

scientific means. Research is carried out on metabolic processes that accumulate exposure levels allowing ecosystems to exist without serious adverse impacts.

Facilities Facilities playing important roles for addressing radiation and energy-related chemical issues include the Radiological Research Accelerator Facility at Columbia University, the Health Physics Research Reactor at ORNL, and the Janus Reactor at ANL. These facilities provide a spectrum of relatively pure neutron beams over a wide range of doses and dose rates for studies in radiation biology, radiation dosimetry, and for training activities. The Environmental Measurements Laboratory (EML) develops improved techniques for radiolog-

ical and chemical measurements to characterize the chemical and radiological content of atmospheric, soil, and water samples and provides DOE with a rapid response capability for obtaining needed field data. For example, EML recently completed a re-assessment of population dose in Utah from weapons testing based upon their measurement of soil and water levels of cesium-137.

The National Environmental Research Parks (representing protected sites around five National Laboratories with a diversity of flora, fauna, and climate) have for two decades served as outdoor laboratories for quantifying ecosystem responses to a wide range of energy activities, including coal combustion, overhead transmission lines, reactor operations, and

burial of radioactive wastes.

A three-stage mass spectrometer, installed at the Savannah River Laboratory, provides accurate and precise analysis of isotope ratios for very low levels of environmental radionuclides, defining their source and time sequence of deposition in terrestrial and aquatic experiments under field conditions.

Advanced flow cytometers, developed at Los Alamos and LLNL, are also being used by DOE and other sponsors to identify and separate specific cell populations, and purify chromosomes for gene mapping studies to produce template material for making chromosome-specific human gene "libraries" for distribution to the scientific community.