

Science.

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Radiological Science and Engineering Group

Dose Reconstruction



Past industrial practices, such as the development of nuclear weapons, have resulted in human exposures to radioactive materials and hazardous chemicals that would be unacceptable by current standards. The Radiological Science and Engineering Group (RSEG) of the Pacific Northwest National Laboratory (PNNL) is a world leader in reconstructing past radiological exposures to workers and the public. We have successfully reconstructed worker exposure profiles, workplace radiation fields, likely source terms, transport paths through natural environments, and public exposures.

We can evaluate:

- Workplace exposures based on past nuclear or radiological activities
- Releases to environment (air, soil, water)
- Radiation (beta, photon, neutron) measurements and/or analytical transport calculations
- Environmental transport pathways
- Human intake (dose, health impact, risk).

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Proven Experience

The Radiological Science and Engineering Group can evaluate exposure to workers and to the public using deterministic or stochastic methods. We have led programs for numerous research efforts on a range of complex and notable projects:

- U.S. Department of Energy and other sponsors over many years. Evaluation of radiation (beta, photon, neutron) fields and occupational dose (skin, body, organs) from routine practices or incidents using field measurement techniques (photon and neutron spectroscopy, absorbed dose) or analytical (Monte Carlo, discrete ordinate transport) methods.
- Hanford Environmental Dose Reconstruction (HEDR), Washington State/USA. Evaluation of releases and exposures to people living in an area of over 75,000 square miles in the U.S. Pacific Northwest resulting from operation of the first production reactor facilities in the world. Funded by the U.S. Department of Energy and Centers for Disease Control and Prevention.
- Joint Coordinating Committee on Radiation Effects Research (JCCRER), Mayak plutonium workers and Techa River population/Russia. Evaluation of releases and exposures to over 30,000 members of the public and 20,000 workers resulting from operation of the first production reactor facilities in the former Soviet Union, which also reprocessed spent fuel. Doses from ionizing radiation range from very low to very high. Funded by multiple U.S. agencies, and the Russian Ministries of Health and Atomic Energy.
- International Agency for Research on Cancer and the U.S. National Institutes of Occupational Safety and Health. We have prepared dosimetry data for inclusion in worker epidemiologic studies and have participated in review and guidance for dose reconstructions performed by government agencies.

**Pacific Northwest
National Laboratory**

Operated by Battelle for the
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Dose Reconstruction A Local, National, and International Challenge

We work with our clients to determine acceptable and appropriate measures and levels of uncertainty. We develop realistic bounds on potential worker exposures using knowledge of processes, source terms, and radiation transport. Teaming with other scientists from PNNL, RSEG staff, develop project-specific environmental transport reconstructions of industrial effluents.

We apply interdisciplinary skills from several technical areas, including environmental pathway analysis, source term assessment, aerosol dynamics, dose calculation, risk, and potential health effects, to client-specific radiological and non-radiological issues.

Dose reconstruction endpoints are client-specific and often include estimates of dose, health risk, and health impact. Results can be used for compensation determinations or for support to epidemiological studies.

We provide our clients with:

- Technical support for evaluating or preparing radiation exposure data for workers and members of the public, including health assessment, regulatory compliance documents, and epidemiologic analyses. We can address issues for any radiological agent, whether naturally occurring or found in the workplace.
- Dose reconstruction expertise and experience. We help reconstruct doses under the Energy Employees Occupational Illness Program Act (EEOICPA), and conduct environmental release and pathway analysis to support national programs to provide compensation to workers in nuclear weapons complexes and to their families for the health impacts of exposures. We also evaluate levels of exposure for the U.S. military for exposures associated with depleted uranium.

Creating the State-of-the-Art

Technology that PNNL and RSEG have developed over the years can be used in typical exposure scenarios to rapidly assess individual or population impacts. Experienced staff in multiple disciplines are available to address almost any dose-reconstruction scenario. We also develop custom software for larger projects. Our IT developments include a variety of customized geographic information systems (GIS). Our modeling software, such as RATCHET, has been standard-setting, with portions used by others in their own dose reconstructions.

