Catalogue of Training Courses

Offered by the IAEA Nuclear Applications Laboratories located in Austria

Nuclear Science and Technologies for Sustainable Development: Supporting Food Safety and Security, Human Health, Water Resources Management, Environmental Protection and Industrial Applications

IAEA

Scan or click here to access the Training Calendar

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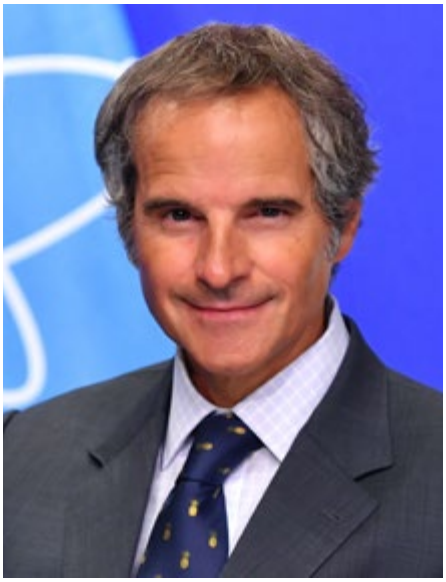
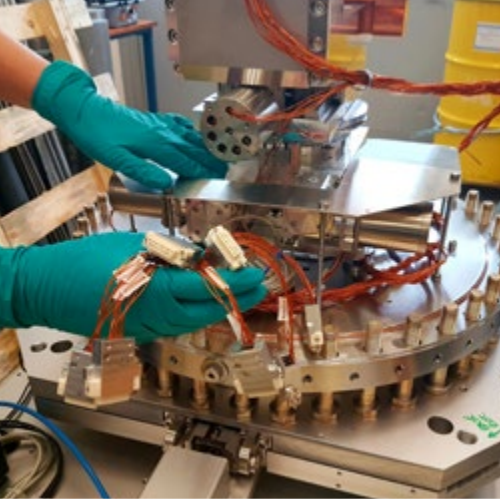
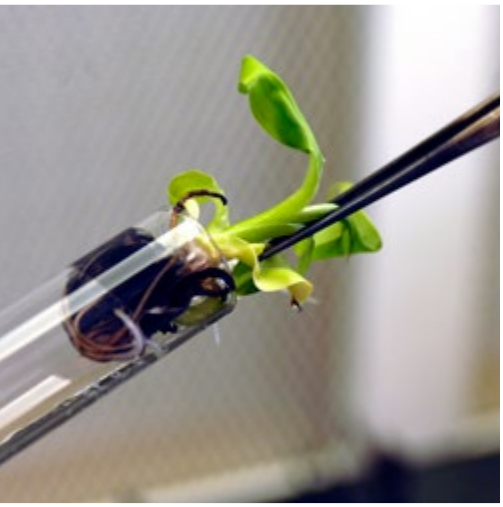


“The IAEA is a global leader in harnessing nuclear technology, driving innovation, sustainability, and scientific progress. At the heart of this mission are our Nuclear Sciences and Applications Laboratories, a hub of excellence and international collaboration. Through the hands-on training and applied knowledge these laboratories offer, we empower scientists, researchers, and professionals across the world to tackle pressing challenges, from health care and food security to environmental protection and climate adaptation.

This catalogue presents a diverse array of IAEA training programmes, many of which support our flagship initiatives: Rays of Hope, which expands access to radiation medicine; Atoms4Food, which enhances food security through nuclear science; ZODIAC, which strengthens preparedness for zoonotic diseases; and NUTEC Plastics, which combats plastic pollution with nuclear technologies. Together, these efforts and the transformative work of our laboratories are delivering a safer, healthier, and more sustainable future through the power of nuclear science.”

Rafael Mariano Grossi,
IAEA Director General






Photos: IAEA

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Foreword

THE IAEA NUCLEAR APPLICATIONS LABORATORIES: ***ADVANCING SUSTAINABLE DEVELOPMENT***

At the heart of this endeavour lie the twelve laboratories managed by the IAEA's Department of Nuclear Sciences and Applications, essential assets within the United Nations (UN) framework. These laboratories engage in applied research and development, provide training and capacity-building to Member States, and deliver technical and analytical services. Situated in Austria (Seibersdorf and Vienna), and the Principality of Monaco, and collaborating with partners worldwide, they address critical areas such as food, agriculture, healthcare, water resources and environmental conservation.

This catalogue showcases a diverse selection of training courses that the Austria-based Nuclear Applications Laboratories are equipped to deliver, highlighting their vital role in fostering sustainable development and enhancing global collaboration.

Tailored to address various interests and needs, the actual selection of courses available at a given time varies based on interest of participants, available funding, and availability of the respective laboratory. The courses can be customized to meet specific requirements.

The training courses are reviewed as needed to reflect evolving demands, scientific advancements, and strategic priorities, ensuring relevance and impact.

All training courses are conducted in English, emphasizing hands-on learning with complementary computer-based components. A minimum lead time of six months is required after confirming funding, planning, and participant selection to ensure proper logistical preparation. Certain training courses may have regional relevance based on specific needs or priorities.

Vienna International Centre,
Wagramer Str. 5,
1220, Vienna, Austria

IAEA Environment Laboratories,
4 Quai Antoine 1er,
98000 Monaco

IAEA Laboratories
Friedenstraße 1,
2444 Seibersdorf, Austria

NUCLEAR TECHNOLOGIES FOR SDG ATTAINMENT

The Nuclear Applications Laboratories contribute to the achievement of the Sustainable Development Goals (SDGs) by advancing nuclear science and technology. Their work supports countries in sectors such as health, food and agriculture, water, environment, and industry.

