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Free Webinars on Occupational Radiation Protection

24 June 2020 **10:00- 11:30 CEST**

24 June 2020

Individual monitoring with radiophotoluminescence (RPL) passive integrating dosimeters

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Welcome to the 9th ORP webinar

JOINT ORPU/RSTSU WEBINAR ON INDIVIDUAL MONITORING WITH RADIOPHOTOLUMINESCENCE (RPL) PASSIVE INTEGRATING DOSIMETERS

24 June 2020 **10:00- 11:30 CEST**

IAEA
International Atomic Energy Agency

24 June 2020

Individual monitoring with radiophotoluminescence (RPL) passive integrating dosimeters

Moderator: H. Burçin Okyar

Occupational Radiation Protection Unit
Section of Radiation Safety and Monitoring
Division of Radiation, Transport and Waste Safety
Department of Nuclear Safety and Security

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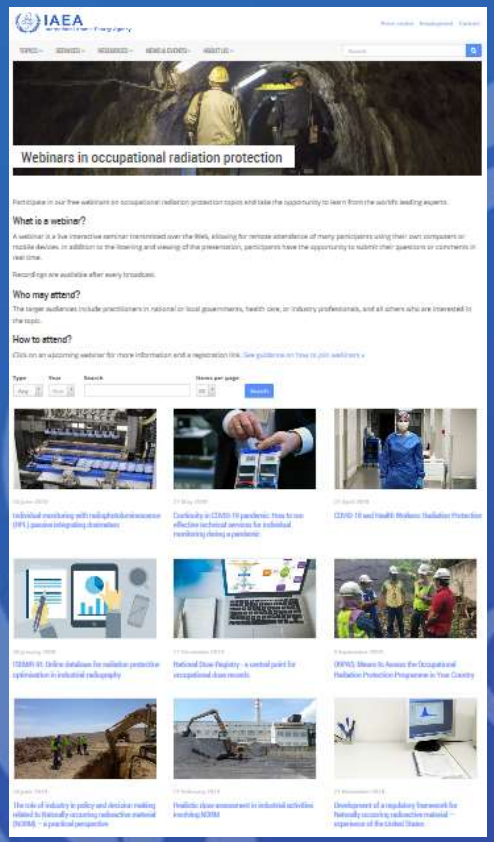
24 June 2020

Individual monitoring with radiophotoluminescence (RPL) passive integrating dosimeters



https://www.iaea.org/topics/radiation-safety/webinars

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Organized jointly with

- Institute for Radiological Protection and Nuclear Safety (IRSN)
- Chiyoda Technol Corporation

Learning objectives

- IAEA GSR Part 3 requirements & GSG-7 guidance for technical service providers for external individual monitoring
- RPL dosimetry and setting an RPL dosimetry laboratory for individual and workplace monitoring
- Routine operation of an RPL dosimetry laboratory for individual monitoring
- Clinical applications of RPL dosimeters
- Experience of laboratories to deal with the COVID-19 pandemic
- Experience of the IAEA Radiation Safety Technical Services on characterization of RPL dosimetry system for individual monitoring

Radiation Safety and Monitoring Section

RSM: https://www.iaea.org/about/radiation-safety-and-monitoring-section

Welcome note from
Miroslav Pinak
Head of Radiation Safety and Monitoring Section/ NSRW

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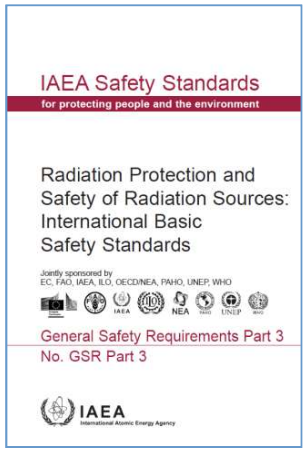
Webinar on "*Individual monitoring with RPL passive integrating dosimeters*"

International Basic Safety Standards, GSR Part 3

- An integrated and consistent set of Safety Requirements that establishes the requirements that must be met to ensure the protection of people and the environment, both now and in the future.



- GSR Part 3 (BSS) follows ICRP 103 recommendations
- Protection and Safety requirements of the BSS apply to all facilities and activities
- **Planned, emergency and existing exposure situations**
- **Occupational,** public and medical exposure categories
- 52 overarching requirements – for **governments, regulatory bodies, industry, health and safety professionals, workers**, public and **service providers** such as technical support organizations
- **12 requirements for ORP**; **Control, monitoring and recording**
- **Regulator, TSP** (authorization or approval of service providers for individual monitoring and calibration services) & **Operators**

GSR Part 3 coverage for ORP

Planned exposure situation

Occupational exposure

Req 19: Responsibilities of the regulatory body
Req 20: Requirements for monitoring and recording of occupational exposure
Req 21: Responsibilities of employers, registrants and licensees
Req 22: Compliance by workers (*Responsibilities of workers*)
Req 23: Cooperation between employers, registrants and licensees
Req 24: Radiation protection programme
Req 25: **Assessment of occupational exposure** and workers' health surveillance
Req 26: Information, instruction and training
Req 27: Conditions of service
Req 28: Protection and safety for female workers and for persons under 18 years of age

Emergency exposure situation

Exposure of Emergency Workers

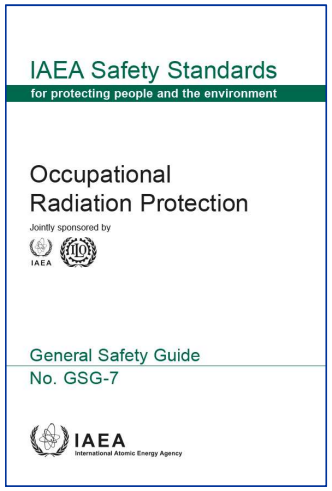
Req 45: Protection of emergency workers (arrangements for controlling the exposure

Existing exposure situation

Occupational exposure

Req 52: Protection of workers in existing exposure situations (remedial actions, Rn in workplaces, exposure of air crew)

General Safety Guide on ORP (GSG-7)



- Provides guidance on the control of occupational exposure (technical and operational aspects)
- Based on “exposure situations”, and provides information on ORP framework, exposures of workers in different exposure situations, protection of workers in special cases, dose assessment, management system for service providers, control measures as well as health surveillance
- New approaches for itinerant workers, female workers during and after pregnancy, monitoring of lens of the eye, etc.

