of using nuclear technologies in biomedical applications.

1. Human health research—This program ascertains by epidemiologic studies the potential spectrum of human health problems associated with occupational and environmental exposures to radiation and chemicals in DOE operations and emerging energy technologies. Investigators also detect and measure genetic and significant subclinical changes in exposed humans that can serve as early indicators of latent disease induction or to identify particularly sensitive individuals.

2. Medical applications of nuclear technology—This program exploits the Department's interdisciplinary cadre of investigators and technological resources in physical, chemical, and computational sciences to develop and evaluate new approaches, instruments, and methodology for the improved diagnosis and therapy of human diseases and in the study of human physiological processes. Current emphasis is on the development, production, and evaluation of new radionuclides, labeled pharmaceuticals, radiation beams, imaging devices, and enriched stable isotopes.

Physical and Technological Research This is the physical sciences component of the health and environmental research program that addresses a broad range of fundamental and applied activities. Many of the projects interact with the biological and ecological components of the program. Other projects involve the development of experimental techniques or advanced measurement instrumentation. The major areas addressed are the physical and chemical characterization of products and effluents of new energy technologies, the transport and transformation of pollutants in the atmosphere, measurement science, health and safety, and the fundamental mechanisms of pollutant interaction with environmental and biological systems. Categories of research activity include:

1. Analytical Characterization—The distribution, concentration, and the physical, chemical, and radiological properties of emissions and effluents associated with energy-technology processes are determined. Field sampling and measurement and laboratory studies provide detailed information on the chemical and physical properties of collected materials.

2. Atmospheric Transport and Transformation—This category includes research to develop an improved understanding of meteorological, chemical, and physical processes that influence the transport, transformation, and fate of gaseous and particulate species emitted into the atmosphere. Improved atmospheric dispersion models are developed and validated through field experimentation.

3. Measurement Science—New concepts and improved measurement systems required to address environmental, health, and safety concerns related to energy production are investigated. Research covers a broad scope of activities ranging from the basic science of measurements to the construction and evaluation of prototype instrumentation systems.

4. Radiological Physics and Chemistry—This is a fundamental research program of radiological physics and chemistry directed toward understanding the entire chain of events from the initial radiation interaction process to the eventual biological effect. Both theoretical and experimental research investigate the mechanisms of radiation energy deposition and transfer in simple systems and extends this understanding to more complex and biologically relevant systems.

Ecological Research The ecological research program provides the scientific information base needed for appropriate siting, operation, and disposal of materials from energy activities. To obtain this information base, comprehensive basic research in terrestrial and aquatic systems is conducted in different climatic regions of the United States and in off-shore regions along the eastern and western United States on mechanisms that influence and control total ecosystems. The research is carried out by integrating all aspects of the physical and biological sciences. This multidisciplinary program includes experts in soil science, plant science, animal biology, chemistry, geology, and freshwater and marine sciences.

Research describes how energy by-products move and are acted upon by plants and animals in terrestrial and marine systems and identifies the major routes and rates of transfer of these by-products back to humans. Natural and energy-related stresses are studied from the subcellular level to the community level of ecosystems to determine the rate and mechanisms by which populations and ecosystems disturbed by energy activities adapt or react to these stresses. Categories of research opportunity include:

1. Cycling of natural and energy materials that include mobilization and movement of trace elements and compounds through water bodies, soils, sediments, plants, and animals. Research into the cycling of energy introduced substances is coupled to research into the cycling of normally required nutrients to permit the most appropriate cost effective measures to be developed for redistribution and control of energy materials in the environment.

2. Biologic responses derived from community structure, population dynamics, and physiological ecology research. Knowledge of accommodation by plants and animals to natural stresses is used to allow energy-related activities to expand while taking into consideration limits of ecosystem stress. Processes of natural succession are studied to determine if disturbed land is best left to natural revegetation or whether revegetation can be accelerated or improved by