The IAEA Nuclear Applications Laboratories at a Glance

SUPPORTING THE PEACEFUL USES OF NUCLEAR TECHNOLOGIES

FAO/IAEA AGRICULTURE AND BIOTECHNOLOGY LABORATORIES

Animal Production and Health Laboratory

Develops, validates and applies techniques for the utilisation of local feed resources and optimization of animal feeding; animal genetic evaluation and integration to breeding; enhancement of animal reproduction; and early, rapid diagnoses and control of transboundary animal and zoonotic diseases, enhancing food security and livelihoods.

Food Safety and Control Laboratory

Enhances food safety and quality by employing nuclear and complementary techniques to develop analytical methods for detecting contaminants and residues in food, preventing food fraud, promoting food irradiation, and supporting regulatory systems by facilitating the generation of reliable data for risk assessment and decision making. It focuses on food safety, authenticity, and emergency response to food contamination incidents.

Insect Pest Control Laboratory

Utilizes sterile insect technique to reduce insect populations by releasing sterilized males, protecting crops, livestock and human health, and minimizing pesticide use.

Plant Breeding and Genetics Laboratory

Leverages mutation breeding and biotechnological approaches to develop high-yielding, nutritionally rich crop varieties with enhanced resilience to biotic and abiotic stresses, and sustainable plant health solutions towards food and nutritional security goals.

Soil and Water Management and Crop Nutrition Laboratory

Optimizes soil and water management, along with crop nutrition, to enhance climate resilience and agricultural sustainability through research on soil degradation, nutrient and water use efficiency, and environmental pollution.

Photo: IAEA

Dosimetry Laboratory

Ensures safe and accurate use of radiation in medicine, enhancing cancer treatment outcomes through precise dosimetry and advanced radiotherapy techniques.

Isotope Hydrology Laboratory

Uses isotopic techniques to study and manage water resources, addressing issues of water scarcity and climate change by analysing the source, age and movement of water throughout the hydrological cycles.

Terrestrial Environmental Radiochemistry Laboratory

Monitors environmental radionuclides and pollutants, analysing soil, water, and biological samples to protect ecosystems and human health.

Nuclear Science and Instrumentation Laboratory

Promotes, educates, and develops advanced nuclear instrumentation, to facilitate research and industrial applications with analytical tools and techniques.

List of Courses

FOOD AND AGRICULTURE

Food and Agriculture

Photo: IAEA

Photo: S. Mania/FAO

The FAO/IAEA Agriculture and Biotechnology Laboratories support the safe and appropriate use of nuclear and related technologies in food and agriculture, aiming to enhance global food safety and security and promote sustainable agricultural development. The training courses cover a wide range of areas, including soil and water management and crop nutrition, animal production and health, food safety and control, insect pest control, and plant breeding and genetics. Participants gain both practical and theoretical knowledge, equipping them to apply nuclear techniques and advanced technologies in agricultural research and practice. This comprehensive approach fosters innovation and effectiveness in advancing sustainable solutions to address critical agricultural challenges.

Use of Cosmic Ray Neutron Sensor (CRNS) Technology for Agricultural Water Management - Part 1: Introduction to CRNS Principles

Purpose
- To introduce the principles of the use of CRNS for monitoring soil moisture at area-wide level.

Objectives
- To introduce participants to the fundamental principles of CRNS technology for soil moisture monitoring in agricultural contexts.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand the principles of the use of CRNS equipment for area-wide soil moisture monitoring and making informed decisions in agricultural water management.

Course Topics
- Introduction to Cosmic Ray Neutron Sensor (CRNS) Technology.
- Principles of Soil Moisture Monitoring with CRNS.

Who should attend?
- Scientists and technicians with soil science back ground and experience in irrigation agronomy or soil physics

Details
- Duration: 3 days
- Group Size: 15 to 20 participants
- Prerequisites: Good understanding of soil physics and agricultural water management.
- Lead Time: 6 months
- Training Provider: Soil and Water Management and Crop Nutrition Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: SWMCN.Training@iaea.org

Use of Cosmic Ray Neutron Sensor (CRNS) technology for agricultural water management. Part 2: Installation, CRNS Calibration, Data Interpretation, and Application

Purpose
- To provide training on the installation and calibration of the CRNS sensors, how to process and interpret CRNS data

Objectives
- To provide hands-on training for participants in the installation and calibration of CRNS equipment.
- To enhance participants' skills in interpreting CRNS data for effective agricultural water management.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Install CRNS equipment for area-wide soil moisture monitoring.
- Calibrate CRNS instruments to facilitate accurate data collection.
- Effectively interpret CRNS data for making informed decisions in agricultural water management.

Course Topics
- Installation Procedures for CRNS Equipment.
- Calibration Techniques for CRNS Instruments.
- Interpreting CRNS Data for Agricultural Water Management.
- Practical Hands-on Training with CRNS Equipment.

Who should attend?
- Scientists and technicians with soil science background and experience in irrigation agronomy or soil physics.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Good understanding of soil physics and agricultural water management.
- Lead Time: 6 months
- Training Provider: Soil and Water Management and Crop Nutrition Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: SWMCN.Training@iaea.org

Use of Cosmic Ray Neutron Sensor (CRNS) Technology for Agricultural Water Management. Part 3: Combining Nuclear and Digital Technology

Purpose
- To equip participants with the knowledge and skills needed to integrate Cosmic Ray Neutron Sensor (CRNS) technology with remote sensing tools for area-wide soil moisture monitoring in agriculture.