GSG-7

- **Framework for ORP** (Section 2)
  - Graded approach
- **Planned Exposure Situations** (3)
  - RPP and exposure to natural sources of radiation
- **Emergency Exposure Situations** (4)
  - Emergency workers, management
- **Existing Exposure Situations** (5)
- **Protection of workers in special cases** (6)
  - Female workers during and after pregnancy & itinerant workers

- **Assessment of occupational exposure (7)**
  - External, internal, emergency, skin contamination and records
- **Management of technical service providers** (8)
  - Management, process, additional guidance for providers of calibration and testing
- **Engineered, administrative controls and PPE** (9)
  - Control measures
- **Workers' health surveillance** (10)
  - Examination, records, overexposure management

- **Appendices**
  - Exposure of workers to naturally occurring radioactive material
  - **Methods and systems for individual monitoring for assessment of external exposure**
  - Workplace monitoring instruments for assessment of external exposure
  - Biokinetic models for assessment of internal exposure
  - Methods for individual monitoring of internal contamination
- **Annex**
  - Techniques for retrospective dosimetry

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Today's Speaker: Yasuhiro Koguchi

Deputy Head of Oarai Research Center
Chiyoda Technol Cooperation

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Today's Speaker: Alain Savary

Head of Metrology and Method Unit of the Department of Institute for Radiological Protection and Nuclear Safety (IRSN)

RSTSU: https://www.iaea.org/topics/workers/radiation-safety-technical-services

Today's Speaker:
Michael Hayek
Individual Monitoring Service Group Leader

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Implementation of Radiophotoluminescence Dosimetry at IAEA Radiation Safety Technical Services Laboratory

M. Hajek[1,*] M. Sugiyama[1,2], G. Kolb[1], D. T. Tucker[1] & M. Pinak[1]

[1] *Division of Radiation, Transport and Waste Safety, International Atomic Energy Agency*

[2] *Ōarai Research Center, Chiyoda Technol Corporation*

*E-Mail: m.hajek@iaea.org

Topics in Radiation Protection Dosimetry – Radiophotoluminescence Dosimetry
24 June 2020, IAEA Technical Webinar Series

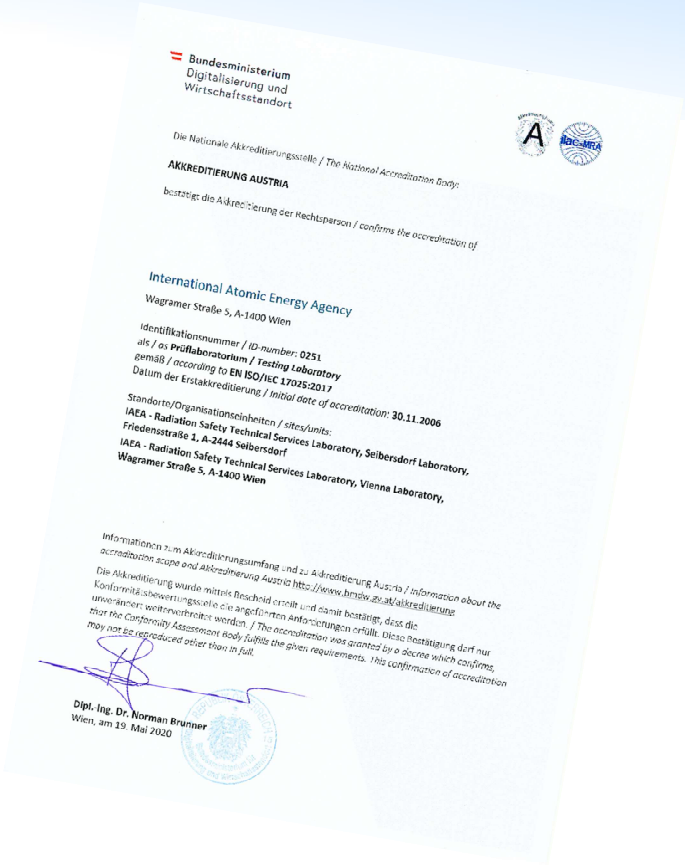
Radiation Safety Technical Services Laboratory

- External and internal individual monitoring for all operations under IAEA control or supervision around the globe
  - 3000 monitored individuals, 45000 external dose measurements
  - Bound to IAEA Radiation Safety and Nuclear Security Regulations implementing requirements of International Basic Safety Standards

Services to events
in 110 countries

Accreditation to EN ISO/IEC 17025:2017

- Formal recognition of laboratory's competence, impartiality and independence
- Regular assessments by internationally recognized accreditation body
  - Ensuring continued compliance with requirements
  - Verifying that standard of operation is maintained
- Scope of accreditation comprises 13 methods in external, internal and workplace monitoring



Bundesministerium
Digitalisierung und
Wirtschaftsstandort

Die Nationale Akkreditierungsstelle / *The National Accreditation Body:*

AKKREDITIERUNG AUSTRIA

bestätigt die Akkreditierung der Rechtsperson / *confirms the accreditation of*

International Atomic Energy Agency
Wagramer Straße 5, A-1400 Wien

Identifikationsnummer / *ID-number:* 0251
als / *as* **Prüflaboratorium / *Testing Laboratory***
gemäß / *according to* **EN ISO/IEC 17025:2017**
Datum der Erstakkreditierung / *Initial date of accreditation:* **30.11.2006**

Standorte/Organisationseinheiten / *sites/units:*
IAEA - Radiation Safety Technical Services Laboratory, Seibersdorf Laboratory,
Friedensstraße 1, A-2444 Seibersdorf
IAEA - Radiation Safety Technical Services Laboratory, Vienna Laboratory,
Wagramer Straße 5, A-1400 Wien

Informationen zum Akkreditierungsumfang und zu Akkreditierung Austria / *Information about the accreditation scope and Akkreditierung Austria* http://www.bmdw.gv.at/akkreditierung

