Intern. Conference on Occupational Radiation Protection: Enhancing the Protection of Workers – Gaps, Challenges and Developments

Vienna, 1 – 5 December 2014

Session 10:
Occupational radiation protection in nuclear / fuel cycle facilities

Practical challenges in ongoing NPP decommissioning

J. Kaulard – TUV Rheinland Industrie Service GmbH, Cologne, Germany
H. B. Okyar – OECD Nuclear Energy Agency, Paris, France

TÜVRheinland®
Precisely Right.

Content

- ORP during decommissioning vs. operation
- Data on occupational exposure related to NPP decommissioning*)
- Contributors to a successful optimization in ORP for decommissioning
- Challenges and conclusions

*) *Note:*
Data labeled as "decommissioning" represent data from the ISOE database related to NPPs in "cold shut down" or "under decommissioning"

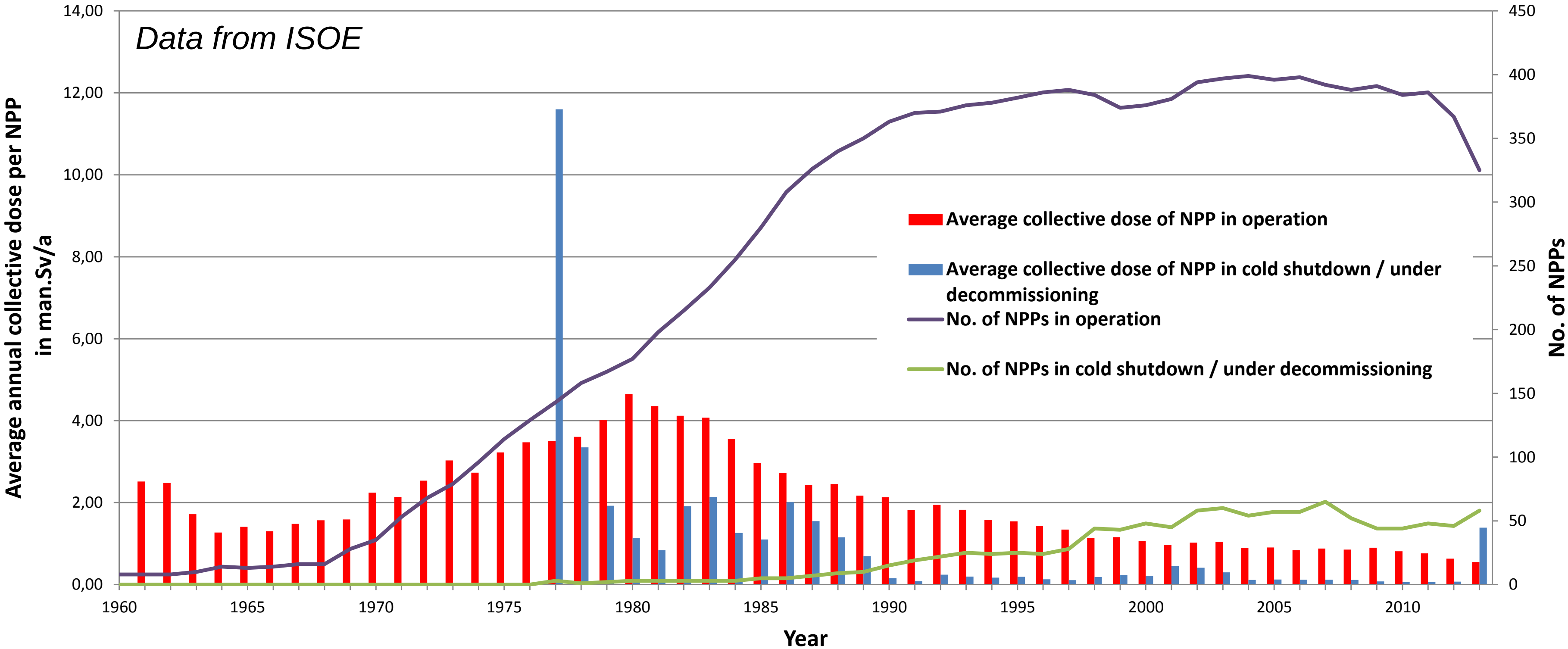
ORP during decommissioning vs. operation