Objectives
- To train participants in the integration of CRNS technology with Sentinel satellite data for comprehensive area-wide soil moisture monitoring.
- To provide participants with the skills to build integrated CRNS-Sentinel data platforms for visualization and analysis of soil moisture data.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Effectively merge CRNS and remote sensing data to calibrate satellite imagery for accurate area-wide soil moisture monitoring.
- Develop and manage integrated CRNS-Sentinel data platforms for analysis and visualization of soil moisture data.

Course Topics
- Cosmic Ray Neutron Sensor Technology and Remote Sensing for Area-wide Agricultural Water Management.
- Combining CRNS technology with sentinel satellite data.
- Principles of area-wide soil moisture monitoring.
- Building integrated CRNS-sentinel data platforms.
- Calibrating satellite imagery for soil moisture monitoring.
- Visualizing and analysing soil moisture data.
- Practical exercises and case studies in CRNS-remote sensing integration.

Who should attend?
- Scientists and technicians with soil science background and experience in irrigation agronomy or soil physics or remote sensing.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Good understanding of the use of CRNS for area-wide soil moisture monitoring.
- Lead Time: 6 months
- Training Provider: Soil and Water Management and Crop Nutrition Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: SWMCN.Training@iaea.org

Use of Infrared Spectroscopy for Soil Property Monitoring. Part 1: Introduction to Principles, Sampling, Sample Preparation, and Analysis

Purpose
- To provide an introduction to the use of Infrared Spectroscopy for soil property monitoring

Objectives
- To familiarize participants with the fundamentals of Infrared Spectroscopy.
- To introduce participants to the concept of soil property monitoring using Infrared Spectroscopy.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Demonstrate a comprehensive understanding of the basic principles that underline Infrared Spectroscopy as a technique for soil property monitoring.
- Effectively apply the knowledge gained to sample soil, including proper techniques and protocols.
- Successfully process soil samples, preparing them for spectral analysis.
- Utilize the acquired skills to estimate soil properties through spectral data analysis, supporting soil property monitoring and assessment.

Course Topics
- Introduction to Infrared Spectroscopy and its applications.
- Fundamentals of Infrared Spectroscopy.
- Soil property monitoring techniques using Infrared Spectroscopy.

Who should attend?
- Scientists and technicians with soil science background and experience in environmental sampling and basis in soil chemistry.

Details
- Duration: 10 days
- Group Size: 15 to 20 participants
- Prerequisites: Good understanding of traditional soil fertility monitoring and management.
- Lead Time: 6 months
- Training Provider: Soil and Water Management and Crop Nutrition Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: SWMCN.Training@iaea.org

Use of Infrared Spectroscopy for Soil Property Monitoring. Part 2: Models for Soil Properly Prediction and Data Interpretation

Purpose
- To enable participants to develop spectral libraries and soil property estimation models using Infrared Spectroscopy.

Objectives
- To train participants in the development of spectral libraries using Infrared Spectroscopy.
- To instruct participants on how to create soil property estimation models using Infrared Spectroscopy and Partial Least Square Regression (PLSR).

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Develop spectral libraries using Infrared Spectroscopy.
- Create soil property estimation models using Infrared Spectroscopy and PLSR.

Course Topics
- Use of Infrared Red Spectroscopy for Soil Property prediction and data interpretation.
- Development of spectral libraries with Infrared Spectroscopy.
- Creating soil property estimation models using Infrared Spectroscopy and PLSR.

Who should attend?
- Scientists and technicians with soil science background and experience in data analysis (preferably, Python).

Details
- Duration: 10 days
- Group Size: 15 to 20 participants
- Prerequisites: Good understanding of the use of infrared spectroscopy for soil property estimation.
- Lead Time: 6 months
- Training Provider: Soil and Water Management and Crop Nutrition Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: SWMCN.Training@iaea.org

Assessing Immunity (Cell-Mediated) Against Livestock Diseases and Vaccines

Purpose
- To equip participants involved in vaccine research and development with the skills and knowledge to measure cell-mediated immunity induced by candidate vaccines against livestock diseases.

Objectives
- To train participants to use tools and technologies to assess cell-mediated immunity for livestock disease induced through vaccines.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Effectively apply the following tools and technologies to assess cell-mediated immunity against livestock diseases:
  - Enzyme-linked immunosorbent assay (ELISA)
  - Enzyme-linked Immunospot (ELISpot)
  - Real-time Polymerase Chain Reaction (PCR)
  - Flow cytometry

Course Topics
- Immunology.
- Introduction to immunology and immune response.
- Principles of cell-mediated immunity.
- Enzyme-Linked Immunosorbent Assay (ELISA) for immunity assessment.
- Enzyme-Linked Immunospot (ELISpot) Assay.
- Real-time Polymerase Chain Reaction (PCR) in immunity assessment.
- Flow Cytometry and its application in immunology.
- Case studies and practical applications of immunity assessment technologies.

Who should attend?
- Scientists from livestock research institutes and universities.
- A minimum bachelor's degree on related subjects.

Details
- Duration: 5 days
- Group Size: 5 to 10 participants
- Prerequisites: A basic knowledge on infectious livestock diseases, immunology and cell culture.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Serological and Molecular Tools for Pathogens Detection

Purpose
- To equip participants with the skills and knowledge necessary for employing serological and molecular methods in disease detection.

