INTERNAL DOSE ASSESSMENTS AT FORSMARK NPP

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FORSMARK NPP

F1	F2	F3
2 928 MW	3 253 MW	3 300MW
1980	1981	1985
BWR	BWR	BWR

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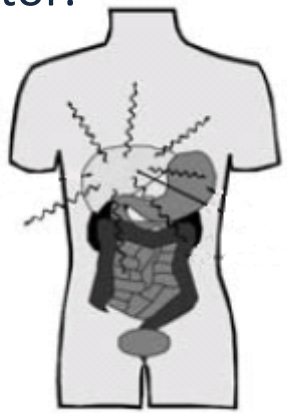
INTERNAL DOSE ASSESSMENTS

General approach:

1. Measurements – Whole body counting (WBC), gamma-detector.
2. Effective dose evaluation – IMBA.



Hard to measure nuclides (e.g. alpha) are considered by using scaling factors (vectors).

Surface contamination is checked to alert for unexpected alpha.

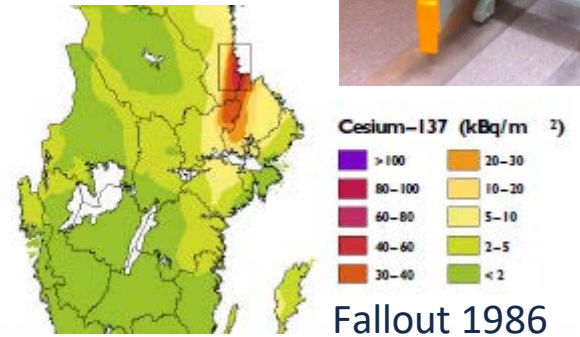
WBC

Chair set-up.

HPGe-detector, 50 % rel. efficiency.

Measurement time 6 minutes.

Cs-137 is often detected due to Chernobyl fallout in wild game meat, berries, mushrooms etc.



Fallout 1986

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400 WBC-MEASUREMENTS PER YEAR

Screening

Routine monitoring of reference group >4 times/ year.

40-50 people:

- Waste
- Chemistry
- Plant technicians
- RP
- Maintenance
- Decontamination

Planned works

Before and after high risk works:

- Control rod drives maintenance.
- Other maintenance of primary system, i.e. specific valves.

Event based

- Alarms in monitors for exit of controlled area.
- Initiated by RP-personnel.
- Known incidents.
- Approx. 25/ year.

On request

→ < 1 internal dose assessment/ year

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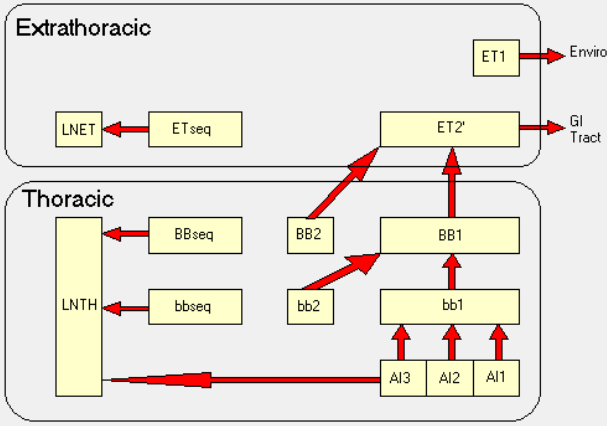
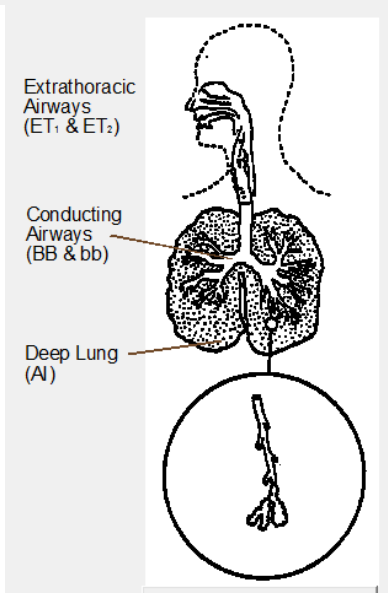
IMBA



- Tool for internal dose assessment.
- Based on ICRP models.
- Calculate dose from intake and/or bioassays.
- Predict uptake and retention.
- Calculate dose from associated nuclides (scaling factors).



