



## **Regulatory Implementation of the Equivalent Dose Limit for the Lens of the Eye for Occupational Exposure**

**Successes and challenges to the approaches identified through a survey of regulators**



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## COMMITTEE ON RADIOLOGICAL PROTECTION AND PUBLIC HEALTH

The objective of the Committee on Radiological Protection and Public Health (CRPPH) is to assist NEA member countries in the implementation and enhancement of the system of radiological protection. This objective will be met by identifying and effectively addressing those conceptual, scientific, policy, regulatory, operational and societal issues that either favourably or adversely affect the system of radiological protection, thereby promoting national and international good practices and identifying potential weaknesses and vulnerabilities.

To accomplish this, the Committee will contribute to the adoption and the maintenance of high standards of protection for the public, workers and the environment in all activities involving the use of ionising radiations, and particularly, but not limited to the field of nuclear energy.

In this context, the Committee on Radiological Protection and Public Health (CRPPH) shall:

- Provide a forum for the exchange of information and the transfer of experience between national radiological protection authorities on policies, regulatory issues and approaches, and their implementation in the context of realistic radiation exposure conditions, and as appropriate, the risks and regulatory arrangements for other common hazards.
- Seek international understanding and guidance, in support of national authorities, on questions of common concern regarding the interpretation and implementation of the ICRP recommendations and international standards in various fields of application of radiological protection, to contribute to the development of co-ordinated approaches among member countries, and to support the development of new international standards.
- Advance concepts and policies which make the system of radiological protection clear, transparent and adaptable to the broader social dimensions of decision making in complex situations, and further facilitate effective engagement with relevant stakeholders, including their involvement in decision making as appropriate.
- Promote international collaboration on specific radiological protection and radiation-related public health topics of interest to the NEA member countries in the framework of the NEA Strategic Plan.
- Keep under review, contribute to the advancement of, and identify needs for the state of the art in the field of radiological protection at the social-scientific, natural-scientific and technical levels, and promote the preparation of authoritative advice and reference documents, for use by national authorities, policy makers and practitioners, on emerging policy, regulatory and operational issues, and in those areas where international consensus on radiological protection concepts, regulatory issues and practices is sought.
- Help ensure the management of radiological protection knowledge and experience between generations of radiological protection experts.
- Actively interact with the International Commission on Radiological Protection (ICRP) to help link national policy and regulatory needs to the development of international recommendations.

In the fulfilment of its mandate, the CRPPH will work in close co-operation with other NEA Committees as appropriate, particularly the Committee on Nuclear Regulatory Activities (CNRA), the Radioactive Waste Management Committee (RWMC), and the Nuclear Law Committee (NLC), as well as with NEA divisions, and competent bodies within relevant OECD directorates and other international organisations active in the field.

## Foreword

The goal of the Nuclear Energy Agency (NEA) Committee on Radiological Protection and Public Health (CRPPH) is to assist member countries in identifying critical and emerging issues in radiological protection, analysing their possible implications for practices and regulation, and contributing to the development of approaches for their resolution.

The NEA Expert Group on the Dose Limit for the Lens of the Eye (EGDLE) was created by the CRPPH with the objective of providing an opportunity for regulators and stakeholders to share lessons learnt in the practical implementation of the International Commission on Radiological Protection's (ICRP's) recommended equivalent dose limit for the lens of the eye for occupational exposures. To this end, the EGDLE supports the CRPPH mandate, in promoting international collaboration on specific radiological protection and radiation-related public health topics of interest to the NEA member countries.

This report summarises the practical experiences of regulators and stakeholders worldwide in implementing equivalent dose limit for the lens of the eye for occupational exposure, including successes and challenges to the approaches. The EGDLE also intends to set up a dedicated network to maintain dialogue and information exchange.

To facilitate the development of the report and help establish a network for continued dialogue and information exchange, a survey was sent to NEA member countries targeting regulators of nuclear, medical and non-nuclear applications. The survey covered: the current status of regulatory dose limits for the lens of the eye, successes in stakeholder engagement, including approaches taken by regulators to ensure positive interactions with stakeholders, accreditation and approval processes for eye dosimetry, and challenges in the practical implementation of new lens of the eye dose limits and actions taken to address these challenges.

This report summarises the analysis of the anonymised EGDLE survey responses and provides insights into opportunities for future work and collaboration.

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## Acknowledgements

This report was prepared by the Nuclear Energy Agency (NEA) Expert Group on the Dose Limit for the Lens of the Eye (EGDLE) held under the Committee on Radiological Protection and Public Health (CRPPH). The NEA would like to express its appreciation to the members of the EGDLE for their involvement and contributions to ensure the successful fulfilment of the EGDLE mandate. In particular, it would like to recognise the efforts of Christina Dodkin (Canada), Chair, and Marie-Claire Cantone (Italy), Vice-Chair, in addition to the expert members of the EGDLE: Andres Rossini (Argentina), Marie-Anne Chevallier (France), Uwe Oeh (Germany), David Pollard (Ireland), Sumi Yokoyama (Japan), Maria Dolorès Rueda Guerrero (Spain), Giuseppe Testa (Switzerland), Luana Hafner (Switzerland), Vaughan Rees (United Kingdom) and James Dillard (United States).

