

Routines for whole body counting at Ringhals NPP



Structure



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- **Equipment**
 - Quick Scan
 - Whole body counter
- **Routines**
 - Reasons for measurement
 - Performance of a measurement
 - Dose calculation
 - Quality assurance program
- **Results**
 - Number of measurements and individuals
 - Contamination incident

Equipment

“Quick Scan”



“Whole body counter”



Equipment - Quick Scan

- Detects both internal and external contamination
- Measurement time: 2*20 s
- 8 plastic scintillation detectors
- Alarm limit for trunk/back, E_{τ} : 0,13 mSv (Co-60)



Equipment – *Whole body counter*

- Equipment replaced 2007/2008
 - Detector
 - MCA
 - Software
- HpGe-detector:
 - Relative efficiency: 66%
 - FWHM: 2,1 keV at 1332 keV
- Software:
 - User interface: Global Value
 - Gamma analysis: Gammavision
- Procedure approved by SSM
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Routines - *Reasons for measurement*

Whole-body measurements are performed on six different categories:

1. On suspicion of internal contamination by radioactive substances
2. During work with an increased risk for internal contamination, a representative group of workers are to be measured after the work is completed
3. A reference group that corresponds to a representative group of workers, who work in the controlled area on a continuous basis (four times a year)
4. All personnel that have worked abroad before arriving at Ringhals NPP
5. All non-Swedish personnel that leave Ringhals NPP
6. Anyone who wishes so

Quick Scan

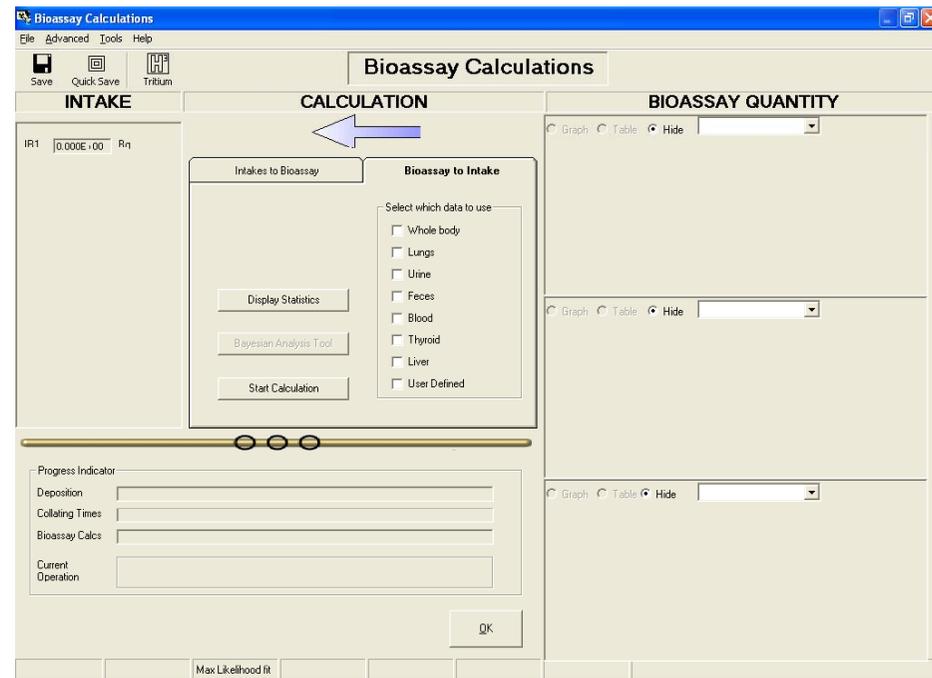
Routines – Performance of a measurement

- The measurement is performed in a chair geometry inside the cage
- Measurement time: 500 s
- Additional measurements are performed if the preliminary dose is $> 0,25$ mSv
- Results are transferred to local dose database (DoS) and the central dose data base for nuclear facilities (CDIS)



Routines - *Dose calculation*

- The first WBC measurement gives a conservative estimate of E_{τ}
- $E_{\tau} > 0,25$ mSv:
Additional WB measurement
- $E_{\tau} > 1,0$ mSv:
Additional WB measurement
Urine samples
- $E_{\tau} > 2,5$ mSv:
Additional WB measurement
Urine and/or faeces samples
- $E_{\tau} > 0,25$ mSv:
The dose is calculated with IMBA software



Routines - *Quality assurance program - Efficiency calibration*

- Are performed every two year
- A human torso phantom made of an tissue equivalent material is used
- Am-241/Eu-152 sources of known activity are placed in the different organs



Routines - *Quality assurance program - Efficiency calibration*

- The phantom is measured sitting in the chair for 50 000 s
- Efficiency as function of the energy is calculated
- The efficiency calibration is performed for four geometries;
 - Lungs
 - Stomach
 - Lungs/stomach
 - Thyroid

