ALARA Management Measures and Experience in Post Handling of Replaced Pressurizer (PRZ), Ringhals unit 4

ISOE NATC Symposium Fort Lauderdale 2015

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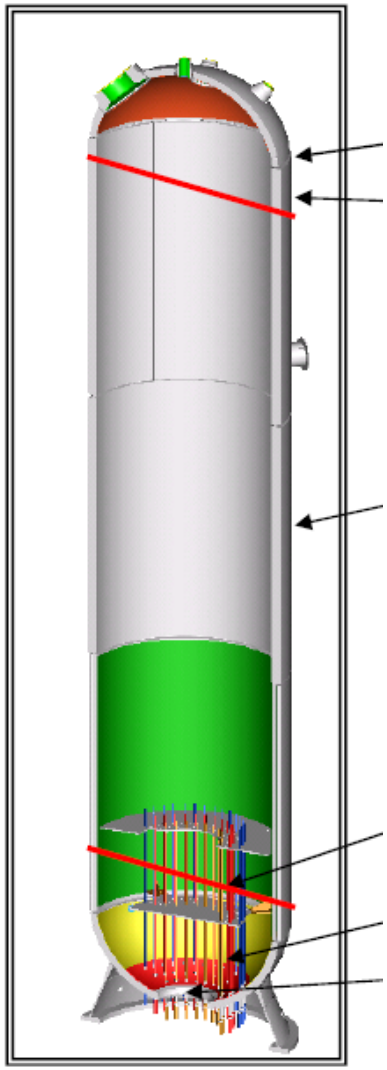
Parts to be removed for investigation



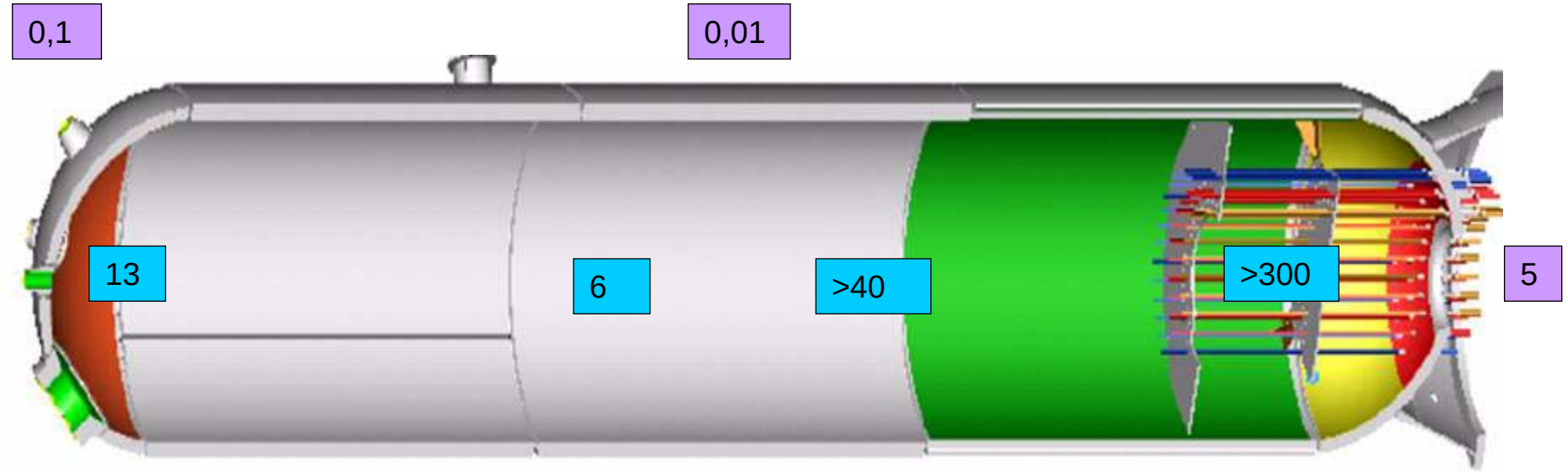
- Instrument nozzle by electro sparking (ESM)
- Top dome by sawing
- Spray nozzle and lining
- Opening for ventilation by ESM
- Surge nozzle and lining by sawing
- 67 Heaters by turning
- Lower dome by sawing

Where shall we work with the PRZ?