The work of the EGDLE report was supported by the great efforts of Dr Jacqueline Garnier-Laplace, Deputy Head of the Division of Radiological Protection and Human Aspects of Nuclear safety, which acts as the NEA EGDLE Secretariat, as well as Jan-Hendrik Kruse, Junior Radiological Protection Specialist in the same division.

In addition to these individuals, many thanks are due to the representatives from the following countries who completed the EGDLE questionnaire: Argentina, Canada, the Czech Republic, Finland, France, Germany, Greece, Iceland, Japan, Norway, Russia, Spain, Switzerland, the United Kingdom and the United States.

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## List of abbreviations and acronyms

BSS	Basic Safety Standards
CRPPH	Committee on Radiological Protection and Public Health (NEA)
DTO	Tritiated heavy water
EGDLE	Expert Group on the Dose Limit to the Lens of the Eye (NEA)
EURADOS	European Radiation Dosimetry Group
FMBA	Federal Medical-Biological Agency (Russia)
ICRP	International Commission on Radiological Protection
IAEA	International Atomic Energy Agency
IEC	International Electrotechnical Commission
IRPA	International Radiation Protection Association
IRSN	Institut de Radioprotection et de Sûreté Nucléaire (Institute for Radiological Protection and Nuclear Safety, France)
ISO	International Organization for Standardization
NEA	Nuclear Energy Agency
NORM	Naturally Occurring Radioactive Material
OSL	Optically stimulated luminescence
OSLD	Optically stimulated luminescence dosimeter
PTB	Physikalisch-Technisches Bundesanstalt (the national metrology institute of Germany)
RELID	Retrospective Evaluation of Lens Injuries and Dose
TENORM	Technically Enhanced Naturally Occurring Radioactive Material
TSO	Technical and Scientific Support Organisation
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
US NRC	United States Nuclear Regulatory Commission

## Executive summary

The lens of the eye is one of the body's most radiosensitive tissues. Opacification of the lens, known as a cataract in advanced stages, may be radiation-induced or related to other factors such as age, smoking, or obesity, and can lead to vision impairment and even blindness. To prevent the occurrence of ionising radiation-induced cataracts, regulatory bodies worldwide set equivalent dose limits for the lens of the eye for workers and members of the public.

Several studies have suggested that the development of cataracts may occur following exposure to significantly lower doses of ionising radiation than previously considered. Given this evidence, on 21 April 2011, the International Commission on Radiological Protection (ICRP) issued a formal statement indicating that tissue reactions for the lens of the eye have dose thresholds that are, or might be, lower than previously considered. Related recommendations were issued one year later in Publication 118 (ICRP, 2012).

The Nuclear Energy Agency (NEA) Expert Group on the Dose Limit for the Lens of the Eye (EGDLE) was created by the Committee on Radiological Protection and Public Health (CRPPH) with the objective of providing an opportunity for regulators and stakeholders to share lessons learnt, both successes and challenges, in the practical implementation of the ICRP's recommended equivalent dose limit for the lens of the eye for occupational exposures.

The deliverables of the EGDLE include:

- a report which summarises the practical experiences of regulators and stakeholders worldwide in implementing the ICRP's recommended equivalent dose limit for the lens of the eye for occupational exposure, including successes and challenges to the approaches;
- a network to maintain dialogue and information exchange.

To help fulfil its mandate, the EDGLE developed a survey to gather information from NEA member countries' regulatory bodies and Technical and Scientific Support Organisations (TSO) on the implementation of the ICRP's recommended equivalent dose limit for the lens of the eye for occupational exposures. A total of 24 organisations from 15 countries (50% of the NEA CRPPH country membership) provided responses to the survey. The responding organisations represented 18 regulatory bodies and 3 TSOs. In addition, 3 nuclear fuel cycle facilities in one country proactively provided responses, complementing those of the regulatory body.

It is clear that the countries that responded to the survey have been active in various initiatives in responding to the latest scientific information regarding tissue reactions for the lens of the eye, and to the need for revising their respective dose limits for the lens of the eye. Regulators recognised the importance of early engagement with stakeholders while considering revisions to legislation. In this context, stakeholders include: regulated entities and licensees, advisory bodies, unions, professional organisations, and professional societies and associations. Countries also recognised the importance of continued stakeholder engagement in order to advance and promote the resolution of issues and continuous improvements in monitoring and ascertaining doses to the lens of the eyes.

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Some practical challenges remain, though most countries are making progress in addressing them in consultation with stakeholders. There is a consensus among responding regulatory organisations on the value of guidance provided by international entities such as the International Atomic Energy Agency (IAEA) and the International Radiation Protection Association (IRPA).

Responding countries identified areas where they could benefit from sharing experiences and from a possible harmonisation in approach. They include:

- Requirements for individual monitoring, and consensus on the use of eye lens dosimeters measuring personal dose equivalent  $H_p(3)$ .
- Eye lens dosimetry, with the use of ISO and IEC standards to define accreditation and technical/performance specifications for  $H_p(3)$  eye lens dosimeters. Issues such as beta and neutron radiations, and mixed radiation fields (beta/photons), and inter-comparisons, need to be addressed.
- Dosimeter placement and taking account of personal protective equipment.
- Acceptability of the use of surrogate dosimeters and correction factors.

All the respondent countries identified opportunities for continued dialogue and information exchanges in international fora, especially in the above-mentioned areas, where international harmonisation would be beneficial. They also identified areas of research that could contribute to advances in radiological protection aspects for the eye, in addition to improvements in eye lens dosimetry.