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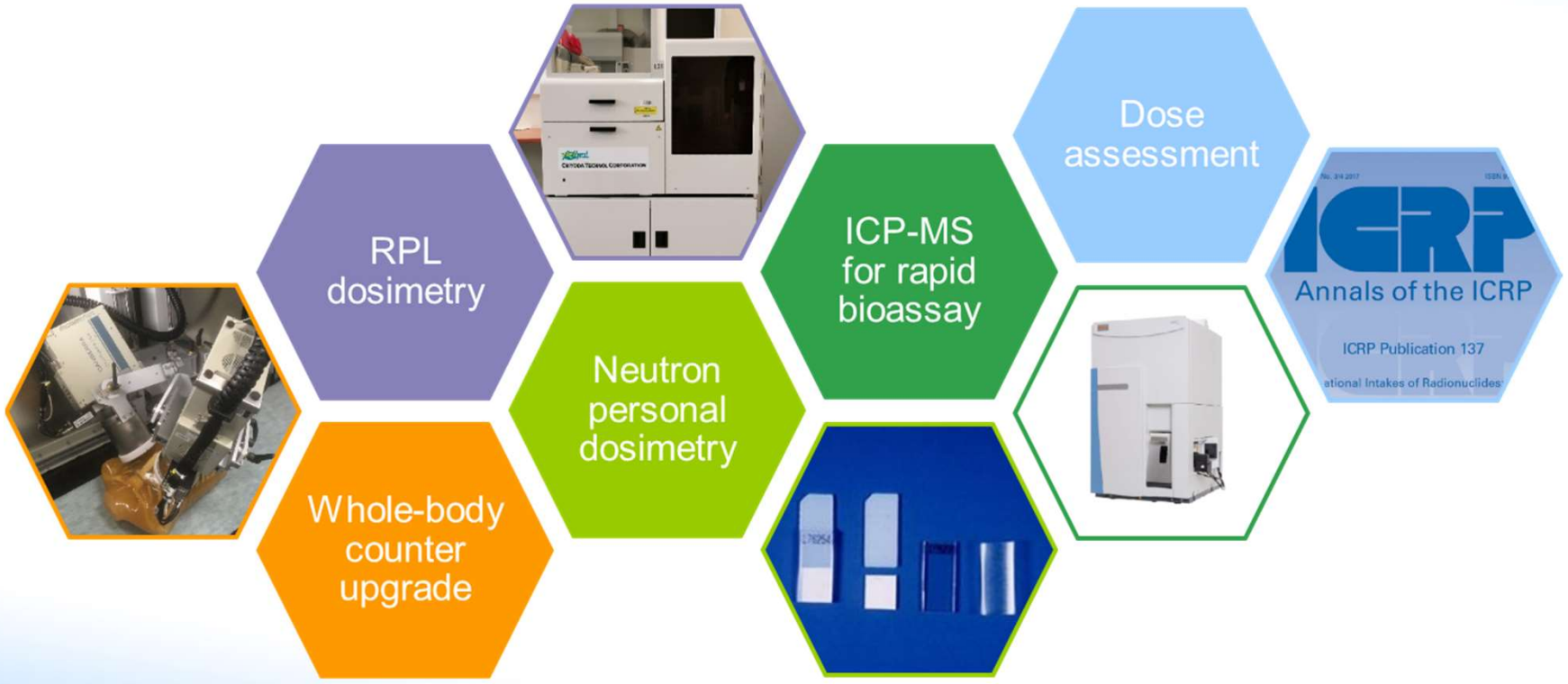
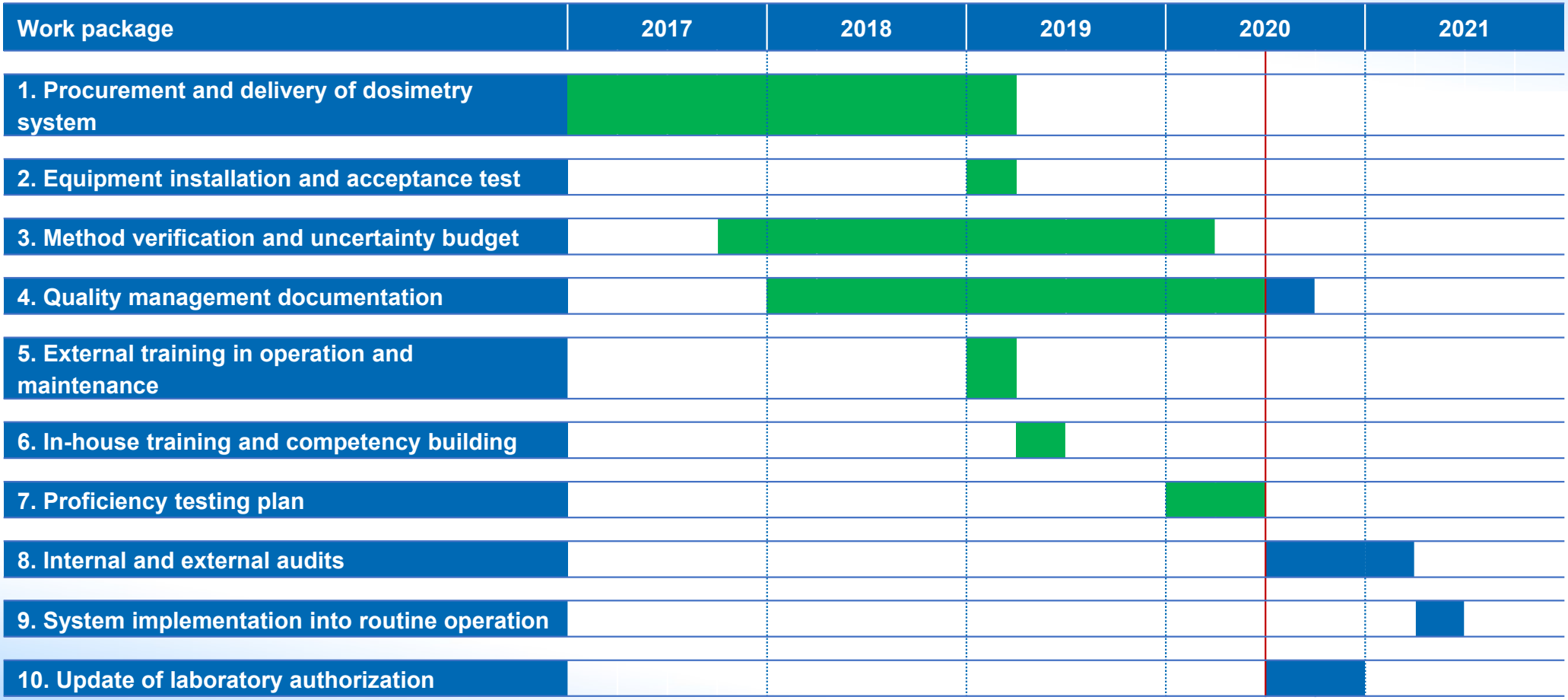
Dipl.-Ing. Dr. Norman Brunner
Wien, am 19. Mai 2020

