



Nuclear
Sciences and
Applications



Securing A Better Future For All **Nuclear Techniques for Global Development and Environmental Protection**

Nuclear Sciences and Applications Laboratories

Supporting Development: R&D, Capacity Building and Technical Services

The system of twelve dedicated IAEA laboratory facilities is a unique feature in the United Nations. The laboratories support and implement programmatic activities that respond to the developmental needs of Member States in food and agriculture, human health, environmental monitoring and assessment, as well as the use of nuclear analytical instruments.

The laboratories carry out three essential types of activity, which are simultaneously supported worldwide in Member State laboratories: (i) applied research and development; (ii) training and capacity building and (iii) technical and analytical services. Their primary aim is to assist in increasing the impact of related IAEA programmes.

While the laboratories share certain types of activity, their fields of expertise range from food and agriculture, medical dosimetry to the environment and water resources.

Most of the laboratories are based in Seibersdorf, a town about 35 km southeast of Vienna. There are five FAO-IAEA agriculture and biotechnology laboratories assisting Member States to develop and adapt new and existing agricultural technologies involving isotopes and radiation to suit local requirements and environmental conditions, and to provide the necessary training and analytical services pertaining to the efficient use of these technologies:

- **Insect Pest Control Laboratory:** Develops environmentally friendly methods of pest control (e.g. sterile insect technique, F1-sterility) for area wide control of key pests.
- **Animal Production and Health Laboratory:** Strengthens the productivity of indigenous and exotic livestock breeds through genetic characterization and disease diagnosis.
- **Soil and Water Management and Crop Nutrition Laboratory:** Develops methodologies for the cost effective optimization of water and fertilizer usage.

Applied research and development is related to coordinated research activities and technical cooperation projects. The IAEA laboratories provide support for development of new technology and/or its adaptation to local needs and environments. In this area, scientists and laboratory technicians have the opportunity to put theories into practice by developing or fine tuning methodologies tailored to the needs of developing countries. Laboratory results can be tested and then disseminated through field projects.



- **Plant Breeding and Genetics Laboratory:** Focuses on radiation induction and 'fingerprinting' of novel plant varieties with improved yield and hardiness under local conditions, such as disease resistance and salinity tolerance.
- **Food and Environmental Protection Laboratory:** Facilitates compliance with regulatory guidelines for international markets through provision of methodologies for determining veterinary drug and pesticide residues.

The **Dosimetry Laboratory**, based in Seibersdorf, is part of the IAEA's human health programme. It is responsible for the quality assurance aspects of the use of radiation in medicine, it provides dosimetry calibrations for national standards laboratories and conducts audits of the dose in radiotherapy and radiation protection.

From its facility in Seibersdorf, the **Nuclear Spectrometry and Applications Laboratory**, as part of the IAEA's nuclear science programme, works with laboratories in Member States to enhance their use of nuclear instrumentation and nuclear spectrometry based analytical techniques in environmental pollution monitoring and other applications, including nuclear energy systems related needs.

The **Terrestrial Environment Laboratory** facility in Seibersdorf is part of the IAEA's environment laboratories. Its role is to foster the capabilities of Member States in understanding and protecting the terrestrial environment. To achieve this, the laboratory develops suitable radiological assessment strategies and ensures the quality of measurement results by recommending methods, providing reference materials and organizing proficiency tests.



There are three marine environment laboratories located in Monaco, also part of the IAEA environmental laboratories, dedicated to the preservation of a healthy marine environment and the sustainable development of environmental resources:

- **Radiometrics Laboratory:** An internationally recognized centre for the study of the oceans by use of radionuclides and isotopes as environmental tracers, in collaboration with leading research centres around the world. It develops analytical methods and supports Member States in their quality assurance activities by enabling interlaboratory comparisons and production of reference materials of marine origin.
- **Radioecology Laboratory:** Focuses on the study of nuclear and non-nuclear contaminants in seafood and food webs using radiotracer techniques, on the impact of ocean acidification on the development and biology of marine organisms of commercial interest and on the tracking of carbon export from the upper ocean using natural radiotracers.
- **Marine Environmental Studies Laboratory:** Covers isotopic and elemental analysis of trace elements, organic contaminants and lipid biomarkers. It supports capacity building in Member States to enhance the quality of analytical measurements and the capabilities for marine environmental surveys.

In Vienna, the **Isotope Hydrology Laboratory**, as part of the IAEA's water resources programme, plays a substantial role in the dissemination of knowledge about state of the art analytical techniques in isotope hydrology.

Training and capacity building is an essential part of technology transfer and is frequently provided at the IAEA laboratories or in regional laboratories. Dozens of training courses, workshops and seminars are held annually at the Nuclear Applications Laboratories, involving hundreds of trainees, with the overall goal of building the capacity of Member States. IAEA fellowships usually extend no more than six months, and while importance is given to training in technology, every effort is made to ensure that equal emphasis is given to the wider aspects of the problem to be studied or solved.



For example, in the courses, trainees learn not only nuclear techniques but also conventional techniques so that they recognize the links. They receive intensive hands-on experience in laboratory analysis and also undertake field work. Most training also includes 'training the trainer' elements, so the training will have a multiplier effect. Regional and interregional training courses are held periodically to train young scientists from developing countries in the technologies associated with the application.

Another important function of the IAEA laboratories is the **technical and analytical support** provided to Member States through evaluation, standardization and selection of appropriate equipment for each specific project or need. Equipment supplied is most effectively used when it is simple, robust, easily repaired and fits well within the local infrastructure and conditions. This is why technical staff, scientists and fellows who are responsible for implementing the projects aim to acquire experience in the routine operation, maintenance and even repair of commonly used equipment. Supplies of frequently required spare parts also can be purchased in bulk and held for quick dispatch to field projects when required.