Objectives
- To train participants to use serological and molecular tools and technologies for the diagnosis of livestock and zoonotic diseases.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Proficiently utilize the following technologies for pathogen detection:
  - Enzyme-Linked Immunosorbent Assay (ELISA)
  - Real-time Polymerase Chain Reaction (PCR)
  - PCR techniques (nested, multiplex)

Course Topics
- Laboratory diagnostics.
- Introduction to laboratory diagnostics.
- Principles of Serological detection Methods.
- Enzyme-Linked Immunosorbent Assay (ELISA) in pathogen detection.
- Virus Neutralization Test (VNT).
- Molecular tools in pathogen detection.
- Real-time Polymerase Chain Reaction (PCR).
- PCR techniques: Nested PCR and multiplex PCR.
- Case studies and practical applications in pathogen diagnostics.

Who should attend?
- Scientists and laboratory technical staff from animal health institutions.

Details
- Duration: 5 days
- Group Size: 5 to 15 participants
- Prerequisites: A basic knowledge on infectious diseases, diagnostics.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Evaluation, Processing and Conservation of Semen

Purpose
- To equip participants with the skills to apply modern tools and technologies for the evaluation, processing, and preservation of high-quality semen for livestock breeding.

Objectives
- To train participants to use modern tools and technologies for the macro- and microscopic evaluation of semen.
- To educate participants on the proper techniques and procedures for processing and preserving semen for livestock breeding.
- To enable participants to troubleshoot and address the causes of low semen fertility.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Effectively evaluate semen quality using macro- and microscopic techniques.
- Apply modern tools and technologies for the processing and preservation of semen.
- Identify and address the factors contributing to low semen fertility in livestock breeding.

Course Topics
- Spermatogenesis, semenology, cryobiology, causes of low semen fertility and their management.
- The process of sperm production.
- Techniques and methods for semen evaluation.
- Principles and practices of semen cryopreservation.
- Identifying and managing factors affecting semen quality and fertility in livestock breeding.

Who should attend?
- Scientists and technicians working in research institutes, training institutes, semen production and artificial insemination centres.

Details
- Duration: 10 days
- Group Size: 5 to 10 participants
- Prerequisites: Basic knowledge in andrology.
- Lead Time: 3 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Bioinformatics Analysis of Livestock Genome Data

Purpose
- To equip participants with the skills and knowledge necessary to use bioinformatics analysis for enhancing livestock productivity.

Objectives
- To provide training to participants on the effective management of large genomic datasets.
- To enable participants to use bioinformatics tools and methods for evaluating livestock populations.
- To educate participants on the application of genomic predictions in livestock breeding.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Utilize various command-line tools and open-source software for handling, processing, and analysing genome sequence and genome-wide genotype data.
- Conduct data pruning and quality control procedures for genomic datasets.
- Perform genomic analysis to evaluate livestock populations and make informed breeding decisions.
- Write and execute scripts to automate bioinformatics analysis tasks.

Course Topics
- Data analysis software and methods, script writing and execution.
- Data Analysis Software and Methods for genomic data analysis.
- Training in writing and running scripts to automate bioinformatics workflows and analysis tasks.

Who should attend?
- Animal Geneticists/Breeders/Animal Biotechnologists.

Details
- Duration: 10 days
- Group Size: 15 to 20 participants
- Prerequisites: Basic knowledge in animal genomics.
- Lead Time: 3 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Multiparametric Detection of Pathogens Causing Major Transboundary Animal Diseases and Zoonoses

Purpose
- To enhance the capacity of participants in utilizing nuclear-derived/molecular assays and serological assays for the multiparametric detection of pathogens causing major transboundary animal diseases and zoonoses.

Objectives
- To review and transfer techniques for the detection and differential diagnosis of transboundary and zoonotic animal pathogens.
- To enhance the capabilities of Veterinary Diagnostic Laboratory Network (VETLAB Network) partners in utilizing multiparametric detection methods, including nuclear-derived/molecular assays and serological assays.
- To equip participants with the skills and knowledge required for syndromic surveillance of transboundary animal diseases (TADs) and zoonotic diseases.
- To foster collaboration and information exchange among VETLAB Network partners to strengthen regional disease control efforts.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Apply advanced techniques for detecting and differentially diagnosing transboundary and zoonotic animal pathogens.
- Utilize nuclear-derived/molecular assays and serological assays for multiparametric pathogen detection.
- Contribute effectively to syndromic surveillance and control strategies for TADs and zoonotic diseases in their respective regions.

Course Topics
- Molecular and serological diagnostics.
- Molecular diagnostics for TADs.
- Serological assays for zoonotic pathogens.
- Multiparametric detection techniques.
- Syndromic surveillance methods.
- Differential diagnosis of animal diseases.
- Laboratory techniques transfer and review.
- Regional disease control strategies.
- Collaborative approaches in disease surveillance.
- Data management and reporting.
- Quality assurance in veterinary diagnostics.
- Case studies and practical applications.

Who should attend?
- Participants designated by the Veterinary Diagnostic Laboratories that are members of the VETLAB Network.

Details
- Duration: 10 days
- Group Size: 10 to 30 participants
- Prerequisites: Basic knowledge in molecular and serological diagnostics.
- Lead Time: 3 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Next Generation Sequencing Bioinformatics and Molecular Phylogeny

Purpose
- To participants to utilize new sequencing technologies and bioinformatics tools for the characterization and molecular surveillance of major pathogens responsible for transboundary animal diseases and zoonoses.