RADSED Major Capital Investment Project

Enhancing Radiation Safety through Efficient and Modern Dosimetry



Implementation of RPL Dosimetry



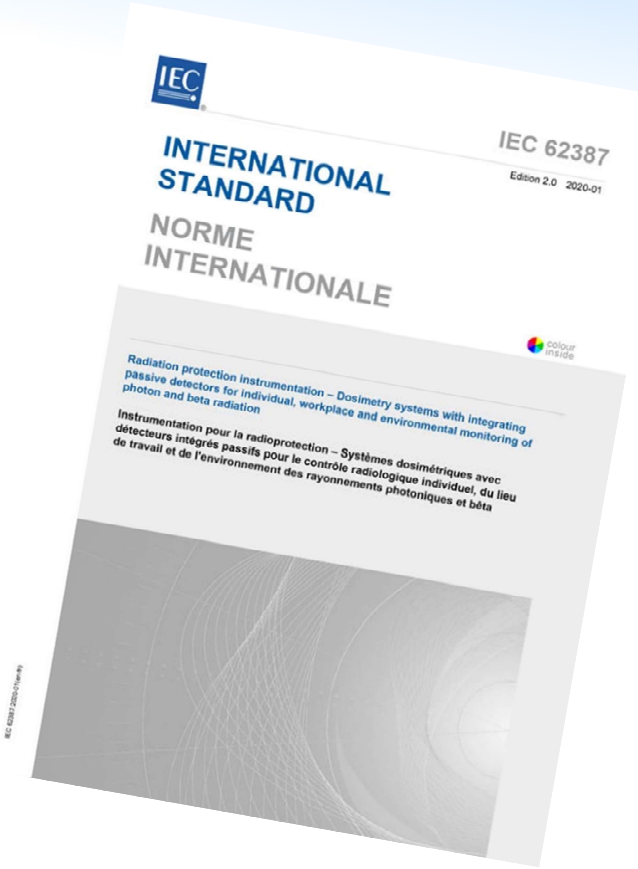
Method Verification

Verification of dosimetric performance properties to IEC 62387:2020

Initially certified at IRSN, France, to previous editions of the standard

- Coefficient of variation
- Non-linearity of response due to dose dependence
- Energy and angular response to betas and photons

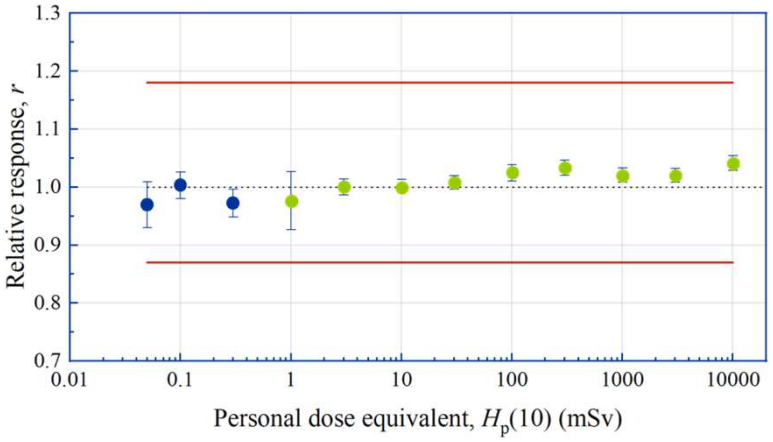
M. Hajek *et al. Radiat. Prot. Dosim.* DOI: 10.1093/rpd/ncaa077 (2020).

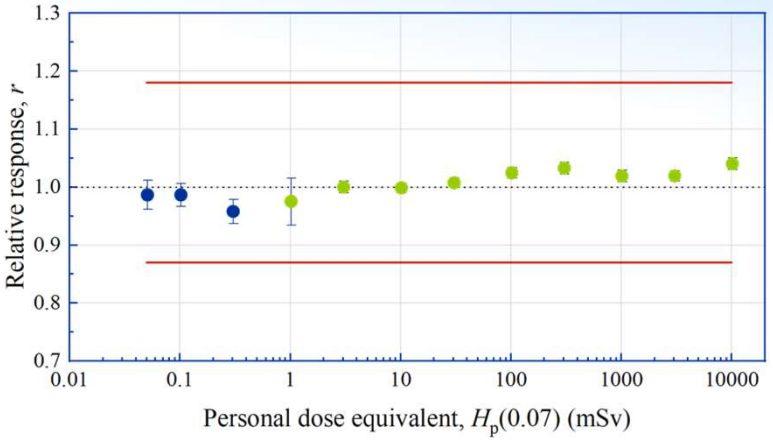


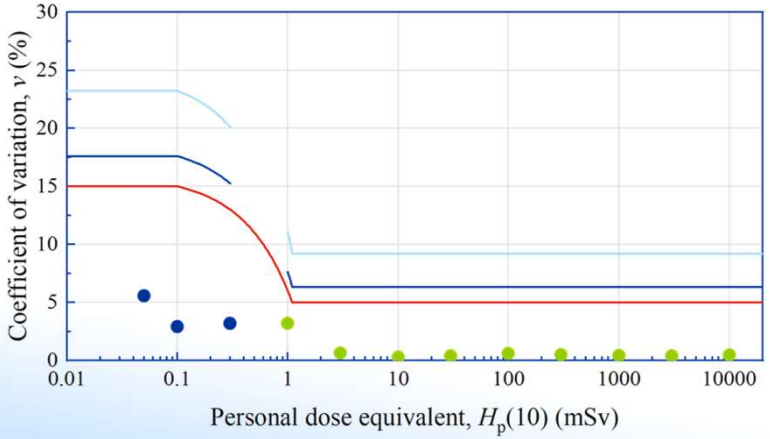
Reference irradiations at accredited SSDLs