→ Compare real WBC-values with predicted values to estimate route of intake and physical/chemical properties of contamination.

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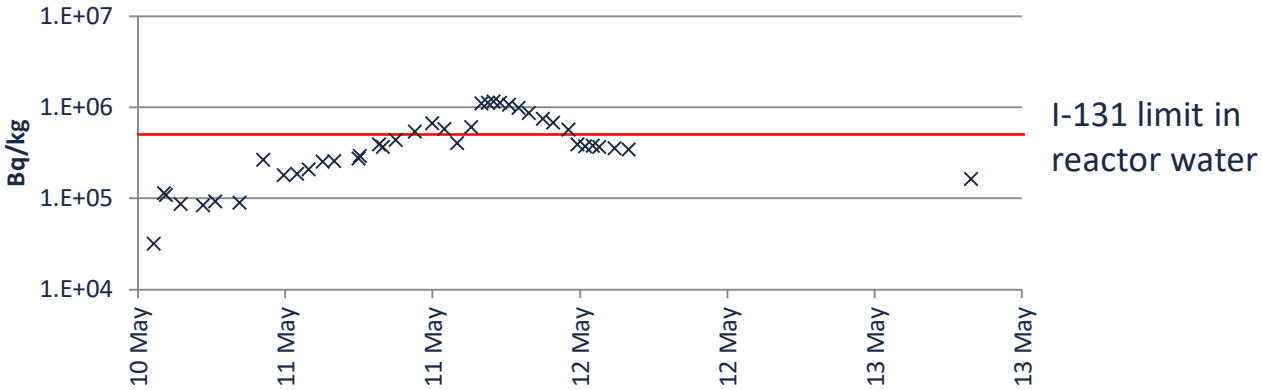
EVALUATION APPROACH

WBC > 1 000 Bq	• Check for external contamination. Repeat measurement. • Calculate preliminary dose using dose coeff. for inhalation.
0.25-1 mSv	• Additional WBC to define time and route of intake, e.g. day 1,2,3,5,10. • Use intake models (IMBA) to assess dose. Consider alpha. Record dose.
1-2.5 mSv	• Additional WBC, e.g. at day 20 and multiple at day 1 to define parameters. • Ask for biological samples (urine).
2.5 – 5 mSv	• Ask for biological samples (faeces).
> 5 mSv	• Contact authorities (SSM). • Consult medical doctor.

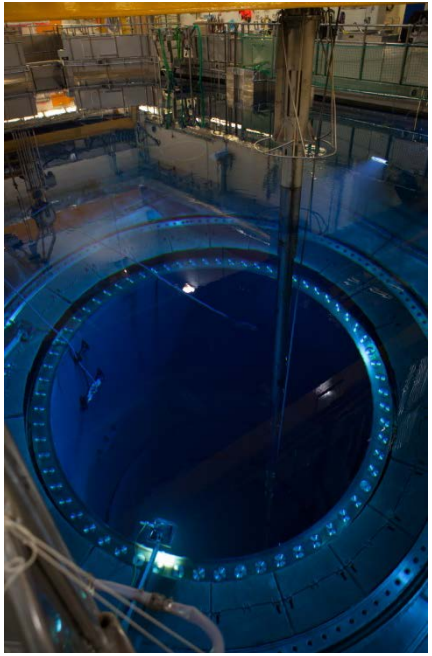
No dose above 0.3 mSv has been recorded.

CASE 1, I-131 MAY 2015

- Outage 2015 at unit F3.
- High levels of I-131 due to fuel failure.