Objectives
- To provide training on sample preparation and sequencing using Next Generation Sequencing (NGS) and Nanopore technologies.
- To educate participants on sequencing data analysis, with a specific focus on animal and zoonotic pathogens.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Demonstrate proficiency in sample preparation and sequencing using NGS and Nanopore technologies.
- Analyse sequencing data effectively to characterize and survey animal and zoonotic pathogens.
- Contribute to national and regional control strategies for Transboundary Animal Diseases (TADs) and zoonotic diseases through enhanced laboratory capabilities.

Course Topics
- Sequencing and data analysis.
- Overview of NGS and Nanopore sequencing technologies.
- Techniques and best practices for preparing samples for sequencing.
- Methods and tools for analysing sequencing data with a focus on animal and zoonotic pathogens.

Who should attend?
- Participants designated by the Veterinary Diagnostic Laboratories that are members of the VETLAB Network.

Details
- Duration: 10 days
- Group Size: 10 to 15 participants
- Prerequisites: Basic knowledge in molecular and sequencing.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Implementation of ISO 17025 Standard for Diagnostic Laboratory Techniques for Detection and Characterization of Animal and Zoonotic Diseases

Purpose
- To facilitate the integration of ISO 17025 standard-compliant diagnostic laboratory techniques for the detection and characterization of animal and zoonotic diseases within veterinary laboratories.

Objectives
- To equip participants with the knowledge and skills required to integrate laboratory techniques in accordance with ISO 17025 standards.
- To provide guidance and support for the implementation and maintenance of ISO 17025 standards in veterinary laboratories.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Demonstrate a detailed understanding of the concepts and requirements of ISO 17025 standard for diagnostic laboratory techniques.
- Outline the steps and processes necessary for the successful implementation and maintenance of ISO 17025 standard within veterinary laboratories.
- Effectively apply their knowledge to ensure that veterinary laboratories are fully compliant with ISO 17025 standard for the targeted diagnostic techniques.

Course Topics
- Laboratory techniques.
- The quality management system.
- Test/calibration methods.
- ISO 17025 requirements.
- Implementation and the accreditation process.

Who should attend?
- Laboratory technical staff from animal health institutions.

Details
- Duration: 10 days
- Group Size: 5 to 10 participants
- Prerequisites: Understanding and experience in performing the target diagnostic assays.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English, Spanish
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

The Use of the Sanger Sequencing Service of APH for Characterization of Animal and Zoonotic Pathogens

Purpose
- To equip participants with the knowledge and skills required for effectively utilizing Sanger sequencing method for the characterization of animal and zoonotic pathogens in veterinary laboratories.

Objectives
- To provide comprehensive training on the utilization of Sanger sequencing method.
- To enhance participants' ability to interpret data generated from Sanger sequencing in the context of animal and zoonotic pathogen characterization.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Demonstrate proficiency in sample preparation and data submission for Sanger sequencing.
- Interpret sequencing results effectively, identifying relevant genetic markers for pathogen characterization.

Course Topics
- Laboratory techniques.
- Introduction to Sanger Sequencing method.
- Utilizing Sanger Sequencing for pathogen characterization.
- Data interpretation in pathogen characterization.
- Laboratory techniques for pathogen analysis.

Who should attend?
- Laboratory technical staff from animal health institutions.

Details
- Duration: 5 days
- Group Size: 5 to 10 participants
- Prerequisites: Experience in the relevant techniques for detection of the targeted pathogens.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English, Spanish
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Training in the Use of the iVetNet Information Platform for Implementation and Maintenance of ISO17025 Standard in Veterinary Laboratories

Purpose
- To enable participants to effectively utilize the iVetNet Information Platform for the implementation and maintenance of ISO17025 standards in veterinary laboratories.

Objectives
- To provide participants with comprehensive training on the use of the IAEA iVetNet Information Platform.
- To equip participants with the knowledge and skills necessary to apply ISO17025 standards in veterinary laboratories.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Effectively navigate and utilize the iVetNet Information Platform.
- Demonstrate competence in implementing and maintaining ISO17025 standards within veterinary laboratories using the iVetNet Information Platform.
- Maintain and adhere to international standards for testing and calibration in veterinary laboratories.

Course Topics
- Implementation and maintenance of international standards for testing and calibration laboratories.
- Introduction to the iVetNet Information Platform.
- International Standards for Testing and Calibration Laboratories.
- Utilizing iVetNet for ISO17025 Implementation.
- Maintenance of ISO17025 Standards in Veterinary Laboratories.

Who should attend?
- Laboratory technical staff from animal health institutions.

Details
- Duration: 5 days
- Group Size: 5 to 10 participants
- Prerequisites: Experience in the relevant techniques for detection of the targeted pathogens.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English, Spanish
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Course on Peste des Petits Ruminants (PPR): Control Strategies, Epidemiology and Detection Using Serology and Molecular Diagnostics

Purpose
- To train participants on control strategies including epidemiological tools and molecular and serological techniques for the diagnostics of Peste des Petits Ruminants (PPR), enhancing national and regional capacities in the surveillance, detection, and control of PPR.

Objectives
- To train animal health officers and epidemiologists on PPR control strategies.
- To equip participants with techniques for the diagnosis of PPR using serology and molecular diagnostics.
- To enhance participants' abilities to improve national and regional surveillance, detection, and control of PPR.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand and implement control strategies for PPR.
- Use epidemiological tools for the surveillance and detection of PPR.
- Apply molecular and serological techniques for the diagnosis of PPR.
- Improve national and regional capacities in the surveillance, detection, and control of PPR.