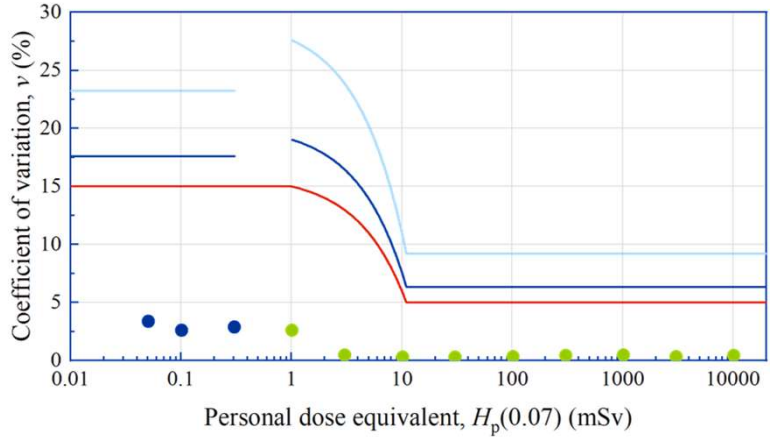
- Seibersdorf Laboratories, Austria
- CIEMAT, Spain

Nonlinearity and Coefficient of Variation

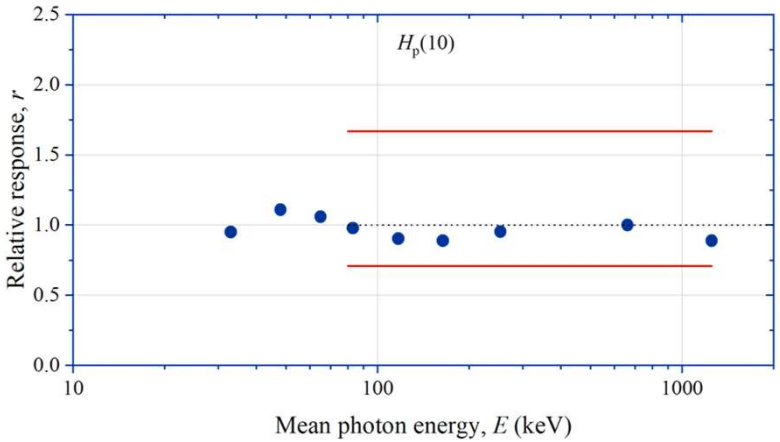


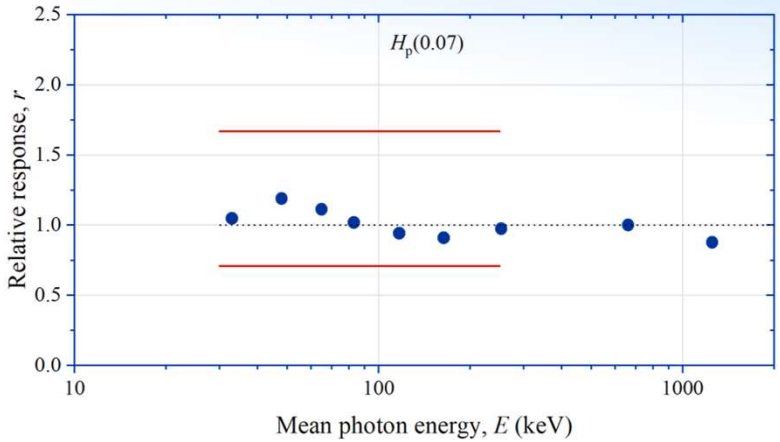




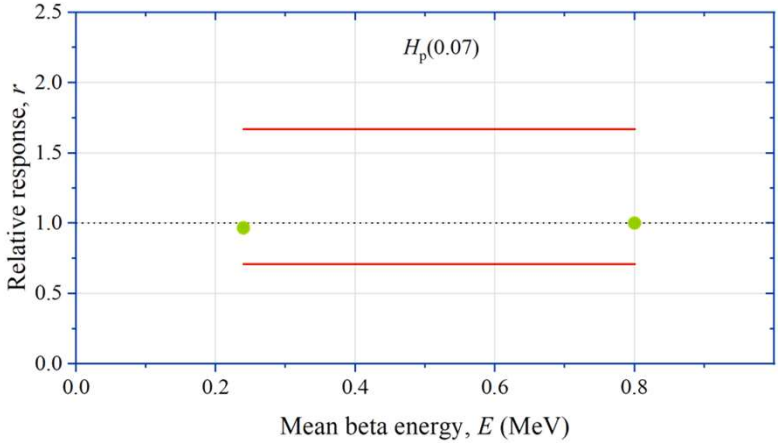


Energy Response

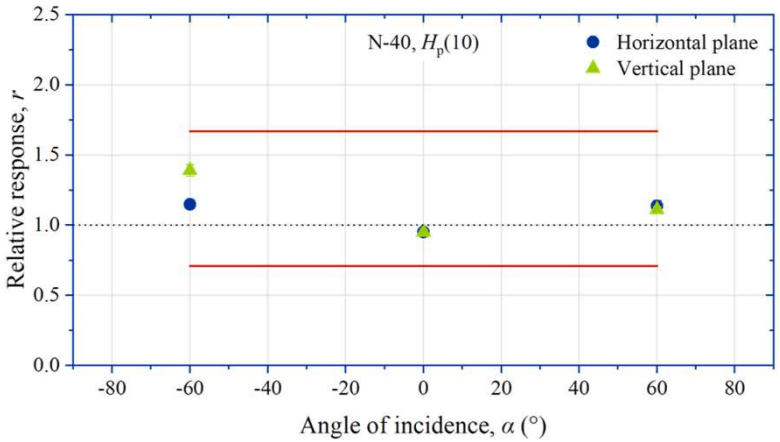


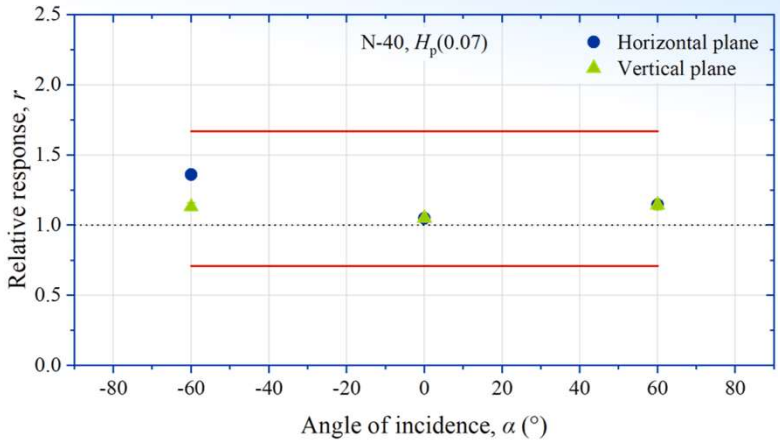


- Photon qualities (~3 mSv, n = 5)
  - N-40, N-60, N-80, N-100, N-150, N-200, N-300, S-Cs, S-Co
- Beta qualities (~10 mSv, n = 8)
  - ^{85}Kr-85, ^{90}Sr/^{90}Y

