



# Programme and Book of Abstracts



# ERPW2023

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## ***ProZES – leukemia risk models for occupational exposures***

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**Purpose:** The software ProZES is one tool used in Germany in compensation claims for possibly radiation-induced cancer due to occupational exposure. Since individual association between cancer and radiation cannot be established from tumor tissue, the program estimates the probability of causation/assigned share from radioepidemiological data. Leukemia risk shows highly complex age and dose dependencies. Prior existing risk models did not provide feasible estimates for all ranges of occupational exposure scenarios. Therefore, robust new leukemia risk models were developed.

**Materials and Methods:** The leukemia risk models comprise five four groups (ALL, CML, AML and, lymphoma, and multiple myeloma). Risk models with different age and dose dependencies were derived from? fitted to the LSS cohort of the atomic bomb survivors. The resulting risk models were combined using the method of multi-model inference (MMI) where each model was weighted according to its goodness of fit. Uncertainties were estimated by Monte Carlo simulation and include model uncertainty.

**Results:** CML has very strong temporal dependencies, and a single risk model was not able to predict reasonable estimates for the whole age range. A combination of three CML models with different age dependencies was found to show plausible estimates for all exposure scenarios. MMI was also used for lymphoma where epidemiological data showed a biologically implausible difference between male and female risk. The dose response of AML and ALL was non-linear. To avoid underestimation of risk for protracted exposures, additional linear 'twin' models were introduced and combined by MMI with the non-linear models. The multiple myeloma model was linear in dose without age dependencies.

**Conclusions:** Risk estimates for the new leukemia models were shown to be plausible for all possible occupational exposure scenarios, and were implemented in the ProZES software for calculation of the assigned share. It is planned to further advance ProZES with new epidemiological data and methodological developments.

## ***GuideRadPROS: Updating the basis of radiation protection dosimetry by harmonization, update and implementation of standards***

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**Purpose:** The recent update of the ISO 4037, in conjunction with the new radiation protection quantities introduced in ICRU Report 95, present significant challenges to calibration laboratories and industry. Furthermore, there is a need to address gaps and conflicts between standards that set requirements for photon dosimeters, and to incorporate upcoming and new technologies into standardization.

**Materials and Methods:** The European Partnership Project 23NRM07 GuideRadPROS started in June 2023 and will address these issues in the next three years. The objectives are:

- to develop harmonized X-ray spectrometry in accordance with the ISO 4037 standard series, evaluate discrepancies between measured and calculated half value layer of X-ray spectra, and produce data to update requirements for reference X-ray fields.
- to develop guidance for the calibration of dosimeters.
- to produce guidance on validated procedures for harmonized type testing based on IEC standards.
- to assess future standardization needs and to produce a guidance document for the implementation of the new operational quantities of ICRU Report 95 into standards and regulations.
- to collaborate with ISO and IEC and users of their dosimetry standards to ensure that project outputs align with their needs.

**Results:** The outcome of this project will lead to improved and comparable procedures in calibration and type testing within Europe. Furthermore, the evaluation of the impact of the ICRU Report 95 quantities will allow for an informed realization of calibration fields.

**Conclusions:** GuideRadPROS will improve the confidence in radiation protection dosimetry, both via the promotion of the implementation of the ISO 4037 standard series, and via the assessment of the impact of the ICRU Report 95 operational quantities on daily measurements in radiation protection.

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