

Ask EuroSafe Imaging Tips & Tricks IR Working Group

Eye Dose Limits Achieving Regulatory Compliance in Interventional Radiology

Gabriel Bartal MD, Interventional Radiologist, Meir MC, Tel Aviv University, Israel.

Barry Hallinan, Radiographer, Beaumont Hospital, Dublin, Ireland.

Roberto Sanchez, PhD, Medical Physicist, Hospital San Carlos, Madrid, Spain.

Regulations

- ❑ The Council Directive 2013/59/Euratom⁽¹⁾ should, by now, be implemented by the Member States of the European Union
- ❑ Transposition into the national legislation of those individual states should be completed
- ❑ Radiology / Interventional Radiology departments should be familiar with BSS detailed requirement for radiation protection of workers⁽²⁾

Main Messages Of the BSS

- Changes in justification
- Patient information
- Defined Responsibilities – Both for Licensees and Workers
- Dose reporting
- Diagnostic Reference Levels
- Medical Physics Role Clarification
- Lower Eye Dose limits**

Summary of the European Directive 2013/59/Euratom: essentials for Health Professionals in Radiology. European Society of Radiology (3)

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Are we Achieving Compliance?

- A pilot survey on behalf of ESR undertaken in November 2018 suggested a lack of compliance⁽⁴⁾
 - Justification demonstrated the poorest compliance
 - Results achieved **varied in relation to dose limits**, patient information and accidental exposure notification
 - The results however should have far higher compliance with implementation of Diagnostic Reference levels (DRLs)

Becoming Compliant – Interventional Radiology



- ❑ Radiation Protection is a tool for the management of measures to protect health against the risks (for people and environment) generated by the use of ionising radiation

- ❑ Mechanisms / tools include:
 - Establishing Diagnostic Reference Levels (DRL's)
 - Mandatory Clinical Audit
 - Abiding the regulatory **Dose limits**
 - Developing Mechanisms for notification of accidental exposures
 - Education (key in demonstrating the impact of using Personal Protective Equipment)⁽⁵⁾

- ❑ The ESR published a call for action in 2018 to strengthen radiation protection across Europe⁽⁶⁾
- ❑ The key Actions support the implementation of BSS
- ❑ Ask Eurosafe Imaging published further guidelines in 2017 **on Guidance on eye protection in interventional procedures**⁽⁷⁾

BSS Occupational Dose limits adopted from the ICRP

Type of Dose Limit	Limit on Dose from <u>Occupational Exposure</u>
<u>Effective Dose</u>	<p>20 mSv per year, averaged over defined periods of 5 years, with no single year exceeding 50 mSv</p> <p>After a worker declares a pregnancy, the dose to the embryo/fetus should not exceed about 1 mSv during the remainder of the pregnancy</p>
<u>Equivalent Dose</u> to the Lens of the Eye	20 mSv per year, averaged over defined periods of 5 years, with no single year exceeding 50 mSv
<u>Equivalent Dose</u> to the Skin Averaged over 1 cm ² of skin regardless of the area exposed	500 mSv in a year
<u>Equivalent Dose</u> to the Hands and Feet	500 mSv in a year

Becoming Eye Limit Compliant in Interventional Radiology



- Use both ceiling suspended and mobile shields
- Utilisation provides more effective and practical protective measures against radiation induced eye lens opacities
- Minimising scatter that can enter the operator from the side
- Shielding screens reduce dose rate by a factor of between 5 and 25⁽⁸⁾

Becoming Eye Limit Compliant in Interventional Radiology

- Leaded eyeglasses with large lenses and protective side shields provide more protection, therefore are more safe
- Use of lead glasses reduces the lens dose rate by a factor of at least 2.5 – 4.5⁽⁹⁾
- To be used together with ceiling suspended and mobile shields when possible
- Utilisation of both provides more effective protection



Becoming Eye Limit Compliant in Interventional Radiology



- ❑ Disadvantages of wearing Glasses:
 - Weight
 - Discomfort
 - Optical prescriptive requirements
 - Potential fogging that reduces image perception

- ❑ Correct fitting for closeness, non-fogging and comfort should be carried out in all instances