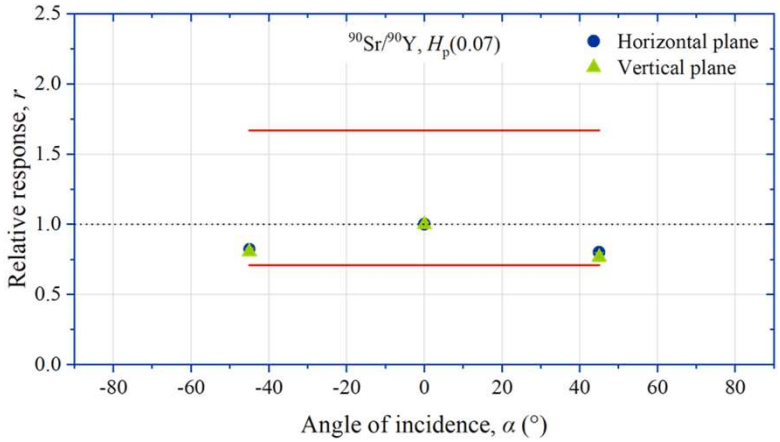


Angular Response





- Photon qualities (~ 3 mSv, *n* = 5)
  - N-40, N-60, N-80

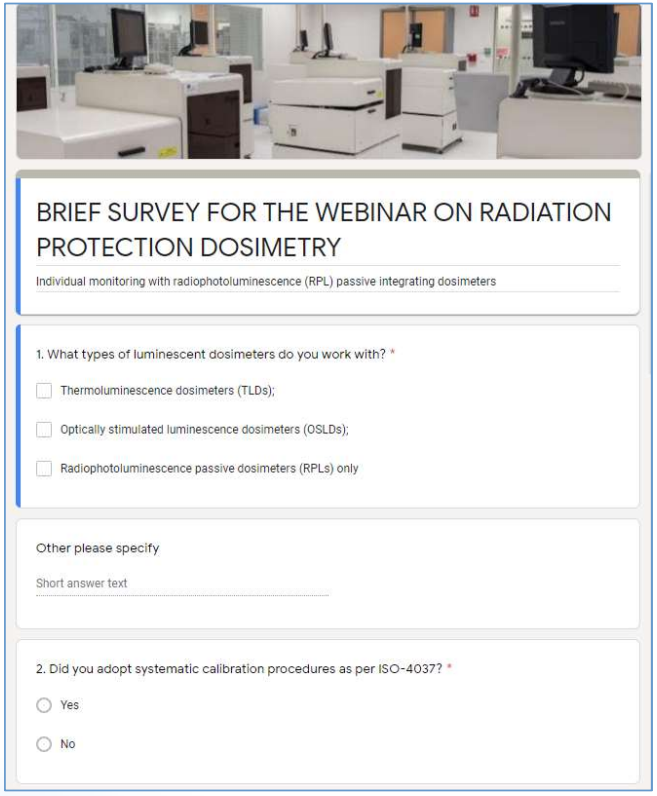


- Beta qualities (~ 10 mSv, *n* = 8)
  - ^{85}Kr-85, ^{90}Sr/^{90}Y

Method Verification

- Extremely fast readout
  - Throughput of 300 dosimeters per hour in compact reader instrument
- Possibility for repeated reads
- Superior response characteristics and wide dose range
- Robustness against fading and environmental temperature

Preliminary assessment of the brief survey results



BRIEF SURVEY FOR THE WEBINAR ON RADIATION PROTECTION DOSIMETRY

Individual monitoring with radiophotoluminescence (RPL) passive integrating dosimeters

1. What types of luminescent dosimeters do you work with? *

- Thermoluminescence dosimeters (TLDs);
- Optically stimulated luminescence dosimeters (OSLDs);
- Radiophotoluminescence passive dosimeters (RPLs) only

Other please specify

Short answer text

2. Did you adopt systematic calibration procedures as per ISO-4037? *

- Yes
- No

- 10 questions to understand the participant's practices with RPL
  - Type of Services
  - Calibration procedures
  - Accreditation
  - Algorithm for dose assessment, etc.

Roman Abutalipov
Associate Radiation Safety Officer

1. What types of luminescent dosimeters do you work with?

- [x] Thermoluminescence dosimeters (TLDs);
- [x] Optically stimulated luminescence dosimeters (OSLDs);
- [ ] Radiophotoluminescence passive dosimeters (RPLs) only

20 %

- [x] Thermoluminescence dosimeters (TLDs);
- [ ] Optically stimulated luminescence dosimeters (OSLDs);
- [x] Radiophotoluminescence passive dosimeters (RPLs) only

6,7 %

- [x] Thermoluminescence dosimeters (TLDs);
- [ ] Optically stimulated luminescence dosimeters (OSLDs);
- [ ] Radiophotoluminescence passive dosimeters (RPLs) only

40 %

- [ ] Thermoluminescence dosimeters (TLDs);
- [ ] Optically stimulated luminescence dosimeters (OSLDs);
- [x] Radiophotoluminescence passive dosimeters (RPLs) only

20 %

- [ ] Thermoluminescence dosimeters (TLDs);
- [x] Optically stimulated luminescence dosimeters (OSLDs);
- [ ] Radiophotoluminescence passive dosimeters (RPLs) only

6,6 %

- [ ] Thermoluminescence dosimeters (TLDs);
- [x] Optically stimulated luminescence dosimeters (OSLDs);
- [x] Radiophotoluminescence passive dosimeters (RPLs) only

6,7 %

2. Did you adopt systematic calibration procedures as per ISO-4037? *

- [x] Yes
- [ ] No

66,7 %

3. Is your service authorized or approved by the respective national regulatory authority? *

- [x] Yes
- [ ] No

80 %

4. Has your service been accredited to internationally accepted management standards such as ISO/IEC 17025? *

- [x] Yes
- [ ] No

73,3 %

5. What type of services do you perform using RPL dosimeters?

- [x] Individual monitoring;
- [ ] Workplace monitoring;
- [ ] Environmental monitoring;
- [ ] In-vivo dosimetry;
- [ ] Emergency dosimetry;
- [ ] Calibration;