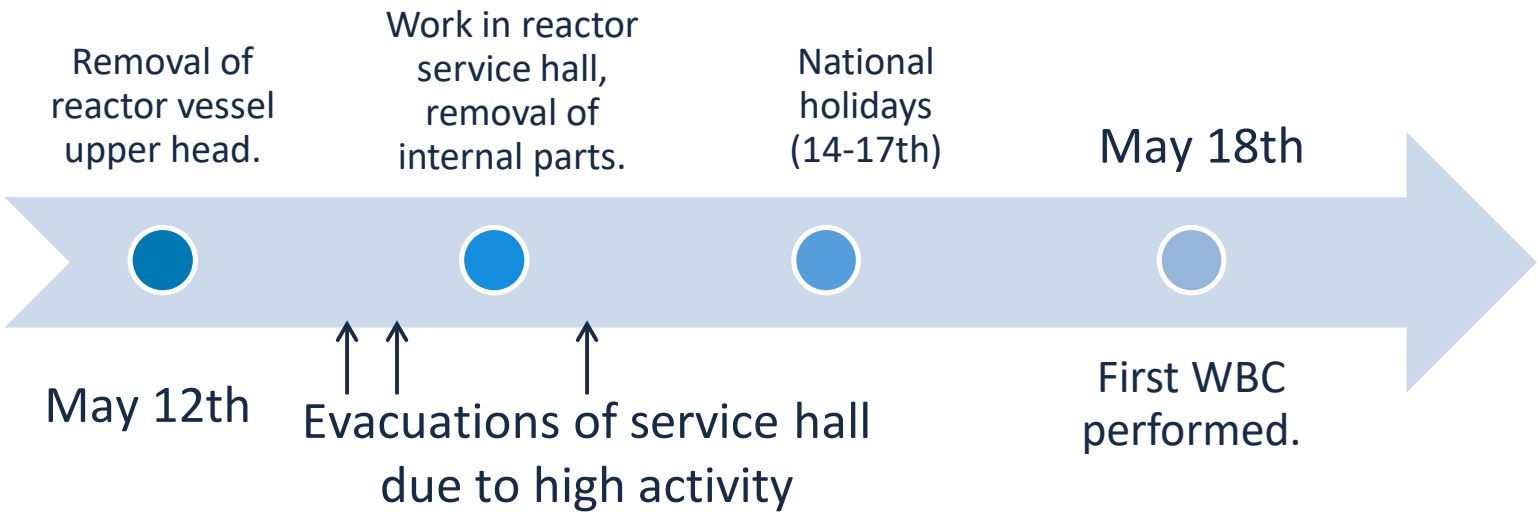


I-131 limit in reactor water



- Alarm for high activity in reactor service hall leads to evacuation of the room.

COURSE OF ACTION



Date	Activity (Bq) Person 1	Activity (Bq) Person 2
2015-05-18	1 900	1 070
2015-05-20	1 900	653

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WHO SHOULD BE MEASURED?

Everyone in the service hall when it was evacuated?

- Alarm for high activity (cps) 2 times on May 12th.
- Alarm for high iodine-activity on May 13th.

"If an intake that is calculated to imply a committed effective dose of 0.25 mSv or more is found, the whole team shall be measured." - SSMFS 2008:26

When did the intake happen? Could the dose be above 0.25 mSv?

WBC I-131 RESULTS

- Total of 25 persons measured.
- I-131 was detected in 17.
- Significant I-131 values detected in 3.

- Possible first contamination between May 12th-15th.
- A few persons were measured for the first time after 2 weeks.

Date	Activity (Bq) Person 1	Activity (Bq) Person 2	Activity (Bq) Person 3
2015-05-18	1 900	1 070	-
2015-05-20	1 900	653	-
2015-05-21	1 950	629	1 150
2015-05-22	-	-	898
2015-05-25	1 250	442	-
2015-05-28	723	279	545
2015-06-01	674	-	465
2015-06-04	308	-	-

Also Co-60 and Cs-137 was detected.

