Radiological Protection in PET and PET/CT

How to monitor staff in PET

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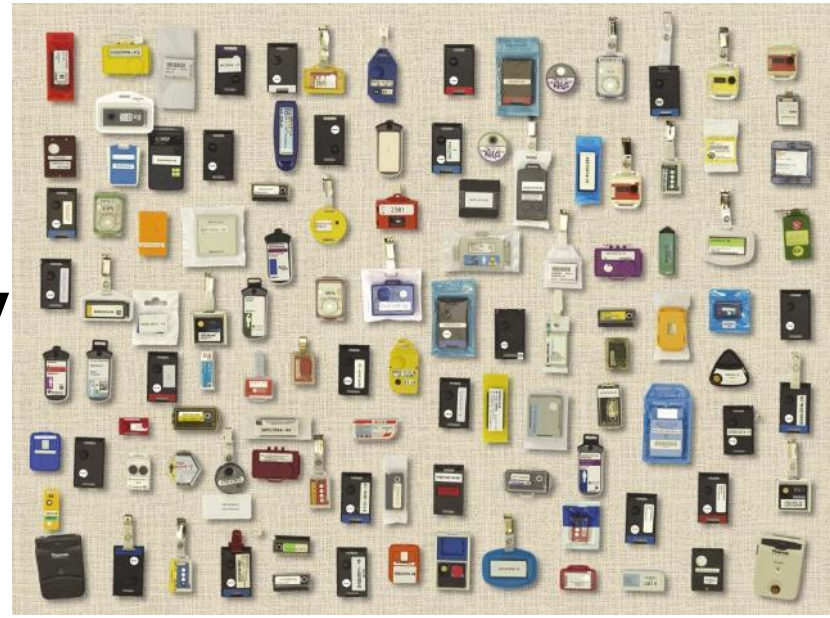
Routine monitoring of staff

- Individual monitoring is required to verify compliance with **dose limits**
- Monitoring should be undertaken for workers who have a reasonable **probability** of receiving per year an equivalent dose higher than **3/10th of one of the yearly limits**
- Whole-body doses of staff should be measured based on **continuous monitoring with doses reported on a monthly basis**



Routine monitoring of staff

- **Radiation doses to the eyes have been found to be similar to whole-body doses**
  - A whole-body dosimeter worn on the chest should give a measure of probable eye dose levels
  - If these are high (approaching 6 mSv per year), independent measurements of eye doses should confirm the levels of the eye lens doses
- **Doses to the extremities and the skin, cannot be estimated from whole-body monitoring results, due to the non-homogeneous exposure conditions**
  - These **need to be monitored**

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Type of extremity dosimeters

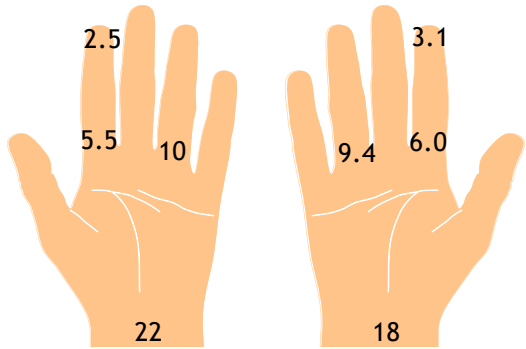
- **The skin of the extremities is the limiting organ rather than the extremity itself.**
- An estimate of **the equivalent dose to the skin, H_{skin},** is normally a conservative estimate of the equivalent dose to the extremities
  - Therefore, an extremity dosimeter **shall be designed to measure $H_p(0,07)$** at the most exposed 1 cm^2
- **The dosimeters used for extremity monitoring are generally based on passive techniques**
- **Two types of passive dosimeter:**
  - **Rings**: worn at the thumb, index, middle or ring finger
  - **Finger-stalls**: with the detector located at the fingertip
  - Wrist dosimeters are not recommended
- **The technical specifications are defined in IEC 62387**