26 %

- [x] Individual monitoring;
- [x] Workplace monitoring;
- [x] Environmental monitoring;
- [ ] In-vivo dosimetry;
- [ ] Emergency dosimetry;
- [ ] Calibration;

13 %

- [x] Individual monitoring;
- [x] Workplace monitoring;
- [x] Environmental monitoring;
- [ ] In-vivo dosimetry;
- [ ] Emergency dosimetry;
- [x] Calibration;

13 %

- [x] Individual monitoring;
- [x] Workplace monitoring;
- [x] Environmental monitoring;
- [ ] In-vivo dosimetry;
- [x] Emergency dosimetry;
- [ ] Calibration;

7 %

- [x] Individual monitoring;
- [x] Workplace monitoring;
- [x] Environmental monitoring;
- [ ] In-vivo dosimetry;
- [x] Emergency dosimetry;
- [ ] Calibration;

7 %

- [x] Individual monitoring;
- [x] Workplace monitoring;
- [ ] Environmental monitoring;
- [ ] In-vivo dosimetry;
- [x] Emergency dosimetry;
- [x] Calibration;

7 %

6. For which of the following radiation types are you able to provide a dosimetry service using RPL dosimeters?

- [ ] X-rays;
- [ ] Gamma radiation;
- [ ] Beta radiation;
- [x] All mentioned

66 %

- [x] X-rays;
- [x] Gamma radiation;
- [ ] Beta radiation;
- [ ] All mentioned

20 %

- [ ] X-rays;
- [ ] Gamma radiation;
- [x] Beta radiation;
- [ ] All mentioned

7 %

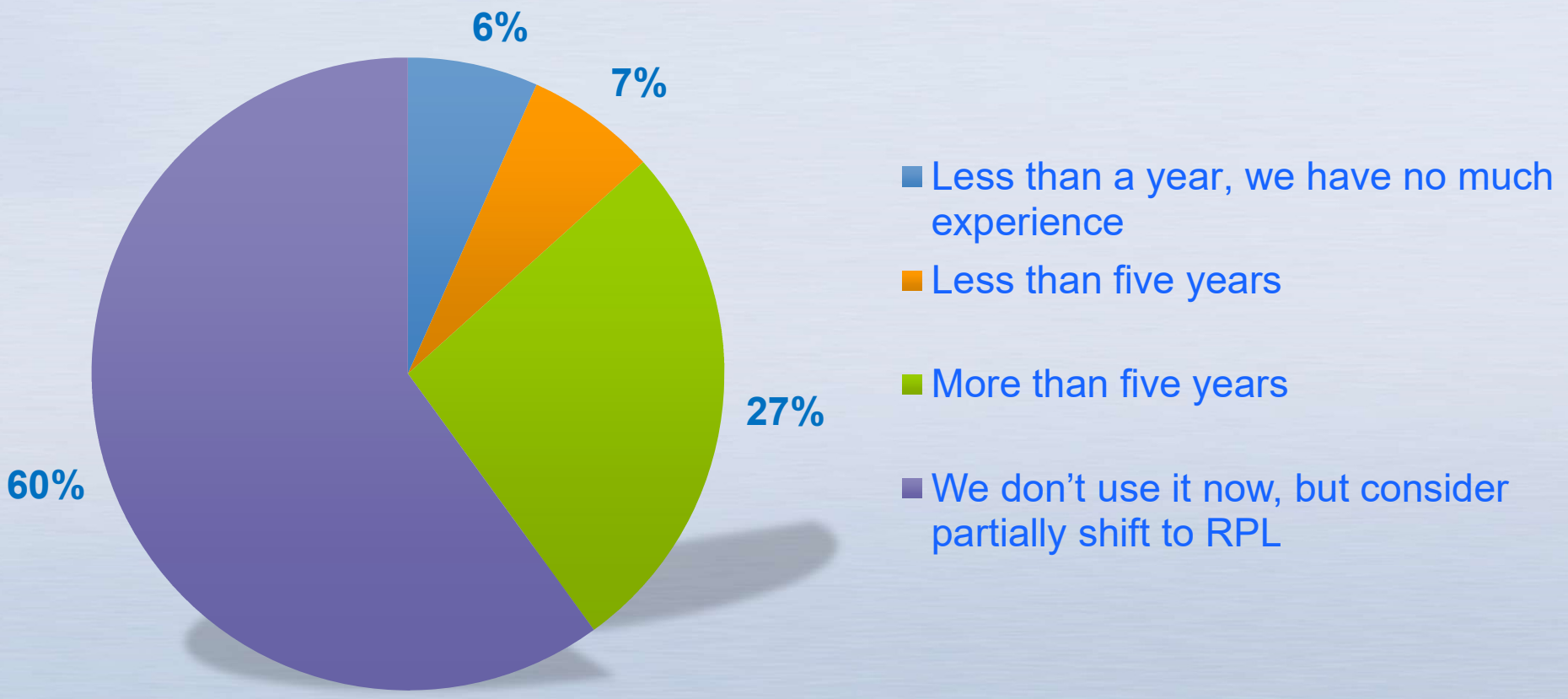
- [ ] X-rays;
- [x] Gamma radiation;
- [ ] Beta radiation;
- [ ] All mentioned

7 %

7. Are all or most of your RPL dosimeters equipped with energy compensator filters?

If yes, do you use any algorithm for dose assessment?

8. For how long has your service been working with RPL dosimeters?



9. What are the monitoring quantities the most commonly used in you practice working with RPL dosimeters?

- [x] Hp(10);
- [ ] Hp(3) of lens of the eyes;
- [ ] Hp (0.07) of hand or finger (extremity)

40 %

- [x] Hp(10);
- [ ] Hp(3) of lens of the eyes;
- [x] Hp (0.07) of hand or finger (extremity)