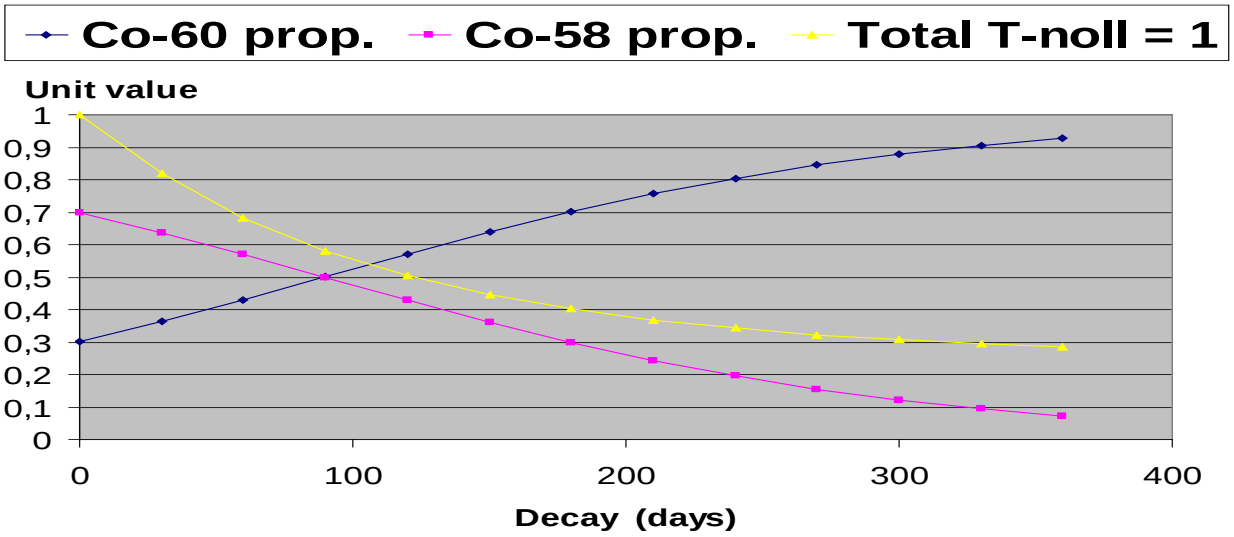
- Historical use of sealed sources meaning absence of:
  - Painted surfaces
  - Negative pressure
  - Air sampling
  - Active drain
  - Adapted filtrated ventilation

PRZ – dose rate survey

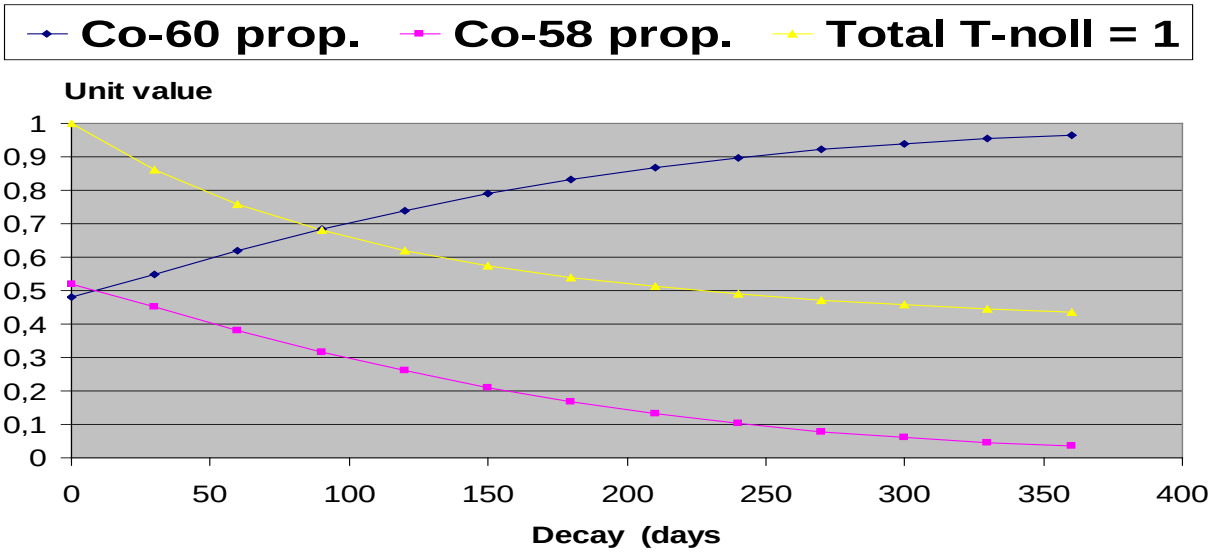
- The initial dose rates were determined by manual measurements and by nuclide specific surface activity measurements. TLD measurements via the PRZ safety valves and a PT 100 nozzle.
- Dose rates inside varied between 5 to 300 mSv/h
- Ambient dose rates in the range of a few µSv/h to 5 mSv/h