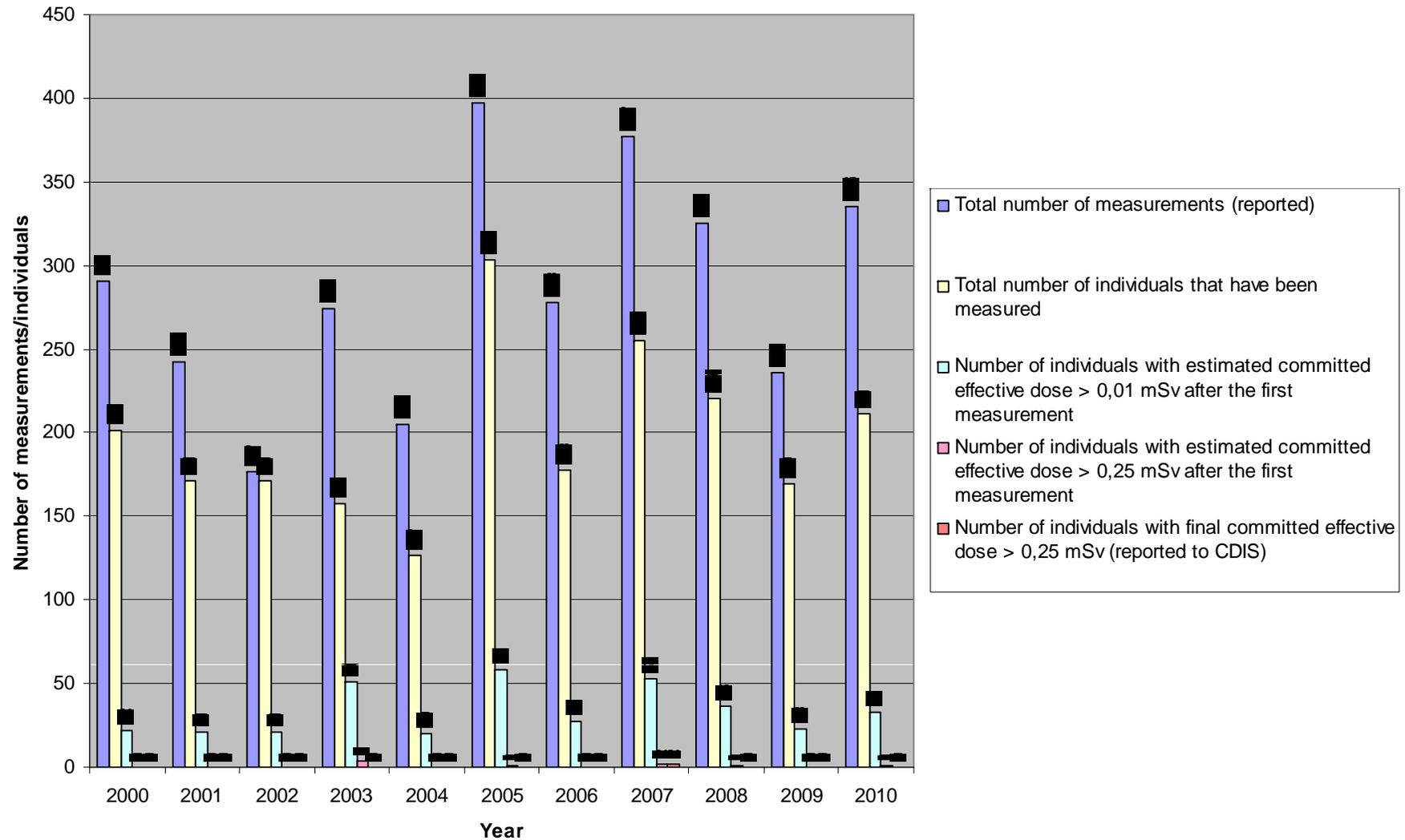


Routines - *Quality assurance program – Constancy control*

- Background measurement (100 000 s) is performed every weekend
- A check with Co-60 and Cs-137 is performed every week to verify that;
 - The chair is in the right position
 - The energy- and FWHM calibration is OK
 - The status of the detector is OK

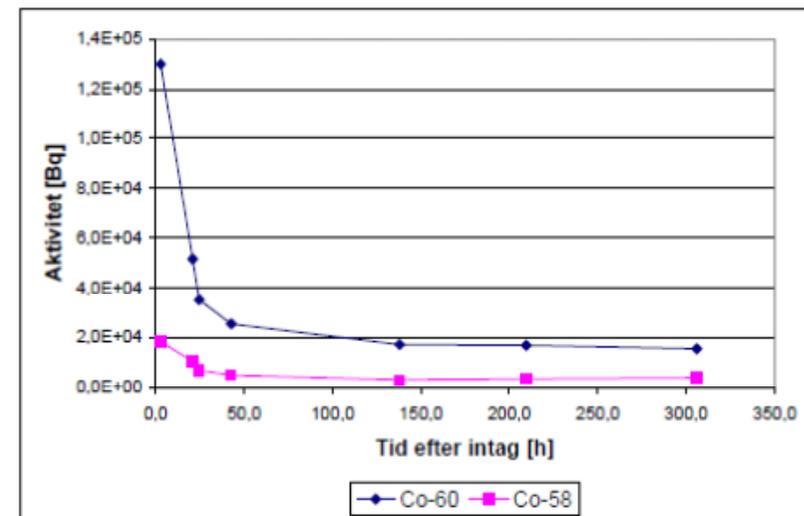


Results – Number of measurements and individuals



Results - Contamination incident May 2007

- Two workers where internal contaminated during a work with balancing an axis in the WS on the controlled area
- Activity from water in a cavity in the impeller;
Co-60, Co-58, Mn-54, Nb-95, Sb-124 and Fe-59
- Dose calculation;
 - Additional measurements in the QS and WBC
 - Inhalation
 - No urine samples
 - Calculation was performed in two ways, with similar results
 - ICRP 78 default values were used



- $\Rightarrow E_{\tau, \text{Person 1}} : 1,1 \text{ mSv} \quad E_{\tau, \text{Person 2}} : 1,4 \text{ mSv}$

Thank you for the attention!