Becoming Eye Limit Compliant in Interventional Radiology



- ❑ Do we need monitoring?
- ❑ Pilot study ⁽⁵⁾ demonstrated only 28.6 % dose limit compliance
- ❑ The use of protective measures
 - ❑ (Screens / Lead glasses / Combination)
- ❑ Should be an absolute requirement for operators carrying out Fluoroscopy or CT guided interventional procedures. ⁽¹⁰⁾

- Monitoring varies amongst institutions
- ***The IAEA*** ^(11,12) ***recommends:***
 - ◆ The wearing of a **standard radiation dosimeter at collar level above** radioprotective garments.
 - ◆ Unprotected eyes receive approximately the dose indicated by such a monitor which **acts as a reasonable eye dose estimate**

Eye Limit Compliance



- ❑ Good Audit is mandatory to capture local practice.
- ❑ A reasonable method of accurate assessment is needed as suggested by the IAEA
- ❑ **Considering the evidence**
 - ❑ **Individual Operator Eye Dose monitoring with a dedicated dosimeter should be carried out** ⁽¹³⁾

References

1. Council Directive 2013/59/EURATOM on basic safety standards for protection against the dangers arising from exposure to ionising radiation, 5 December 2013.
2. [IAEA \(International Atomic Energy Agency\)](https://www.iaea.org/resources/rpop/resources/training-material#10)
<https://www.iaea.org/resources/rpop/resources/training-material#10>.
Accessed 14 June 2019.
3. Summary of the European Directive 2013/59/Euratom: essentials for Health Professionals in Radiology. European Society of Radiology. *Insights Imaging*. ;6(4): 411-417. (2015) DOI 10.1007/s13244-015-0410-4
4. The Current Status of Uptake of European BSS Directive (2013/59/Euratom) Requirements – Results of a Pilot Survey in European Radiology Departments with a Focus on Clinical Audit. European Society of Radiology. *Insights Imaging*. 10:50 (2019).
<https://doi.org/10.1186/s13244-019-0734-6>

References

5. Joeris, Alexander. (2018). Intraoperative Radiation Exposure of Orthopaedic Surgeons – Mismatch Between Concerns and Protection. Occupational Medicine & Health Affairs. 6. 10.4172/2329-6879.1000273.
6. European Society of Radiology (ESR) (2018) EuroSafe Imaging Call For Action. Available at <http://www.myESR.org/media/659> . Accessed 14 Jun 2019.
7. European Society of Radiology (ESR) (2017) Guidance on eye protection in interventional procedures (http://www.eurosafeimaging.org/wp/wp-content/uploads/2015/09/IR-WG_TipsTricks6_final.pdf)
8. [IAEA \(International Atomic Energy Agency\) https://www.iaea.org/resources/rpop/health-professionals/radiology/cataract/staff#11](https://www.iaea.org/resources/rpop/health-professionals/radiology/cataract/staff#11). Accessed 14 June 2019.

References

9. Colin J. Martin. Eye Lens Dosimetry For Fluoroscopically Guided Clinical Procedures: Practical Approaches To Protection and Dose Monitoring. *Radiation Protection Dosimetry*, Volume 169, Issue 1-4, June 2016, Pages 286–291.
10. O'Connor U, Walsh C, Gallagher A, et al. Occupational radiation dose to eyes from interventional radiology procedures in light of the new eye lens dose limit from the International Commission on Radiological Protection. *Br J Radiol*. 2015;88(1049):20140627. doi:10.1259/bjr.20140627
11. [IAEA \(International Atomic Energy Agency\) https://www.iaea.org/resources/rpop/health-professionals/radiology/cataract/staff](https://www.iaea.org/resources/rpop/health-professionals/radiology/cataract/staff). Accessed June 2019.
12. [IAEA \(International Atomic Energy Agency\) https://www.iaea.org/resources/rpop/health-professionals/interventional-procedures/radiation-doses-in-interventional-fluoroscopy#6](https://www.iaea.org/resources/rpop/health-professionals/interventional-procedures/radiation-doses-in-interventional-fluoroscopy#6). Accessed June 2019.

References



13. Betti, Margherita et al. Surgeon eye lens dose monitoring in catheterization lab: A multi-center survey. *Physica Medica: European Journal of Medical Physics*, 2019; Volume 60, 127 – 131.