Source term dominating the RP measures



- Open source

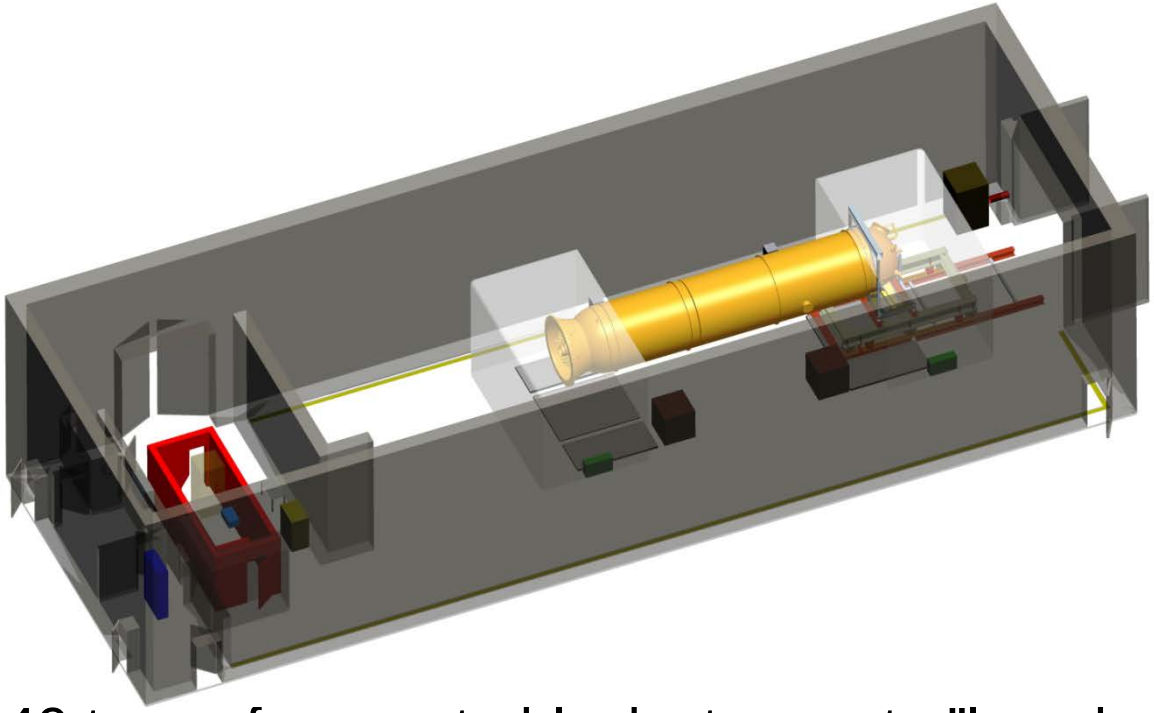


- Sealed source
  8 cm Fe

ALARA-plan – main goals

- Very close cooperation between maintenance and RP
- Mock-up training before operations
- Remote controlled equipment. Handled from low dose area
- ”Tailor made” shielding in all occasions near radioactive source
- Create negative pressure in the PRZ to prevent spread of contamination
- Use of telemetric dosimetry
- Dose estimation 75 mmanSv

