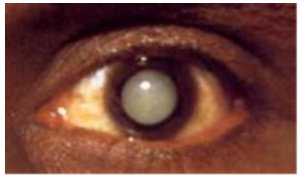
CONTENT

- Regulatory background – a short reminder- status today
- Key take away from the Swedish pilot study (previous ISOE Symposia)
- What have we done after the pilot study
- What is left to do?
- Summary and conclusions

REGULATORY BACKGROUND



- ICRP Statement on Tissue Reactions, April 2011 (ICRP ref 4825-3093-1464)
- ICRP 118: ICRP statement on tissue reactions and early and late effects of radiation in normal tissues and organs – threshold doses for tissue reactions in a radiation protection context
- IAEA GSR Part 3: Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards
- Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation…
- IAEA TECDOC No. 1731: Implications for Occupational Radiation Protection of the New Dose Limit for the Lens of the Eye (published in Dec 2013)

TODAY IN SWEDEN…

- The new Swedish Regulatory ”package” has started to roll out…**1 June 2018**
- Dose limit for the dose to the lens of the eye is lowered from 150 mSv/year to **20 mSv/year**
- **Radiation Safety Authority's regulations on basic rules for licensable practices with ionizing radiation (SSMFS-2018:1)**

ISO 15382:2015 recommends that monitoring should be undertaken if there is reasonable probability to receive a dose of 15 mSv in a single year, Or if there is reasonable probability to receive a dose of 6 mSv in consecutive Years. For lower levels – a survey should be sufficient

→ in our (Sweden) operation, outages each and every year…We will need to monitor for eye dose

PRESENTATIONS IN PREVIOUS ISOE SYMPOSIA

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Equivalent dose to the lens of the eye at nuclear facilities and shielding factors for protective eye wear – measurements and calculations

2014 ISOE European Symposium, Bern (Switzerland) from 9 to 11 of April 2014

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Lowered dose limit to the lens of the eye - Preparations at Forsmark NPP

2016 ISOE RPM meeting, Brussels 31 May 2016

Staffan Hennigor, Forsmark NPP
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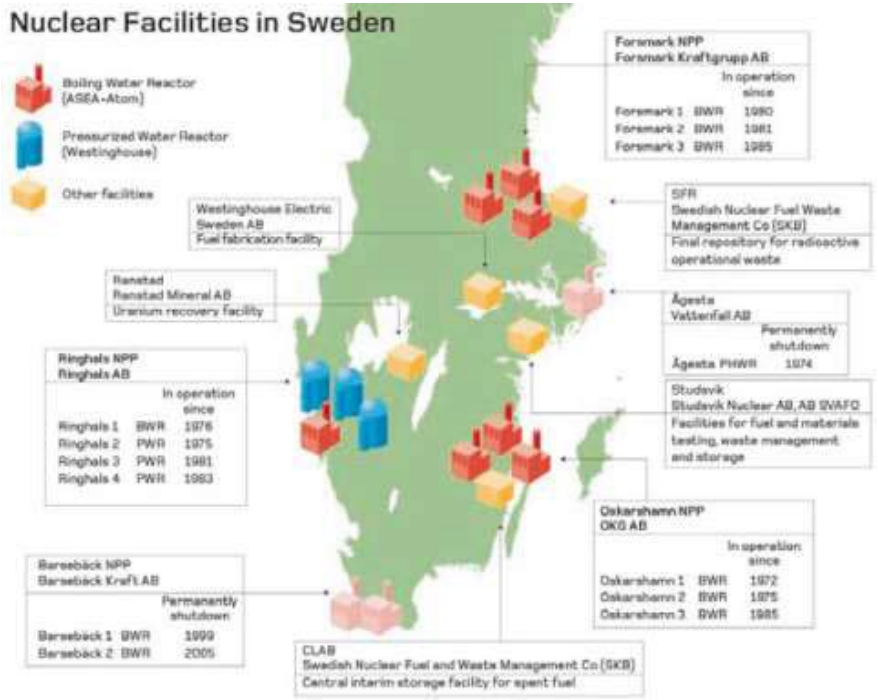
Karin Andgren, Vattenfal AB

