, doserate,..
- Reconstruction : act fast (memory)
- Interpretation needed
- Complementarity of health physics and occupational physician

Questions?