ALARA preparations before handling the PRZ as an open source

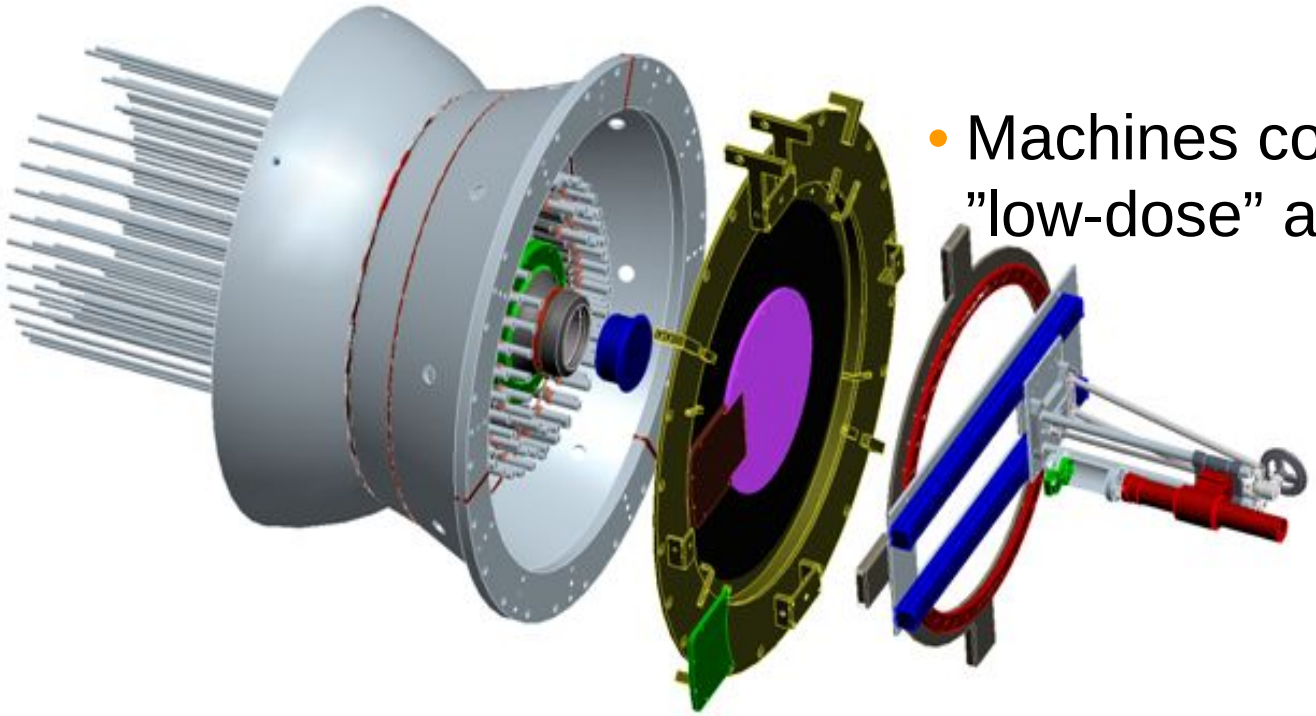


- Import of 40 tons of concrete blocks to create ”low-dose” areas
- Connecting ventilation to the inside of PRZ
- Manufacture of a 5 ton concrete shielded box to store the removed 67 heaters
- Tents with negative pressure

Sawing off the upper part of PRZ

- Air-flow into PRZ confirmed by smoke generator (from both sides of the opening)
- 4 mSv/h inside PRZ
- Purpose built 20 mm steel plates mounted at openings
- Top dome moved to decontamination workshop before re-use as mock-up

Sawing surge nozzle and turning heaters



- Rotating shielding
- Air-flow into PRZ
- Machines controlled from ”low-dose” area

Pulling the heaters out of PRZ

- Always as a sealed source
- Negative pressure inside PRZ
- 1-6 mSv/h in contact
- Placed in 5 ton concrete box, attenuation factor 10

Sawing off the lower part of PRZ

- Air-flow into PRZ from both sides of the opening, confirmed with smoke
- 6 mSv/h inside PRZ
- Purpose built 20 mm steel plates mounted at openings
- Bottom dome moved to decontamination workshop before re-use as mock-up

Decontamination of the lower part

Result

- Planned dose: ~75 mmanSv
- Received dose: ~28 mmanSv
- Max individual dose: 4,2 mSv
- No personal contamination
- No injuries
- Technical information received
- Full functional ”Mock-up”

Thank you!