NUCLEAR FACILITIES IN SWEDEN



- AB SVAFO (decommissioning old facilities),
- Barsebäck Kraft AB (2 BWR NPP shut down since 1999 and 2005, about to be decommissioned),
- Forsmarks Kraftgrupp AB (3 BWR),
- OKG Aktiebolag (3 BWR, O1 and O2 shut down recently, to be decommissioned),
- Ringhals AB (1 BWR, 3 PWR, R1 and R2 to be shut down by 2020),
- Studsvik Nuclear AB (material testing, waste handling),
- SKB (waste repository, future final storage for spent fuel), and
- Westinghouse Electric Sweden (nuclear fuel)

CONCLUSIONS FROM THE SWEDISH STUDY

- Open systems with CRUD deposition are expected to provide high Hp (3) doses. In these cases, the gamma contributes most to the eye dose and therefore the protective equipment hardly gives any effect.
- The pilot study showed that Hp(10) is rather equivalent to monitored ”eye lens dose” for more common tasks at the facilities.
- The study on the effectiveness of protective equipment showed that safety glasses do not protect against gamma radiation representative at Swedish nuclear power plants (65-1250 keV). Safety glasses do shield a certain amount of the beta radiation, depending on the energy and type of glasses. Shielding factor could vary between 26-99 %.

RESULTATS FROM PILOT STUDY

	All sites, October 2013	All sites, November 2013
Monitored persons, #:	126	144
$H_p(3) \geq 0.5$ mSv, # of persons:	26	22
Highest $H_p(3)$ dose: Proffesion: $H_p(10)$ from whole body dosimeter:	2.9 mSv Decontamination 2.3 mSv	1.2 mSv Two radiation protection workers 0.8 and 1.1 mSv

	Ringhals unit 1, outage 2014	Ringhals unit 3, outage 2014
Monitored persons, #:	14	7
$H_p(3)$ and/ or $H_p(10) \geq 0.5$ mSv, # of persons:	13	5
Highest $H_p(3)$ dose: Proffesion: $H_p(10)$ from whole body dosimeter:	2.4 mSv Mechanist 4.2 mSv	1.6 mSv Mechanist 1.6 mSv

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AFTER THE PILOT STUDY…

- Continous monitoring of the eye lens dose has been conducted, focusing on specifik work tasks
- RP Procedures updated –
  - *Use of extra dosimeters for personnel and measurements with working dosimeters*.
  - *Pre Job Briefing for Radiological Reason (elevated RP risk)*
- Ringhals uses ”in house” dosimeters for monitoring of the eye lens dose $H_p(0.07)$.

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WHEN TO USE EYE DOSIMETER

- Situations where the eye is more exposed than the rest of the body due to shielding
- Situations where the eye is closer to the source of radiation than the rest of the body

- **Specific tasks when eye dosimeter SHALL be used:**
  - ➢ CRDM service (BWR)
  - ➢ Work on (inside) primary circuit components (PWR/BWR)
  - ➢ SG inspection (PWR)

- Planning value 0,5 mSv

0.5 mSv x 12 months = 6 mSv (monitoring level according to ISO 15382)

Tabell 1. *Arbetsmoment/ situationer där extra dosimetrar alltid skall användas, oavsett uppskattad dos.*

Moment/Situation	Val av dosimeter
Dykning/vadning i bassänger eller tankar innehållande radioaktivt medium.	*Dykning:* Extremitet: hand/finger Helkropp *Vadning:* Extremitet: fot
Manuell hantering av reaktorns interna delar med inducerad aktivitet. *Exempel;* *Hantering av materialprover, demonterade objekt, förberedelser för transport etc.*	Extremitet: hand/finger
Arbete/inspektion i ÅG primärsida (PWR).	Extremitet: hand/finger fot Ögondosimeter
Arbete i 313 pumphus (impeller)/ ventiler (ventilkäglor)/ ledningar (BWR och PWR).	Extremitet: hand/finger Ögondosimeter
Demontage och dekontaminering av drivdon.	Extremitet: hand/finger Ögondosimeter eller huvuddosimeter