- At first glance: ORP for **“Decommissioning” is equal to**
  ORP for **“extended Outage”**
  - no other “daily” challenges than during outage
  - procedures and protective measures from operation deem appropriate
- At a closer look: **some aspects more relevant / new** for decommissioning compared to operation, e.g. due to
  - continuous change of the facility status (technical, radiological relevant)
  - increased number of (long-lasting) work activities with interdependencies
  - access to workplaces, inaccessible during operation
  - (need for) deviations from plans on the conduct of work
  - high volume of radioactive / non-radioactive material flow
  - replacement of technical barriers by administrative ones (incl. PPE)
  - long-lasting increase of number of personnel during full year in RCA

➔ Experience: ORP is ensured, optimization is possible,
but: aspects for further improvements exist

Data on the occupational exposure related to NPP decom.

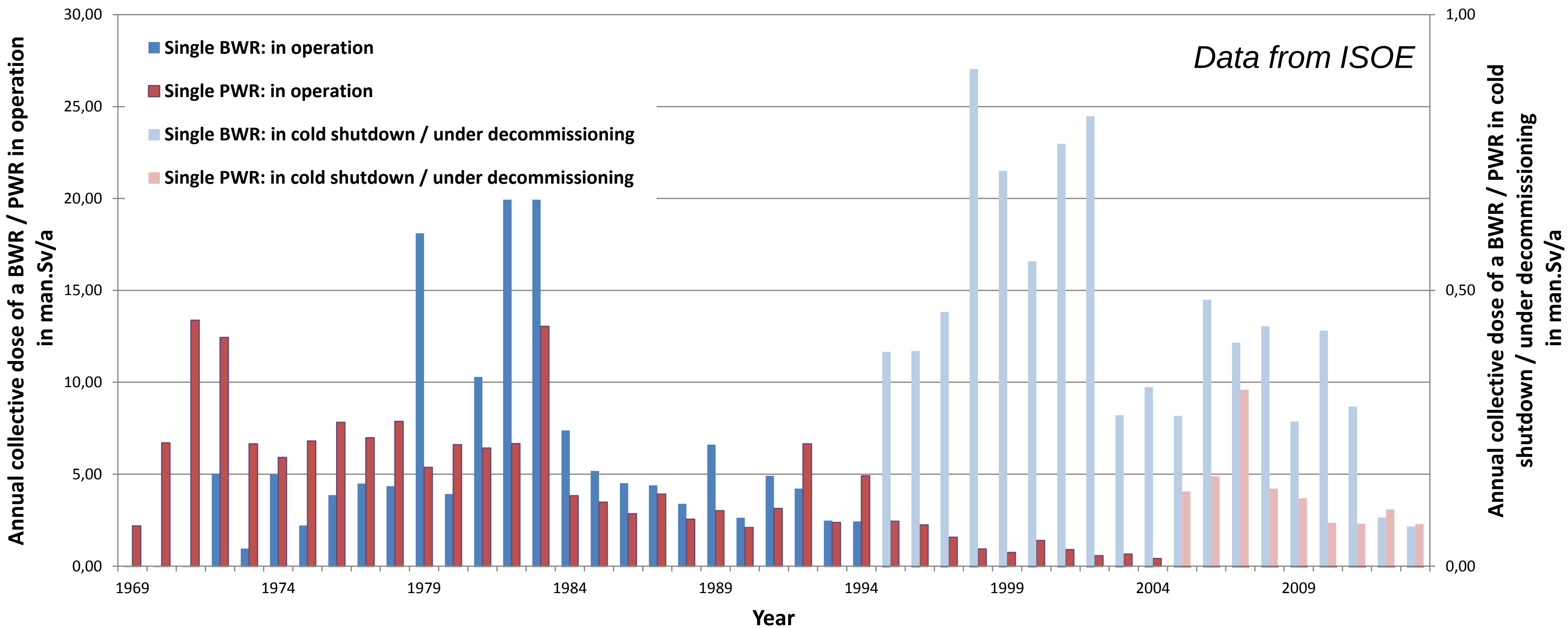
Average annual collective dose per NPP worldwide



