



Occupational radiation protection for the lens of the eye

To reduce the risk for cataracts in the lens of the eye, the IAEA General Safety Requirement Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (No. GSR Part 3) states that occupational exposure of the lens of the eye should be limited to an equivalent dose limit of 20 mSv per year, averaged over five years, with no annual dose in a single year exceeding 50 mSv. This dose limit is in line with the recommendation in the International Commission on Radiological Protection (ICRP) Publication 103.

Optimizing protection

Appropriate protective actions need to be taken to ensure that doses to the lens of the eye do not exceed the dose limit. Workers potentially at risk include medical specialists operating image guided equipment in interventional cardiology and interventional radiology, medical specialists performing some tasks in nuclear medicine, workers involved in some tasks in the decommissioning of nuclear facilities, workers in nuclear facilities using glove boxes, workers that carry out some tasks in fuel cycle facilities, emergency response workers and industrial radiographers.

As outlined in the General Safety Guide on Occupational Radiation Protection (No. GSG-7), optimizing protection of workers against high doses to the lens of the eye involve:

- Engineered controls such as shielding to reduce exposure of the eyes.
- Administrative controls such as written rules to control exposure in normal operations.
- The use of personal protective equipment such as protective glasses. Glasses made of Perspex or equivalent materials may be sufficient in cases involving beta radiation. Protective glasses containing lead can be used to protect against scattered low energy X rays.
- Information, instruction and training for workers on any changes to the radiation protection program to reduce doses.



When considered necessary, employers should provide workers with dosimeters to measure the dose to the lens of the eye to verify compliance with the dose limit.



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Roles and responsibilities

The GSR Part 3 and GSG-7 define roles and responsibilities:

- ✓ The government is responsible for ensuring the provision of technical services for personal dosimetry related to eye lens dose assessment.
- ✓ The regulatory body is responsible for establishing a dose limit for the lens of the eye and enforcing compliance through monitoring. It should provide guidance on dose assessment methods and the use appropriate protective means.
- ✓ The regulatory body is responsible for establishing and maintaining records of occupational eye lens doses.
- ✓ Employers have the prime responsibility for radiation protection and safety of workers. They should provide information, instruction and training so that workers are aware about risks and know how to protect themselves.
- ✓ Employers are responsible for carrying out safety assessments to identify workers at risk of receiving doses to the lens of the eye that may exceed the dose limit. Such assessments could include identifying the ways in which exposure could arise, estimating potential exposure and redefining protective and safety measures.
- ✓ Workers are responsible for carrying out their duties in a safe manner, including by using protective means in line with the information, instruction and training they have received.

Eye lens dose routine monitoring

The GSR Part 3 and GSG-7 make recommendations on eye lens dose routine monitoring.

- Workers for whom lens of the eyes routine monitoring might be needed:
 - Workers exposed to highly non-uniform radiation fields in which the eyes may be exposed, such as interventional radiologists and cardiologists.
 - Workers exposed to weakly penetrating radiation fields, such beta radiation fields, that produce a significant dose to the lens but a low effective dose.

- The eye lens dose level should be estimated prior to routine monitoring. The results of workplace monitoring, simulations and measurements as well as data from scientific papers could be used to determine whether routine monitoring is needed.
- The most accurate method for monitoring the equivalent dose to the lens of the eye is to measure the personal dose equivalent at 3 mm depth, $H_p(3)$, with a dosimeter worn as close as possible to the eye and calibrated on a phantom representative of the head. In certain circumstances the measurement of $H_p(0.07)$ or sometimes $H_p(10)$ can provide a sufficiently accurate estimate of $H_p(3)$.

Additional resources

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (No. GSR Part 3)

www.iaea.org/publications/8930/radiation-protection-and-safety-of-radiation-sources-international-basic-safety-standards

General Safety Guide on Occupational Radiation Protection (No. GSG-7)

www.iaea.org/publications/11113/occupational-radiation-protection

Radiation Protection and Safety in Medical Uses of Ionizing Radiation (No. SSG-46)

www.iaea.org/publications/11102/radiation-protection-and-safety-in-medical-uses-of-ionizing-radiation

Implications for Occupational Radiation Protection of the New Dose Limit for the Lens of the Eye

www.iaea.org/publications/10628/implications-for-occupational-radiation-protection-of-the-new-dose-limit-for-the-lens-of-the-eye

Occupational Radiation Protection Networks
<https://nucleus.iaea.org/sites/orpnet/home/SitePages/Home.aspx>

Radiation Protection for Workers
www.iaea.org/topics/workers