



## NCRP Report No. 186: Approaches for Integrating Information from Radiation Biology and Epidemiology to Enhance Low-Dose Health Risk Assessment

### National Council on Radiation Protection and Measurements

NCRP Report No. 186, *Approaches for Integrating Information from Radiation Biology and Epidemiology to Enhance Low-Dose Health Risk Assessment*, is a comprehensive compilation of data and studies on the types of epidemiological and biological information and techniques available to support biologically based modeling of risks for radiation-induced cancers and circulatory disease.

The radiation protection community is challenged to reconcile and integrate the results of epidemiological studies with information from radiobiology research. This Report offers a way forward to resolve this challenge. It seeks to take advantage of the strengths of both approaches by proposing a unified approach using biologically based dose-response models and adverse outcome pathways. Understanding the progression from the initial exposure event through a set of key biological events to a disease outcome is critical to enhance the risk assessment process; such understanding reduces uncertainties in estimated risk following exposure to low doses and low dose rates of ionizing radiation.

This Report covers information related to data and models, including:

- The types of data, such as biological events and parameters, that constitute key events for specific radiation-induced adverse health outcomes.
- Identification of the most informative current epidemiologic data for an integrated approach and how additional epidemiologic data might be obtained.
- A review of available biologically based dose-response models, their value and limitations, and proposals for new predictive models.
- Research needs and gaps for defining adverse outcome pathways and for obtaining reliable key event parameters.

**Researchers, risk assessors and risk managers/regulators can use this report to:**

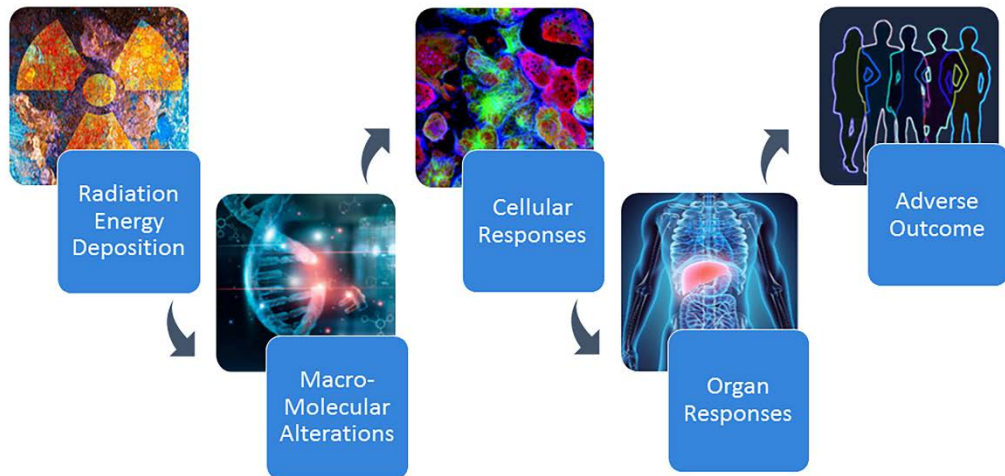
- **Understand the current state of modeling of dose effects.**
- **Evaluate areas in which further work will contribute to an improved knowledge of radiation risk.**

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Report No. 186 is unique because it uses a new approach for integrating epidemiology data and radiation biology data for addressing low dose/low dose rate adverse-health outcomes for radiation exposures building on NCRP work published in Report No. 171 and Commentary No. 24. This approach uses an adverse outcome pathway/key events framework. It provides a comprehensive examination of the current scientific information available and detailed proposals for the types of research studies that are required to apply this approach. In addition, the Report reviews the etiology of cancer and circulatory disease especially in response to radiation. This is important because:

1. Combining radiation biology and epidemiological information can provide the most viable approach for defining the shape of the dose-response curve for low-dose radiation risks.
2. Both epidemiology data and informative radiation biology data are necessary to reduce the uncertainties associated with current approaches.
3. Current advances in technology — both experimental and computational — make the application and refinement of an adverse outcome pathway/key events and biologically based dose response model approach quite feasible.

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