Typical numbers since 1990:	operation:	0,5 – 2,0 man.Sv/a
	decommissioning*) :	0,1 – 0,5 (1,4) man.Sv/a

Data on the occupational exposure related to NPP decom.

Annual collective dose of a PWR and a BWR at different stages



Averages: PWR: operation: 3 man.Sv/a decommissioning*) : 0,2 man.Sv/a

BWR: operation: 5 man.Sv/a decommissioning*) : 0,5 man.Sv/a

Data on the occupational exposure related to NPP decom.

Remarks on the occupational exposure data presented

- Average annual collective dose per NPP
  - **higher** for NPPs in **operation** than for NPPs under **decommissioning***)
  - annual data for NPPs under **decommissioning***) **strongly** depend on
    - **individual decommissioning schedule** and **annual work** performed
    - **reactor type** and **reactor generation**
    - **number of reporting NPPs**
- Annual collective dose for single BWR / PWR during their life cycle
  - **difference** between operational phase and decommissioning phase **about factor of 10**, as e.g. during decommissioning
    - no spent fuel on-site
    - lower radiation fields due to full system decontamination
  - note: **ratio not a "must"** for any type of reactor and generation

Contributors to a successful optimization in ORP for decom.

- **Several contributors** known from **operation important** to optimization of ORP during decommissioning - **spotlight on** following **three**
  1. ***Overall planning process and work control***
     - good practice from operation: **planning of ORP** as **part** of the **overall planning process**
       ➔ accordingly, planning for dismantling/repair/replacement/... mandatory
     - **early integration of ORP** experts in planning to ensure
       - relevant information are used / missing information are retrieved
       - work plans become ORP optimized, adequate protective measures are taken & ORP related preparatory work initiated (e.g. training)
       - extent of participation should be based on criteria
     - **work permits** to cover all **ORP relevant instructions**
     - **graded ORP related work control** (esp. close control in challenging / unknown situations or when individual / collective doses expected high)
     - need of **experience feedback** (e.g. comparison of planned / real doses)

Contributors to a successful optimization in ORP for decom.

- **Several contributors** known ... - **spotlight on** following **three** (cont'd)

  2. Sound and robust system of ORP regulations

  ➔ **Enable workers** to react on **changing radiological situations**

  - **Comprehensive** system of at **least two levels**
    - higher level (stable) – **overall principles**
      (➔ definitions, zones, action levels, characterization concept,...)
    - lower level (adaptable to changes) – **instructions for consideration during detailed work**
      (➔ monitoring of work places / areas, measuring techniques, application of protective measures [which, when, ...], ...)

  3. Radiation source control

  ➔ **keep contamination / dose rates ALARA** to best influence exposure

  - monitoring/influencing of inventory (➔characterization, FSD,...)
  - monitoring/influencing of dose rates and contamination levels
  - control of source build up (➔ logistic, transfer of rad. components ...)

Challenges and conclusions

- **Experience shows**
  - ORP for decommissioning can be based on ORP from operation, but adaptations might be needed to better meet the specific needs
  - occupational radiation exposure (doses) for decommissioning is less than for operation (currently!)
  - optimization in ORP during decommissioning does work
- However, **important questions which should be address in the future** are
  - how to **improve the experience feedback** between different projects considering, that commercial restrictions exist, that may limit the benefit of exchange
  - how to improve **maintaining knowledge** (esp. on concepts and procedures) and **retaining an appropriate level of awareness** on radiation related risks during decommissioning especially, if staff exchanges

Thank you for your attention!