27 %

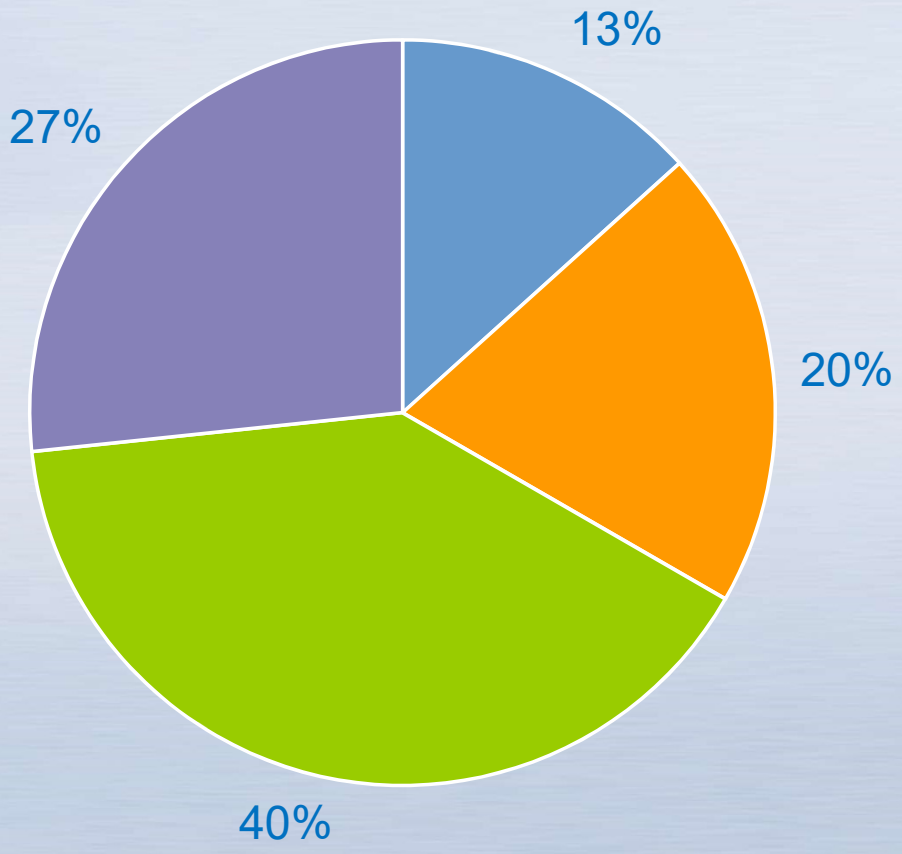
- [x] Hp(10);
- [x] Hp(3) of lens of the eyes;
- [x] Hp (0.07) of hand or finger (extremity)

27 %

- [ ] Hp(10);
- [x] Hp(3) of lens of the eyes;
- [x] Hp (0.07) of hand or finger (extremity)

6 %

10. What disadvantages of RPLD could you emphasize?



Upcoming webinars

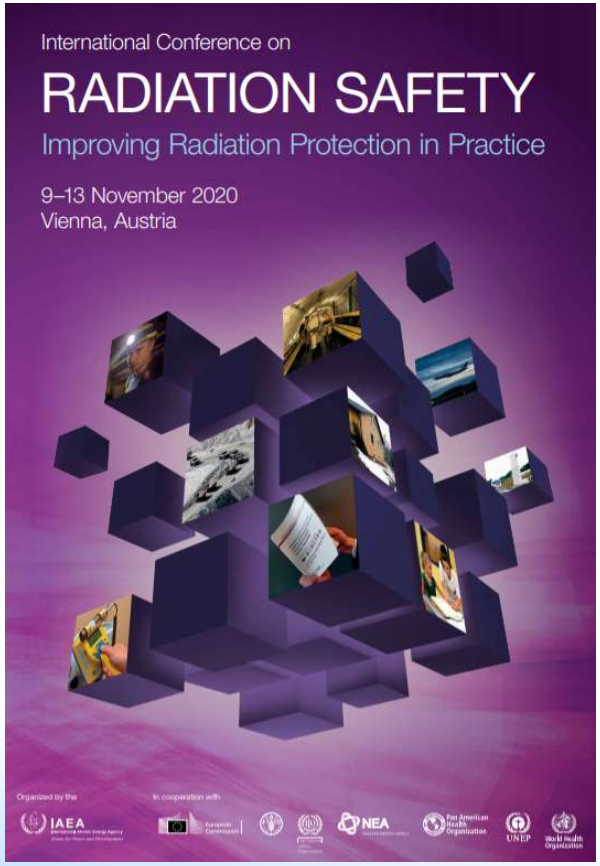
Topics to be addressed;

- Artificial intelligence – with regard to radiation protection of workers and the future of workplace safety (**22 July 2020 at 4 pm CET**)
- Individual monitoring with optically stimulated luminescence passive dosimeters
- Thermoluminescent Dosimeters and maintenance of readers
- Establishment and Operation of Management Systems for TSPs
- Surface contamination monitoring and calibration
- Internal dosimetry – State of the art practices (In-vivo & in-vitro)
- Personal Protective Equipment- Lessons learned from the shortage during the COVID-19 pandemic
- Recognition as a third party and laboratory accreditation – demonstration of fulfilment

Watch the announcements @
ORP webinars web-page: https://www.iaea.org/topics/radiation-safety/webinars

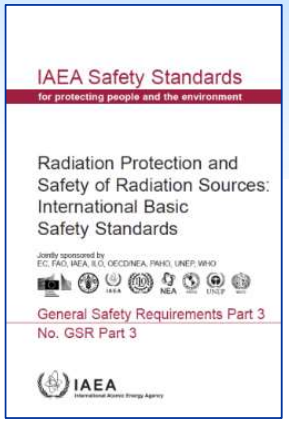
International Conference on Radiation Safety:

Improving Radiation Protection in Practice



Topics

- Challenges with the SRP
- Dose constraints, reference levels, dose limits
- Optimization
- Existing exposure situations
- Dose limit for the lens of the eye
- Implementation challenges
- Radon
- Food and drinking water
- Industrial operations involving NORM
- Aircrew and space crew
- Non-medical human imaging
- Justification of medical exposures
- & others…



KEY DEADLINES:

Electronic submission of synopses through INDICO	**20 January – 15 March 2020**
Submission of Forms A and B through official channel	**1 June 2020**
Notification of acceptance of synopses	**15 July 2020**
Registration only (submission of Form A through official channel)	**No deadline**

https://www.iaea.org/events/international-conference-on-radiation-safety-2020

Register for
ORPNET Newsletter

Thank you for your participation

IAEA ORPNET: https://nucleus.iaea.org/sites/orpnet/home/SitePages/Home.aspx
IAEA ORP Webinars: https://www.iaea.org/topics/radiation-safety/webinars

We invite proposal submissions for consideration in our webinar series
Contact us at Occupational-Protection-Unit.Contact-Point@iaea.org