



AECL'S HEALTH AND ENVIRONMENTAL SCIENCES R&D PROGRAM

Dr. R.V. Osborne

Director, Health and Environmental Sciences Division

AECL, Chalk River Laboratories

Chalk River, Ontario, Canada KOJ1O

Radiological protection is a fundamental requirement in any nuclear technology endeavour. It is also an area where public concerns are often expressed. If protection is inadequate, or is believed to be so, or if concerns are not addressed, the beneficial application of nuclear technologies is inhibited. Historically, AECL, as the driver of nuclear technology in Canada, has ensured that the burgeoning Canadian nuclear industry and other users of the technology have a sound technical base to support all aspects of radiological protection. Meeting this need has meant developing and maintaining expertise and technologies in environmental sciences, health physics, radiation biology, and radiological health matters in general.

The application of this knowledge and technology stretches from nuclear technology cradle to grave-from design and assessment, through operations of nuclear facilities and other applications of technologies, to decommissioning and waste management. The aim is appropriate protection of workers and the public from radiation associated with applications of nuclear technology in Canada. Such applications are in many sectors in Canada-industry, academia and medicine. AECL, on behalf of the Federal Government, has taken the lead in assuring that Canada has a science and technology infrastructure underlying radiological protection. Because of the obvious shared interest and need for this expertise in the Canadian nuclear utilities, that sector has directly shared the support for programs in this area under the auspices of the CANDU, Owners' Group.

To meet these needs, the Health and Environmental Sciences Division undertakes an R&D program that encompasses the links from sources of radiation exposure and radionuclides to ultimate potential impact on biota and on human health. Where necessary, basic physical, chemical and biological processes are studied and described quantitatively. The behaviour of radionuclides released to the atmosphere, surface waters, or groundwater's are examined and described quantitatively to enable predictions to be made of the

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radiation doses received in different parts of the biosphere and of the concentrations to which people are exposed. The human physiological and biokinetic processes are studied to provide quantitative links from exposure to radiation dose in tissues and organs. Biological processes that determine whether there are any consequences to health from small absorbed doses are identified. The work involves studies at the molecular level, with cells in tissue culture, and with animals.

Throughout the program, required measurement technologies are developed. These include radiochemical analytical methods and instruments to measure radionuclides in environmental matrices at low concentrations. The measurements support biosphere model development and validation, and site monitoring. Such technologies are also developed to measure internal contamination by radionuclides in people and to develop and validate biokinetic dosimetry models. In cells and tissues, molecular biological and cytogenic indicators of radiation impact are identified. Molecular biological analytical methods and technologies are also developed. These bear on approaches to sorting out the relative importance of individual genetic variability to the radiation sensitivity expected in populations, and to estimating whether environmental agents such as radiation have contributed to disease. There is particular emphasis on the behaviour and potential biological effects of tritium carbon-14, radionuclides that are of particular interest in Canada.

The direct applications of the results of the program are in assessing workplace and public hazards associated with nuclear technologies, in improving the protection of workers and the public against the radiation hazards associated with nuclear technologies, and in actual measurements of contamination and doses, and in responding to radiological issues and concerns. In addition, the Division provides to the research laboratories of AECL dosimetry and environmental monitoring services that draw heavily on the technologies, expertise and facilities of the R&D program.

Some facilities developed in these programs have unique features that make them attractive to researches in related scientific areas from elsewhere in Canada and abroad.

Because of their strength, these programs have provided resources to support the Federal Government in its interactions internationally and in its internal regulatory activities in the radiological area. The result is assurance to the Government, to the public, and to people working in industry, that protection standards are adequate.