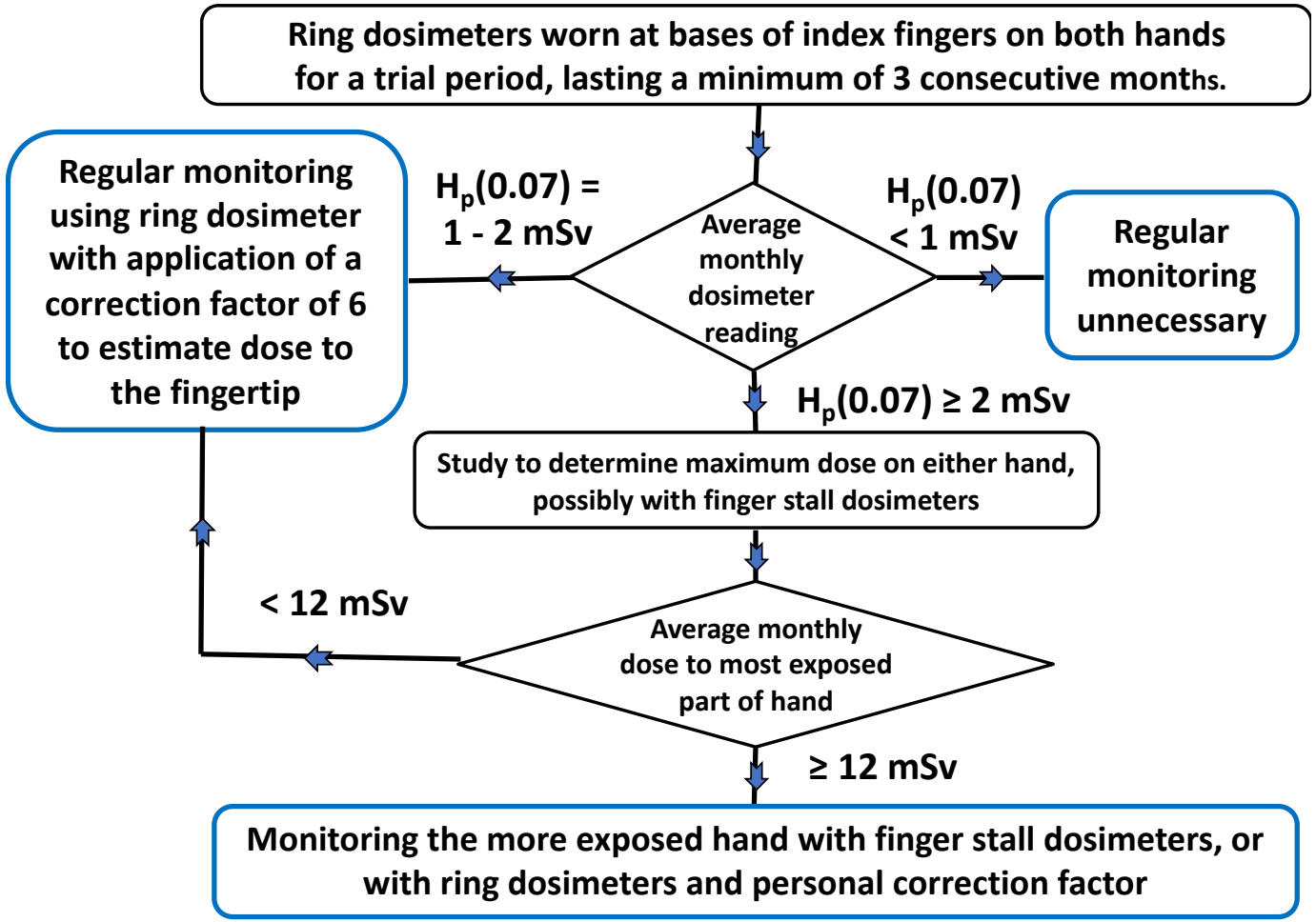


Dosimeter positioning to monitor the extremity dose

- **The extremity dosimeter** should be placed **as close as possible to the most exposed part of the skin surface**
  - This is often difficult as **the most highly exposed area is not known a priori**.
- The dosimeter should be oriented towards the radiation source. The dosimeter shall be worn under protective clothing
- **Common extremity monitoring positions, often underestimate the maximum dose**
  - To estimate the maximum skin dose, **a correction factor** shall be established and employed
- **Measurements of hand exposure at multiple locations on each hand have shown differences between hands of individuals and high dose gradients across the hand**
  - The use of wrist dosimeters is discouraged because of significant underestimation and low correlation with the maximum dose



Guidance on the use of extremity dosimeters



Skin dose monitoring under contamination

- **Immediate and rapid decontamination measures are of higher priority** than an exact evaluation of skin activity and dose
- **There is a proportional relationship between instrumentation count rate and skin dose rate for contamination averaged over a small area (1 cm^2 or less)**
  - Evaluations where the dose is low can be done without knowing the individual radionuclide activities, as the uncertainties will be big anyhow
  - For higher doses, though, it is important to determine the radionuclide activities so that a more accurate estimation of the skin dose can be made
- **When contamination is on protective clothing (e.g. gloves), it contributes to the skin dose**
  - Its contribution to the skin dose should be quantified, **taking into account attenuation** through the protective clothing

Internal dose monitoring

- **An individual monitoring program for internal contamination should be decided based on risk assessment**
  - E.g. Safety Standards Series, RS-G-1.2: Assessment of occupational exposure due to intakes of radionuclides
    - If the decision factor is positive, a technique of **whole-body counting** should be implemented to quantify the internal contamination (in Bq)
    - Once the activity (and the timing) is known, **an estimate of dose** can be obtained