



**Nuclear Science
& Technology:
Crucial to Sustainable
Development**

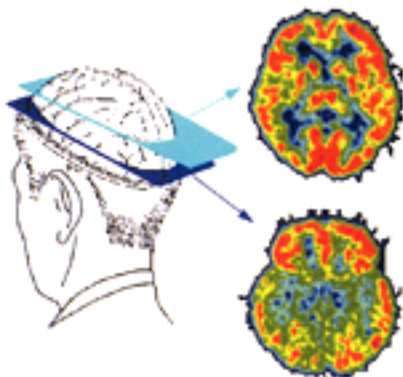
The Earth Summit conference of 1992 brought focus to the earth as a global ecosystem – requiring a comprehensive plan of action to alleviate deteriorating environmental conditions and enable the realization of human potential. The Rio Declaration focuses strongly on human beings as the center of concern for sustainable development, which must be balanced between immediate needs and the needs of future generations. As a result, environmental protection is regarded as an integral part of economic development, which has as its goals improving health and the quality of life for all humanity.

Nuclear science and technology promote sustainable development by improving health and the quality of life. This is done through varied applications such as nuclear medicine, food preservation and safety, industrial materials and processes, basic scientific research, environmental studies, and the generation of electrical power with minimal environmental impact.

Improvement of Health

Nuclear Medicine

Every year one-third of those hospitalized in the United States are diagnosed or treated with nuclear medicine techniques. Diagnostic and therapeutic procedures using radioactive isotopes and radiation sources have had notable success in the treatment of prostate and breast cancers.



Radioactive iodine has been found to be the most reliable treatment for hyperthyroidism, reducing surgeries for this con-

dition from 3,000 to 50 annually in the U.S. In addition, radioactive materials are used to complete the tests which must be performed on many new drugs before they can be approved by the U.S. Food and Drug Administration.

Food Preservation & Safety

One-third to one-half of the food produced in the world is lost due to spoilage and infestation between production and consumption.

Nuclear technologies can prevent much of this loss by delaying spoilage. Use of food irradiation technology also helps solve problems of food safety.



It is effective in killing such dangerous illness-causing microorganisms such as Salmonella, Campylobacter, and E. Coli, which frequently contaminate fresh meat and poultry. Irradiation can also eliminate the potential hazard of trichinosis from fresh pork.

Product Safety

Nuclear technology is useful or essential to many products that contribute to every-day health and safety, such as smoke-alarms, radial tires, and fail-safe lighting sources (emergency exits, runway markers for airports, safety lamps in coal mines, etc.) that require no energy supply. In addition, nuclear radiation is used in the sterilization of many medical supplies and instruments.

Safe Working Conditions

Nuclear technology work environments are highly controlled and regulated; worker safety is carefully protected. As a result, lost-time accidents at U.S. nuclear plants are

significantly below the rates for other industries. In 1997, the accident rate for all U.S. private industry was 3.3 per 200,000 worker-hours, while the rate in U.S. nuclear plants was just 0.45 per 200,000 worker-hours for the same year.

Clean Power

Generating electricity with nuclear power does not emit sulfur dioxide, nitrogen oxides, or fly-ash particulates. Nuclear wastes are low in volume and carefully controlled to remain separated from the biosphere.

Quality of Life: Combating Poverty and Improving Standard of Living

Industrial Materials and Processes

Radioactive sources are used to detect defects in materials, thus avoiding material or product failures that would adversely affect people.

Radioactive sources also improve the efficiency of production, resulting in lower costs and higher quality products. Nuclear gauges are used in automated production lines to control thickness in sheet metal and paper and liquid fill levels for containers.

In many cases, there are no feasible substitutes for these techniques. In recent decades the application of a single nuclear technique – tracers – in the machine tool industry has saved the U. S. economy between \$60 and \$70 billion.



Electrical Power Generation

One of the most important contributions nuclear science and technology makes to sustainable development is in the area of electrical power generation.

Nuclear power plants provide essentially carbon-free electrical generation. They provide an energy source that is sustainable.



Efficient Development of Natural Resources

Nuclear science and technology are often key to the efficient recovery of natural resources. Tracer applications are used in enhanced oil recovery, well logging, and other geological studies. During an enhanced petroleum recovery project in the U.S., a major oil company found that radioactive isotope tracers costing less than \$1 million were an essential component of the reservoir management system that produced an extra 56 million barrels of oil, valued at more than \$1.4 billion.

Employment

The availability of reliable energy sources is critical to a country's economic development. By providing a reliable and economical power source, nuclear technology can make a significant contribution to economic development and employment opportunities.

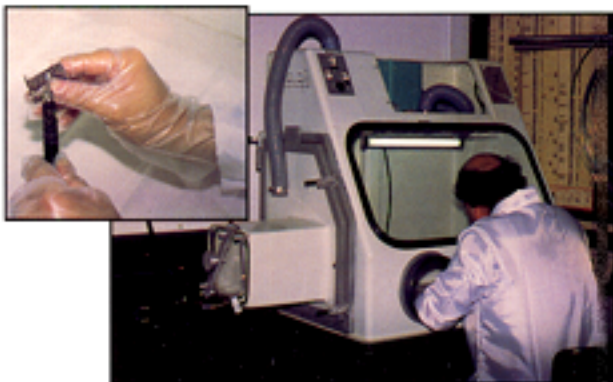
Of course, nuclear technologies themselves also provide employment opportunities. In the U.S. during 1995, nuclear technology-related jobs accounted for 4 percent of total U.S. employment, with 90% of those jobs in fields other than power generation.

Building Capacity Through Scientific Research

The capacity of a country for economic development depends upon the skills of a diverse group of people – engineers, technicians, chemists, architects, doctors, nurses, welders, accountants, and many others. Their contributions help develop the infrastructure and provide the services needed to promote health and contribute to the quality of life.

These specialists utilize the information gathered in basic scientific research to do their day-to-day work. Entire areas of research and development in chemistry, metallurgy, genetics, biotechnology, and many other fields of science and engineering exist because of nuclear technologies.

Radioactive materials are essential to many space probes, especially those to the outer planets. Radioisotopic measurement techniques are the only way for accurately dating many historical and archeological artifacts.



Concern for Future Generations

Environment and the Ecosystem

Scientific studies enhance our understanding of the global ecosystem and help us analyze the environmental impacts of human activity. Those studies involve such areas as geology,

hydrology, atmospheric sciences, and archeology.

Nuclear science and technology impact studies in all of these areas, as well as



chemistry and biology, which are key to environmental understanding.

Radionuclides are helpful in determining plant and sea assimilation of greenhouse gases and measuring carbon dioxide releases from industrial areas. Ocean circulation models and ice core interpretations depend on nuclear techniques.

Nuclear technology is not limited to research. It is also used to solve problems while eliminating harmful environmental impacts. For example, some insects are controlled using radiation-induced sterilization instead of environment-damaging insecticides.

Minimal Waste

All manufacturing and energy generation industries produce waste. Nuclear power plants produce a significantly smaller volume of solid waste than a coal-fired plant. Most nuclear waste is low-level and short-lived in comparison to many hazardous and toxic wastes that have an infinite life. The high-level nuclear waste from a power plant includes some long-lived isotopes which must be handled carefully and recycled or placed in safe storage facilities to keep it isolated from the biosphere.

The safety record for radioactive waste disposal is extremely good, with no examples of harmful exposures in the U. S.

Nuclear Science and Technology

- Make a significant contribution to sustainable development
- Promote improved health
- Improve quality of life
- Help meet the growing global demand for electricity
- Are reducing carbon dioxide emissions



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♻ Contains 10% Post Consumer Waste