Course Topics
- Introduction to PPR.
- Epidemiology of PPR.
- Control strategies for PPR.
- Diagnostic techniques for PPR: Serology.
- Diagnostic techniques for PPR: Molecular Diagnostics.
- Surveillance methods for PPR.
- Case studies and practical sessions on PPR diagnosis and control.
- Developing national and regional PPR control programs.
- Enhancing surveillance and detection capabilities.

Who should attend?
- Scientists and technicians from animal health institutions.
- Epidemiologists working in the Head Veterinary Authorities.

Details
- Duration: 14 days
- Group Size: 22 to 32 participants
- Prerequisites: Knowledge in animal diseases diagnostics.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Early Detection and Characterization of Animal Diseases in Post Flooding Environment, with Emphasis on Water Borne and Vector Borne Diseases

Purpose
- To equip participants with knowledge and skills to detect, diagnose, and characterize animal diseases in post-flooding environments, focusing on waterborne and vector-borne, animal and zoonotic diseases.

Objectives
- To train participants in the diagnosis of especially dangerous and zoonotic animal diseases in post-flooding environments.
- To enhance participants' understanding of serological and molecular testing techniques for disease detection.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Conduct effective diagnosis of especially dangerous animal and zoonotic diseases using serological and molecular techniques.
- Apply epidemiological surveillance methodologies specific to post-flooding environments.

Course Topics
- Overview of post-flooding environmental impacts on animal health.
- Epidemiological surveillance in post-flooding environments.
- Techniques for serological testing in animal disease diagnosis.
- Molecular testing methodologies for zoonotic and dangerous diseases.
- Control and prevention of waterborne and vector-borne diseases.

Who should attend?
- Scientists and technicians from animal health institutions. Epidemiologists working in the Head Veterinary Authorities.

Details
- Duration: 10 days
- Group Size: 10 to 20 participants
- Prerequisites: Knowledge in animal diseases diagnostics.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Course on Verification and Calibration of Biosafety Cabinets

Purpose
- To develop participants' skills in the verification and calibration of biosafety cabinets to ensure safe and efficient laboratory operations.

Objectives
- To train participants in the principles and procedures for verifying biosafety cabinets.
- To enhance participants' skills in calibrating biosafety cabinets to meet international safety standards.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Verify biosafety cabinet performance in accordance with applicable safety standards and protocols.
- Calibrate biosafety cabinets to ensure optimal containment and operational efficiency.

Course Topics
- Introduction to biosafety cabinets and their role in laboratory safety.
- Verification procedures for biosafety cabinets.
- Calibration techniques for biosafety cabinets.
- International standards for biosafety cabinet operation and maintenance.

Who should attend?
- Technical staff from animal health institutions.

Details
- Duration: 5 days
- Group Size: 10 to 30 participants
- Prerequisites: Veterinary laboratory biosafety system knowledge.
- Lead Time: 6 months
- Training Provider: Animal Production and Health Laboratory
- Completion Rules: A discussion at the end of the training.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: APHL.Training@iaea.org

Analytical Methods to Detect and Control Organic Contaminants in Food

Purpose
- To equip participants with hands-on expertise in analytical methods for detecting and controlling organic contaminants such as mycotoxins and residues of pesticides and veterinary drugs in food.

Objectives
- To enhance participants' capacities in utilizing chromatography-mass spectrometry techniques for detecting, quantifying, and confirming the presence of organic chemicals (e.g., contaminants, such as mycotoxins, and residues of pesticides and veterinary drugs) in food.
- To equip participants with the skills needed for routine control of agrochemical residues and chemical contaminants in food.
- To prepare participants to respond effectively to food safety challenges, where rapid detection and identification of the causal agents are paramount.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand the fundamental principles of food sample analysis for contaminant detection and control.
- Apply chromatography-mass spectrometry techniques in real laboratory settings.
- Employ stable isotope-labelled internal standards to enhance method performance.
- Execute sample preparation and treatment techniques with proficiency.
- Implement data treatment methods effectively.
- Optimize instrumental analysis for accurate food testing.
- Implement laboratory quality control procedures to ensure the generation of reliable data.
- Demonstrate proficiency in implementing routine control measures for agrochemical residues and chemical contaminants in food.

Course Topics
- Application of Gas and Liquid Chromatography with Tandem Mass Spectrometry for Controlling Food Residues and Contaminants.
- Principles of Using Stable Isotope-Labelled Internal Standards for Method Enhancement.
- Food Sample Preparation and Treatment.
- Optimization of Instrumental Analysis.
- Data Treatment Techniques.
- Laboratory Quality Control Procedures for Reliable Data Production.

Who should attend?
- Laboratory analysts with at least a first university degree in chemistry, analytical chemistry, food science and at least 3 years of experience in an analytical laboratory.

Details
- Duration: 10 days
- Group Size: 5 to 20 participants
- Prerequisites: This course is open for participants who have basic experience in the operation of chromatography instruments with mass spectrometric detection for the control of food contaminants and residues.
- Lead Time: 8 months
- Training Provider: Food Safety and Control Laboratory
- Completion Rules: Entry test and exit test.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: FSCL.Training@iaea.org

Use of Stable Isotope Ratio Mass Spectrometry to Determine Food Origin and Verify Food Authenticity

Purpose

- To equip participants with the necessary knowledge and skills to utilize stable isotope ratio mass spectrometry for the verification of food origin and authenticity. This capacity building effort will enhance surveillance and research laboratory capabilities among participants.