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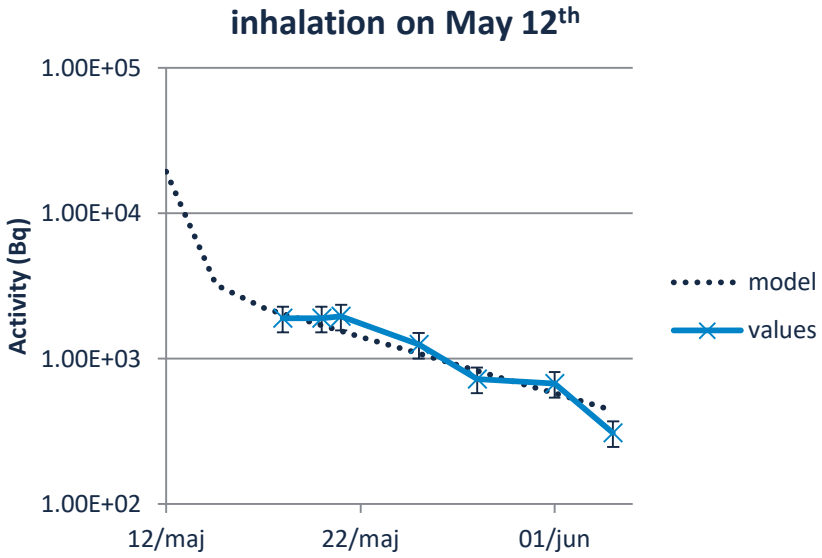
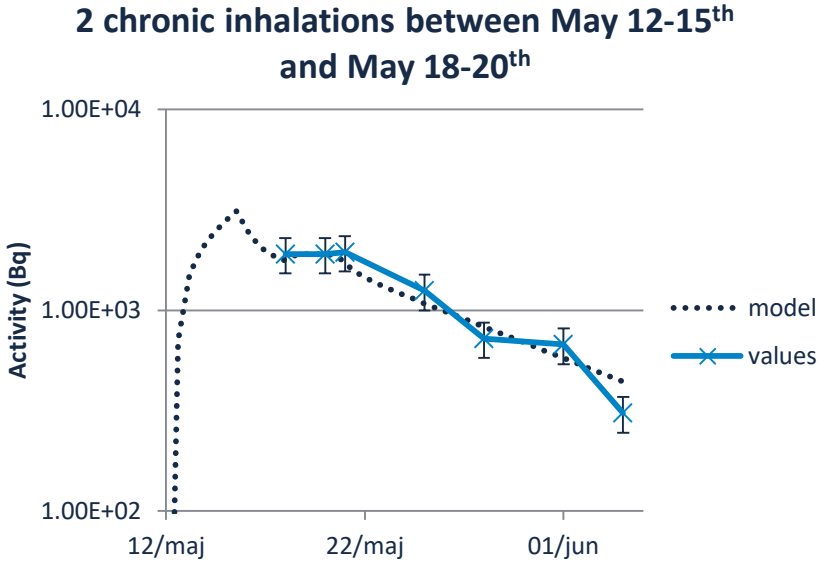
ESTIMATION OF INTAKE, PERSON 1





Depending on time and type of intake the effective dose was calculated to 0.2 – 0.25 mSv.

Using retention models it could also be concluded that those measured after 2 weeks got no significant contamination.

RESULTS

- One person got a recorded dose from internal contamination.
  - ➢Person 1 – effective dose: 0.3 mSv.
    (external dose 0.7 mSv).
- The effective doses for two persons were below the recording limit:
  - ➢Person 2 – effective dose: 0.1 mSv.
  - ➢Person 3 – effective dose: 0.2 mSv.

The effort to evaluate was not proportional to the magnitude of the resulting doses….

LESSONS LEARNED

Internal dose assessments

- Consider iodine levels, plan for WBC?
- Improve communication between RP and dosimetry.
- Guideline with “action levels”.
- Caution if WBC > 1 000 Bq .
- Do not make more measurements than necessary!
- Improve communication with contaminated personnel to prevent worrying people.
- Information leaflet on internal contamination after unplanned WBC.
- Use every opportunity to train dose assessment on real data, in real time.

THANK YOU!

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