TASK GROUP 91
Radiation Risk Inference at Low-dose and Low-dose Rate Exposure for RP Purposes

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Objectives

The Task Group will review the currently available information on the estimation of risk coefficients and recommend:

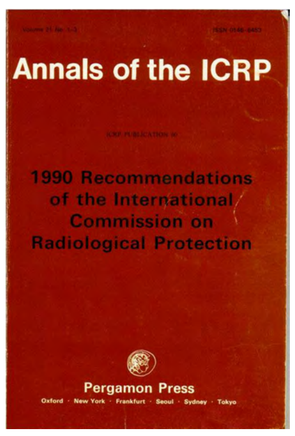
1. Whether it is desirable to continue to estimate risk at low doses by assessing the slope of the dose response at high doses and then applying a DDREF reduction factor. The alternative is to adopt the UNSCEAR approach of inferring the risk coefficients at low doses by using all available information and techniques of Bayesian analysis for estimating the best expert judgment.
2. Whether such coefficients are applicable to acute, protracted and prolonged exposure or need a particular correction.

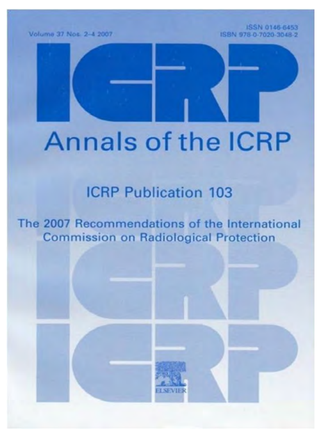
The Task Group will thereafter develop a report for publication in the Annals of the ICRP that presents a review of the current science relevant to the estimation of risk at low doses and dose rates, and provide recommendations on how this risk should be estimated for radiological protection purposes.

Previous Work by ICRP

In Publication 60, the International Commission of Radiological Protection (ICRP) introduced the dose and dose rate effectiveness factor (DDREF) with a numerical value of 2 to be used in radiological protection when inferring health risks at low doses and low dose-rates from risks from higher doses and dose rates.

In 2007, the Commission confirmed this approach in Publication 103.





The Work of TG 91

TG 91 has recently completed a comprehensive review of the currently available information on the radiation risk at low doses and low-dose rates, including the history of low-dose and low-dose-rate effects, various exposure scenarios and their doses and dose rates, radiation-induced effects at the molecular, cellular, animal, and human level, and biologically-based mechanistic models of carcinogenesis. The Task Group performed a meta-analysis of low-dose-rate epidemiological studies, and re-analyses of published results on radiation-induced effects among animal models and among Japanese atomic bomb survivors. This paper provides an overview on selected scientific publications prepared by the TG on these topics. Relevant publications where TG91 members were involved include:

Haley et al. (2015) Animal mortality risk increase following low-LET radiation exposure is not linear-quadratic with dose. PLOS One, 10(12)

Rühm et al. (2016) Dose-rate effects in radiation biology and radiation protection. Proceedings of the Third International Symposium on the System of Radiological Protection. Ann. ICRP 45(1S)

Rühm et al. (2017) Biologically based mechanistic models of radiation-related carcinogenesis applied to epidemiological data. Int J Radiat Biol 93(10), 1093-1117

Shore et al. (2017) Risk of solid cancer in low dose-rate radiation epidemiological studies and the dose-rate effectiveness factor. Int J Radiat Biol 93(10), 1064-1078

Tran and Little (2017) Dose and dose rate extrapolation factors for malignant and non-malignant health endpoints after exposure to gamma and neutron radiation. Radiat Environ Biophys 56(4), 299-328

Rühm et al. (2018) Typical doses and dose rates in studies pertinent to radiation risk inference at low doses and low dose rates. J Radiat Res 59(S2)

Wakeford et al. (2019) The Dose and dose-rate effectiveness factor (DDREF). Health Phys 116(1), 96-99

Little et al. (2020) Lifetime mortality risk from cancer and circulatory disease predicted from the Japanese atomic bomb survivor Life Span Study data taking account of dose measurement error. Rad Res 194(3), 259-276

Little et al. (2021) Methodological improvements to meta-analysis of low dose rate studies and derivation of dose and dose-rate effectiveness factors. Radiat Environ Biophys 60:485–491

Walsh et al. (2021) On the choice of methodology for evaluating dose-rate effects on radiation-related cancer risks. Radiat Environ Biophys 60:493–500

Little et al. (2021) Response to “On the choice of methodology for evaluating dose-rate effects on radiation-related cancer risks” by Walsh et al. Radiat Environ Biophys 60:515–516

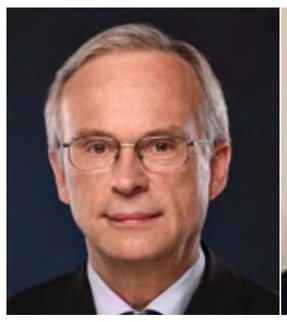
Walsh et al. (2021) Reply and explanation to Little et al. “Response to: On the choice of methodology for evaluating dose-rate effects on radiation-related cancer risks”. Radiat Environ Biophys 60:517–518

Rühm et al. (2022) Cancer risk following low doses of ionising radiation – Current epidemiological evidence and implications for radiological protection. Mut Res 873 (2022) 503436

Lowe et al. (2022) Radiation dose rate effects: what is new and what is needed? Radiat Environ Biophys 61:507–543

TG 91 has now written a comprehensive report based on this review, to be submitted to ICRP’s Main Commission for approval.

Task Group 91 Membership



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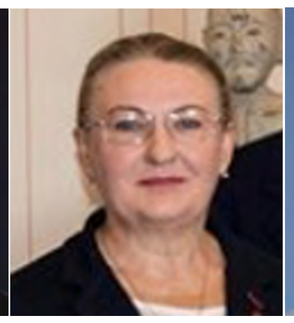

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