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RINGHALS RESULTS OF MEASURMENTS

- **2016:**
  - 16 workers
  - 8 specific work tasks
  - Average eye dose: 1,5 mSv
  - Highest eye dose: 4,1 mSv *(Hp(10)=2,3 mSv. Installation of equipment in SG Channel Head)*
- **2017:**
  - 8 workers
  - 2 specifik work tasks
  - Average eye dose: 1,3 mSv
  - Highest eye dose: 1,4 mSv *(Hp(10)=2,2 mSv. CRDM work on Unit 1, BWR)*

EYE DOSE WORKING GROUP

- The eye lens is exposed even when conducting ”normal tasks”.
- The need for common guidance within the country was identified – specifically regarding itinerant workers (outage to outage) – how could we otherwise keep track on every worker´s ”eye lens doses”?
- Beginning of 2018 - A working group was formed with representatives from all the licensees. Focus was to agree on HOW, and WHAT to register.
- A proposal for a common guidance has been made from the working group.
- Approval from RP Superintendents – May 2018

PROPOSAL FOR COMMON GUIDELINES

- To combine TLD (Hp(10)) and ”eye lens dosimeter” when conducting certain job tasks in order to report a ”total eye lens dose” for the month
- Planning value for the use of ”eye lens dosimeter” for a certain task is set at **1 mSv**
- Dosimeter use when conducting certain tasks: TLD + EPD + ”eye lens dosimeter”
- The guidance is always to wear the ”eye lens dosimeter” under PPE
- Monthly reporting:

$$\rightarrow Eyedose_{month} = H_p(10) - H_p(10)\frac{EPD_{propotional,specific\ worktask}}{EPD_{month}} + Eyedose_{specific\ worktask}$$

Note:

Hp(10) will, by default, be registered as ”eye lens dose” in case the worker has not conducted any specific tasks during which ”eye lens dosimeter” has been worn during the month in question.

PRACTICAL EXAMPLE

Forsmark 3, RFO 2018:

- Work task: dye penetrant inspection, under the reactor vessel head
- PPE: full face mask, ”eye dosimeter” worn under PPE during the specific work task
- During April other inspection tasks in the reactor hall

Person	Period (spec work task)	Eye lens dose (PHE)	EPD for the spec work task	EPD for the month	TLD for the month	”total eye lens dose” month (proposal)
1	20-23 April	0,95	0,670	1,504	1,4	1,7
2	20 April	0,62	0,287	0,421	0,3	0,7

$$Eye\ dose_{month} = H_p(10) - H_p(10)\frac{EPD_{proportion,specific\ task}}{EPD_{month}} + Eye\ dose_{specific\ task}$$

RINGHALS RESULTS IN 2018… (SO FAR)

- May 2018 RFO (Ringhals Unit 3, SG Inspection):
  - 8 workers
  - 5 workers ≥ 0,5 mSv
  - 3 workers: Eye dose > Whole body dose
  - Average eye dose: 1,2 mSv.
  - Highest eye dose: 3,0 mSv (*H*p(10)=1,8 mSv, EPD=2,0 mSv)

WHAT IS LEFT TO DO

- Update of local and central national dose registration and information systems.
- Today there is no obvious choice of eye dosimeters. Ringhals plan is to purchase new eye dosimeters (Hp3, same as was used in the study)
- Updating training program
- Update of relevant RP procedures including practical routine:
  - How should eye dosimeters be worn?
  - How should they be stored when not used?
  - Dosimeters for background measurement?
  - Responsibility, etc.

SUMMARY AND CONCLUSIONS

- Monitoring is recommended at the Swedish nuclear facilities and we are ready to do so. However, the start date for when to start register eye dose data to the central dose informational system is still to be decided.
- During a period of 2 years, in order to gather more data, extended monitoring will be conducted at the facilities. Selected profession is CRDM (BWR) maintenance workers.
- The planning value is based on the recommendations in ISO 15382:2015
- In line with IAEA TecDoc 1731 ”Implications for Occupational Radiation Protection of the New Dose Limit for the Lens of the Eye”
- Potential consequence: being ”too conservative” – although on the safe side!

Thank you!

Questions?

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