Opinion of the

Group of Experts referred to in Article 31 of the Euratom Treaty

on

Estimation of effective and equivalent doses and related

Dose coefficients for occupational exposure from intakes of radionuclides

(Adopted unanimously by the Group Experts referred to in Article 31 of the Euratom Treaty at the meeting held on 28 June 2023)

The Commission has invited the *Group of Experts referred to in Article 31 of the Euratom Treaty* (*Group of Experts*) to examine the scientific developments regarding updated values, relationships, and dose coefficients since 2007, as presented by the International Commission on Radiological Protection (ICRP) in its series on Occupational Intakes of Radionuclides, and to advise the Commission on the future use of these values, relationships, and dose coefficients, in the form of an Opinion.[1]

The *Group of Experts* notes that Council Directive 2013/59/Euratom[2] – the Basic Safety Standards (BSS) Directive – requires that for the estimation of effective and equivalent doses, **appropriate standard values and relationships** shall be used[3]. The calculation of doses from measurable quantities relies on scientifically established values and relationships[4]. Recommendations for such values and relationships have been published by the ICRP, taking account of scientific progress.

The *Group of Experts* recognises that while at the time of publication of the BSS Directive in 2014, ICRP had already published dose conversion coefficients for **external exposure** (in ICRP Publication 116)[5] that followed the methodology lined out in ICRP Publication 103, dose coefficients for **internal exposure** based on ICRP Publication 103 were still to be developed and published by ICRP.

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[1] Summary Report of the Meeting of the Group of Experts established under Article 31 of the Euratom Treaty. Luxembourg, 29-30 November 2022.

[2] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, Official Journal of the European Union OJ L13, 17.1.2014, p. 1 – 73

[3] Council Directive 2013/59/Euratom Article 13 ("Estimation of the effective and equivalent dose"): "For the estimation of effective and equivalent doses, the appropriate standard values and relationships shall be used (...)" and Article 4 (96) "standard values and relationships" means values and relationships recommended in chapters 4 and 5 of ICRP Publication 116 for the estimation of doses from external exposure and chapter 1 of ICRP Publication 119 for the estimation of doses from internal exposure, including updates approved by Member States. Member State may approve the use of specific methods in specified cases relating to the physico-chemical properties of the radionuclide or other features of the exposure situation or of the exposed individual;".

[4] Council Directive 2013/59/Euratom Recital (9): "Calculation of doses from measurable quantities should rely on scientifically established values and relationships. Recommendations for such dose coefficients have been published and updated by ICRP, taking scientific progress into account. A collection of dose coefficients based on its earlier recommendations in ICRP Publication 60, is available as ICRP Publication 119. However, in ICRP Publication 103, a new methodology was introduced by ICRP to calculate doses based on the latest knowledge on radiation risks, and this should, where possible, be taken into account in this Directive".

[5] In 2020, ICRP Publication 116 has been complemented by ICRP Publication 144 on *Dose Coefficients for External Exposures to Environmental Sources*, which provides radionuclide-specific and age-dependent organ and effective dose rate

The *Group of Experts* further notes that, in 2022, ICRP completed its series of Publications on ***Occupational Intakes of Radionuclides: Part 1-5***[6] offering now an ***updated set of dose coefficients for occupational exposure from intakes of radionuclides*** covering the most commonly used radionuclides. These dose coefficients have been calculated on the basis of the biokinetic models implemented in this series in respect to the ICRP revised Human Respiratory Tract Model and reference Human Alimentary Tract Model (ICRP 130, 2015) and are also based on latest scientific developments, namely: revised radioactive decay data (ICRP 107, 2008), reference phantoms based on reference adult model (ICRP 110, 2009), new data on skeletal dosimetry (ICRP 116, 2010), new concept of dose per activity content in a given organ and revised systemic biokinetic and skeletal dosimetry models (ICRP 130, 2015), as well as the latest recommendations of ICRP 103 (2007) in respect of weighting factors and the way the effective dose is calculated.