Objectives

- To enable participants to proficiently apply stable isotope ratio mass spectrometry (IRMS) in assessing food authenticity and origin.
- To familiarize participants with standard sample preparation techniques.
- To ensure participants can effectively operate and maintain IRMS instrumentation.
- To instil the principles of good laboratory practices specifically related to IRMS.
- To equip participants with the ability to evaluate and interpret IRMS-generated data for food authenticity and origin determination.

Course Level

- Fundamental

What will participants gain?

Upon course completion, participants should be able to:

- Apply stable isotope ratio mass spectrometry to assess the authenticity and origin of food products effectively.
- Proficiently conduct sample preparation and treatment following best practices.
- Operate and maintain IRMS instrumentation proficiently.
- Utilize analytical methods, calibration, data processing, and quality control for food authenticity verification.
- Follow good laboratory practices for IRMS analysis.
- Evaluate and interpret IRMS data accurately.
- Apply official methods and protocols for IRMS analysis.

Course Topics

- Principles of stable isotope incorporation into food as indicators of authenticity and origin.
- Sample preparation and treatment techniques.
- Instrumentation and maintenance procedures for IRMS.
- Application of good laboratory practices relevant to IRMS.
- Data evaluation and elaboration methods.
- Additionally, the program will provide theoretical and hands-on training in IRMS within the framework of official methods and protocols, including but not limited to:
  - AOAC Official Method 998.12 - C4 plant sugar detection in honey.
  - CEN ENV 12140 - Fruit and vegetable juices - Determination of the stable carbon isotope ratio (13C/12C) of sugars from fruits juices - Method using isotope ratio mass spectrometry.
  - CEN EN 16466-2 - Vinegar - Isotopic analysis of acetic acid and water - Part 2: 13C-IRMS analysis of acetic acid.
  - IRMS strategies for food origin analysis.
- Upon completing the course, participants will possess the knowledge and skills necessary to employ nuclear technology effectively for assessing food authenticity and origin, thereby enhancing their laboratory capabilities.

Who should attend?

- Laboratory analysts and regulatory personnel in the field of testing for food authenticity and geographical origin.

Details

- Duration: 10 days
- Group Size: 10 to 20 participants
- Prerequisites: Candidates will ideally have been working with IRMS for a few months or be in the process of acquiring IRMS equipment.
- Lead Time: 6 months
- Training Provider: Food Safety and Control Laboratory
- Completion Rules: Active participation in laboratory hands-on exercises. Completion of data processing tutorials and full attendance.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details : FSCL.Training@iaea.org

Use of Nuclear, Isotopic and Complementary Techniques in Assessing Food Authenticity and Origin

Purpose

- To introduce rapid screening and confirmatory nuclear, isotopic, and complementary techniques for food authenticity and origin assessments, enhancing the capabilities of scientists and laboratory personnel to respond effectively to food safety and fraud incidents while improving food control systems.

Objectives

- To introduce participants to the fundamentals of benchtop Fourier transform infrared and near-infrared (FT-IR and FT NIR) spectroscopy and portable NIR spectroscopy; Fourier transform infrared (FT-IR) and benchtop and portable Fourier transform near-infrared (FT-NIR) spectroscopy; Nuclear magnetic resonance (NMR) spectroscopy; Headspace gas chromatography - ion mobility spectrometry (HS-GC-IMS); Stable isotope analysis and their applications in verifying food authenticity and origin.
- To familiarize participants with experimental design and sample preparation for conducting food authenticity studies employing the above-mentioned techniques.
- To instruct and demonstrate sample analysis using the above-mentioned techniques.
- To guide participants through data pre-processing and interpretation methods.
- To demonstrate multivariate data analysis techniques.

Course Level

- Basic to intermediate

What will participants gain?

Upon course completion, participants should be able to:

- Understand the fundamentals of benchtop Fourier transform infrared and near-infrared (FT-IR and FT-NIR) spectroscopy and portable NIR spectroscopy; Nuclear magnetic resonance (NMR) spectroscopy; Headspace gas chromatography - ion mobility spectrometry (HS-GC-IMS); Stable isotope analysis and their applications for the verification of food authenticity and origin.
- Understand how to perform sample preparation and analysis using the above-mentioned techniques.
- Understand how to conduct data pre-processing and interpretation effectively.
- Understand how to perform multivariate data analysis for food authenticity applications.

Course Topics

- Selected applications will be presented to provide the participants with a basic to intermediate knowledge of techniques including:
- Benchtop Fourier transform infrared and near-infrared (FT-IR and FT NIR) spectroscopy and portable NIR spectroscopy.
- Benchtop nuclear magnetic resonance (NMR) spectroscopy.
- Ion mobility spectrometry (IMS).
- Stable isotope analysis.
- Data processing approaches and chemometrics to enable interpretation of the data.
- A dialogue and brainstorming session will be included at the end of the training, to give to the participants the opportunity to discuss the potential of the presented techniques to be applied in the region for priority food fraud issues in priority food commodities.

Who should attend?

- Research or technical personnel from food control or research laboratories.

Details

- Duration: 10 days
- Group Size: 10 to 25 participants
- Prerequisites: Hands-on experience in any of the above-mentioned analytical techniques would be an advantage.
- Lead Time: 6 months
- Training Provider: Food Safety and Control Laboratory
- Completion Rules: Active participation in laboratory hands-on exercises. Completion of data processing tutorials and full attendance. Exit test.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details : FSCL.Training@iaea.org

Irradiation and Dosimetry Procedures to Support Field Projects using the Sterile Insect Technique (SIT) for Plant and Livestock Pests and Human Disease Vectors

Purpose
- To equip participants with the knowledge and skills required to implement dosimetry and irradiation procedures effectively, tailored to the specific needs of SIT field projects, which may focus on particular targets such as plant pests, livestock pests, or human disease vectors (e.g., fruit flies, tsetse flies, or mosquitoes).

