Eye lens dosimetry:

The dosimetry service perspective

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Eye lens dosimetry: Dosimetry service perspective

PRESENTATION CONTENTS

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• To a new infrastructure for eye lens dosimetry
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01

POSITION OF THE DOSIMETRY SERVICE
Dosimetry Services in EU

• COUNCIL DIRECTIVE 2013/59/EURATOM:
  
  "dosimetry service" means a body or an individual competent to calibrate, read or interpret individual monitoring devices (...) or to assess doses, whose capacity to act in this respect is recognised by the competent authority;

• Different types of organizations:
  - from in-house services,
  - to scientific institutes,
  - to commercial service providers

• Different sizes, number of monitored individuals varying
  - from < 1000
  - to > 100.000
Recognition (or Approval)

• By competent authority in EU Member State


• Requirements and procedures vary between 28 member states, but also similarities can be found:
  - Dose results have a legal status
  - Quality assurance, well-established procedures, standards
  - Measurement traceability
  - (International) Intercomparisons
  - Accreditation ISO-17025
Before 2013

- Effective dose limit 20 mSv per year normally sufficient to comply with limit 150 mSv per year for \( H_{\text{eye}} \)
- ICRP Publication 103 (2007)

**personal dose equivalent \( H_p(3) \), has rarely been used in practice and very few instruments exist for measuring this quantity. It is suggested that its use is discontinued because the monitoring of the exposure to the eye lens is also sufficiently achieved if the dose to the eye lens is assessed in terms of the other operational quantities**

- Poor “infrastructure” for \( H_p(3) \):
  - \( H_p(3) \) type tested dosemeters
  - (International) standards
  - Suitable phantom, air kerma \( K_{\text{air}} \) to \( H_p(3) \) conversion factors
  - (International) intercomparisons
2012

- EURADOS WG2 Questionnaire
- 40% of the services evaluated eye lens dose
  - $H_p(3)$ used in 50% of these cases (that means 25% of the total)
  - Dosemeter at eye position in 16% of the cases (that means 6% of the total)
- 7% said to report $H_p(3)$
After 2013

• COUNCIL DIRECTIVE 2013/59/EURATOM ("BSS")
  - Adopts limit 20 mSv per year for $H_{\text{eye}}$

  especially category A workers should be systematically monitored based on individual measurements performed by a dosimetry service. In cases where workers are liable to receive significant exposure of the lens of the eye, an adequate system for monitoring must be in place

• Implementation in national legislation of Member States by 2018

• Requirements for eye monitoring might vary for different Member States
02
TOWARDS NEW INFRASTRUCTURE
Strategy

- Free after Porter’s 5 Forces
Legislation

• Requirements for Dosimetry Services
  - Level of technical detail
  - Need to have a specific $H_p(3)$ dosemeter?
  - Need to have a dosemeter suitable for positioning close to the eye?
  - Need to include in formally approved system?
  - Take into account protective eye wear?

• Requirements for Users
  - As above
  - For which workers specific eye lens dosimetry would be applicable?

• National dose registry – radiation passbooks – legal doserecords
Example legal aspects: the Netherlands

- Implementation BSS kept to the minimum

- Only adaptation of yearly limit 20 mSv

- General requirements
  - to provide “suitable system” of monitoring
  - mandatory for exposed workers

- More details in Guidelines from Netherlands Commission on Radiation Dosimetry
Example legal aspects: UK

• Problem: how to define the eye lens dose in legal dose records

• Nuclear sector: legal dosimetry with APD, plus sometimes passive eye lens dosemeter

• Before 2018: $H_{\text{eye}}$ was set equal to $H_p(0.07)$ from APD, plus $H_p(3)$ from eye dosemeter (if present)

• Limit to 20 mSv per year: Conservative algorithm used in nuclear sector would lead to apparent dose limit violations

• After 2018: $H_{\text{eye}}$ is set equal to $H_p(0.07)$ from APD or $H_p(3)$ from eye dosemeter (whichever is higher)
Example legal aspects: UK

- Much more information:

**Practical Matter Article**

*Eye lens dose monitoring in the UK nuclear industry using active personal dosemeters*

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Users

• Protect their workers from harmful effects of ionizing radiation

• Comply with (national) regulations

• Expect the only one true value from the approved dosimetry service

• Limit resources spent on dosimetry program
  - Attention needed from staff managing the dosimetry program
  - Costs dosemeter subscriptions
  - Costs lost dosemeters

• Limit annoyance of employees because of having to wear (multiple) dosemeters
  - Wearing comfort
User questionnaire in Germany

- HelmholtzZentrum AWST Munich (H. Hoedlmoser)
- 500 customers, 100 replies
Suppliers

- “Make or buy”

- Buy dosemeter hardware or outsource the service

- At early stage not much choice

- Product developments:
  - Research projects: ORAMED
  - Commercially developed products
  - In-house developed solutions

Google search result:
Example development in partnership

Other dosimetry services

• May be either partner/supplier or competitor

• Partner/supplier
  - Share development costs
  - No need to re-invent the wheel

• Competitor
  - Unique selling points
  - Price
Example offering of a large dosimetry service

Headband adapters: for certification and studies

Adhesive adapters: for customers with existing glasses or visors

Clip: for glasses or caps
Alternatives - substitutes

- Use $H_p(10)$ and/or $H_p(0.07)$ dosemeter
  - Whole body
  - Extremity
  - Specific wearing position

- “Conversion factor” from $H_p(10)$ and/or $H_p(0.07)$ (collar, whole body) to $H_{eye}$
- Demonstrate compliance based on risk assessments
- Sophisticated calculations like demonstrated with the “Podium” project (“Personal Online DosImetry Using computational Methods”)

T.W.M. Grimbergen – EURADOS Winter School – 30/01/2020
Implementation example
Mirion Dosimetry Services (Arnhem, the Netherlands)
Implementation at Mirion Arnhem (Netherlands)

- No provision for reporting eye lens dose to national dose registry NDRIS
- Additional to the approved dosimetry service (no formal approval required)
- Not within accreditation scope
- Outsourced measurements
- Headband type dosemeter
- Following the Guidelines of Netherlands Commission on Radiation Dosimetry
QA, training, IT, reporting

- Training staff
  - new procedures
  - Logistics
  - QA procedures
  - Customer service

- Dummy customer subscription

- Extra attention for transit doses

- Participation in EURADOS IC2019<sub>ext,eye</sub>

- Integration in customer portal
Implementation at Mirion Arnhem (Netherlands)

• Since start, requests from about 2% of all customers

• So far yearly doses < 10 mSv

• Meanwhile about half of them stopped the subscriptions (used only for survey / trial)

• Number of subscriptions peaked early 2019
Summary

Eye lens dosimetry: the dosimetry service perspective
Summary of the dosimetry service perspective

• Strategy will depend on local requirements

• Infrastructure for $H_p(3)$ has been build up

• Set-up and maintenance of a dosimetry system for $H_p(3)$ requires similar efforts as for any other dosimetry system

• Depending on local requirements and status of radiation protection practices, the number of actual subscriptions to eye lens dosimetry service will be limited to a relatively (or very?) low number