A new approach for radon evaluation and related management has been adopted by ICRP using a dosimetric approach to derive dose coefficients, replacing the previously used epidemiological approach deriving conversion coefficients (ICRP 115, 2010, ICRP 126, 2014). ICRP considers that there is "*a remarkable consistency between radon dose coefficients obtained by dosimetric calculations and conversion coefficients based on epidemiological comparisons. Noting that inhaled ^{222}Rn and progeny is a special case for which there is good epidemiology as well as dosimetry, and taking account of the two methods of calculation of dose coefficients with their associated uncertainties*", ICRP recommends rounded dose coefficients for radon (ICRP 137, 2017).

The *Group of Experts* considers the now available set of ICRP publications relevant for the estimation of effective and equivalent dose for occupational exposure to be scientifically sound and based on the latest scientific knowledge. The set of ICRP Publications on Occupational Intakes of Radionuclides: Part 1-5 (ICRP Publications 130, 134, 137, 141 and 151) is unique at an international level and reflects the state of the art in dose coefficients for occupational intakes of radionuclides, considering both the advanced methodology and its application to an extensive number of radionuclides.

The *Group of Experts* is of the opinion that the series of ICRP Publications on Occupational Intakes of Radionuclides: Part 1-5 (ICRP Publications 130, 134, 137, 141 and 151), and all the dose coefficients therein, should be used in the estimation of the effective dose and equivalent dose for the purpose of the BSS Directive.

The *Group of Experts* recognises that these revised ICRP Publications include changes in methodology and dose coefficients for some radionuclides, such as for radon, that may pose challenges in their implementation into practice meriting further discussions and exchanges of experience on these challenges.

The *Group of Experts* further notes that ICRP is currently preparing publications on age-dependent dose coefficients for members of the public for intakes of radionuclides by inhalation and ingestion.

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coefficients for the assessment of external exposure of members of the public exposed to radionuclides present in the environment, for the most probable exposure scenarios of ground exposure, air submersion and water immersion."

[6] ICRP Publication 130 (2015), 134 (2016), 137 (2017), 141 (2019), 151 (2022).

The *Group of Experts* considers that it is necessary to continue to closely follow scientific developments which may be of relevance to the estimation of effective and equivalent doses.

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Chair of the Group of Experts

28 June 2023

Annex: Relevant recent publications of the International Commission on Radiological Protection (ICRP)

Publication
ICRP *Publication 103* The 2007 Recommendations of the International Commission on Radiological Protection. Ann. ICRP **37**(2-4), 2007.
ICRP *Publication 107* Nuclear Decay Data for Dosimetric Calculations. Ann. ICRP **38**(3), 2008.
ICRP *Publication 110* Adult Reference Computational Phantoms. Ann. ICRP **39**(2), 2009.
ICRP Publication 115, Lung Cancer Risk from Radon and Progeny and Statement on Radon, Ann. ICRP **40**(1), 2010.
ICRP *Publication 116* Conversion Coefficients for Radiological Protection Quantities for External Radiation Exposures. Ann. ICRP **40**(2-5), 2010.
ICRP *Publication 126* Radiological Protection against Radon Exposure. Ann. ICRP **43**(3), 2014
ICRP *Publication 130* Occupational Intakes of Radionuclides: Part 1. Ann. ICRP **44**(2), 2015.
ICRP *Publication 133* The ICRP Computational Framework for Internal Dose Assessment for Reference Adults: Specific Absorbed Fractions. Ann. ICRP **45**(2), 2016.
ICRP *Publication 134* Occupational Intakes of Radionuclides: Part 2. Ann. ICRP **45**(3/4), 2016.
ICRP *Publication 137* Occupational Intakes of Radionuclides: Part 3. Ann. ICRP **46**(3/4), 2017.
ICRP *Publication 141* Occupational Intakes of Radionuclides: Part 4. Ann ICRP **48**(2-3), 2019.
ICRP *Publication 144* Dose Coefficients for External Exposures to Environmental Sources. Ann ICRP **49**(2), 2020
ICRP *Publication 145* Adult mesh-type reference computational phantoms. Ann. ICRP **49**(3) 2020.
ICRP *Publication 151* Occupational Intakes of Radionuclides: Part 5. Ann. ICRP **51**(1–2), 2022.