Objectives
- To provide participants with tailored training in dosimetry, irradiation, and handling procedures relevant to SIT projects, depending on the specific pest or vector targeted.
- To enhance participants' capabilities in irradiating and sterilizing major target groups.
- To promote networking and information exchange among participants, fostering shared knowledge and standardized approaches across regional SIT pilot trials.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Effectively implement dosimetry and irradiation procedures tailored to the specific needs of SIT programs targeting selected pests or vectors.

Course Topics
- Principles and applications of dosimetry tailored to SIT programmes.
- Irradiation techniques for targeted pest or vector control.
- Networking and collaboration to enhance SIT-based control efforts.

Who should attend?
- Participants with documented experience working on SIT and relevant qualifications.

Details
- Duration: 5 days
- Group Size: 7 – 20 participants
- Prerequisites: Technical staff involved in the implementation of SIT pilot projects and field activities and responsible for the irradiation process.
- Lead Time: 4 months
- Training Provider: Insect Pest Control Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: IPCL.Training@iaea.org

Introduction to Mutation Induction in Seed Crops

Purpose
- To provide participants with a foundational understanding of mutation induction, detection, and characterization techniques in seed crops for breeding applications.

Objectives
- To understand the principles of mutation induction.
- To learn common mutation induction techniques for seed crops.
- To explore potential applications in crop improvement.
- To master basic molecular biology techniques such as DNA isolation methods and PCR-based techniques for mutation detection.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Understand mutation induction for crop genetic variability.
- Identify mutation induction methods and their benefits in crop enhancement.
- Incorporate phenotyping methods into mutation breeding schemes.

Course Topics
- Principles of mutation induction.
- Mutation induction techniques for seed crops.
- Molecular biology techniques for mutation detection.
- Utilizing next generation sequencing for mutation detection, trait discovery and utilization.

Who should attend?
- Participants dealing with plant breeding research development activities.

Details
- Duration: 10 days
- Group Size: 8 to 12 participants
- Prerequisites: Plant breeding background.
- Lead Time: 6 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Photo: IAEA

Introduction to Mutation Induction in Vegetatively Propagated Crops (In Vitro Techniques) Basic

Purpose
- To provide participants with foundational knowledge and skills for mutation induction in vegetatively propagated crops, emphasizing basic in vitro techniques.

Objectives
- To understand the basics of mutation induction in vegetatively propagated crops.
- To learn and apply in vitro techniques, including the interplay of hormones, initiation of cultures, and maintenance.
- To learn and apply common in vitro mutagenesis techniques.
- To gain awareness of the potential applications and benefits of induced mutations in crop improvement.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Comprehend the fundamental principles of mutation induction and its applications for facultative and obligate vegetatively propagated crops (VPC).
- Demonstrate proficiency in basic in vitro techniques.
- Integrate in vitro techniques into mutation breeding programs effectively.
- Appreciate the potential applications of induced mutations in crop improvement, with a specific focus on VPCs.
- Independently isolate DNA from plant samples.
- Conduct simple PCR assays for mutation detection.

Course Topics
- Basics of mutation induction in vegetatively propagated crops.
- In Vitro techniques: Hormone interplay, culture initiation, and maintenance.
- Common In Vitro techniques for mutation induction.
- Applications and benefits of induced mutations in crop improvement.

Who should attend?
- Researchers with plant breeding background.

Details
- Duration: 10 days
- Group Size: 8 to 12 participants
- Prerequisites: Plant breeding background.
- Lead Time: 6-8 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Next Generation Methods in Mutation Detection and Breeding Applications

Purpose
- To provide advanced training for participants with expertise in molecular methods for mutation analysis in crops, equipping them with knowledge and skills in genomics approaches for mutation identification and molecular marker development.

Objectives
- To gain an in-depth understanding of molecular markers and their integration into mutation breeding through Marker-Assisted Selection (MAS).
- To implement advanced molecular techniques for mutation detection.
- To acquire knowledge of the first, second, and third generations of DNA sequencing technologies.
- To integrate and analyse data for comprehensive mutation analysis.
- To apply MAS in breeding processes and make molecular-level selections of breeding lines.
- To understand genomics approaches in Plant Mutation Breeding, including NGS-supported genetic mapping.
- To conduct amplicon sequencing with Oxford Nanopore long reads (hands-on).
- To develop molecular markers and utilize them for high-throughput genotyping (KASP, hands-on).
- To train participants on performing DNA sequencing experiments for mutation detection in target genes.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Demonstrate an understanding of molecular markers and their role in mutation breeding, focusing on MAS.
- Apply advanced molecular techniques for mutation detection.
- Utilize 1st, 2nd, and 3rd-generation DNA sequencing technologies for trait discovery and marker development.
- Integrate and analyse data for comprehensive mutation analysis.
- Use MAS techniques for informed molecular-level selections in breeding lines.
- Understand genomics approaches in plant mutation breeding, including NGS-supported genetic mapping.
- Gain practical skills in whole genome sequencing with Illumina short reads, amplicon sequencing with Oxford Nanopore long reads, sequencer setup, and data analysis on Linux. Develop molecular markers and use KASP for high-throughput genotyping.
- Implement Oxford Nanopore long-read sequencing technology.
- Set up and calibrate Oxford Nanopore sequencing equipment.
- Manage consumables for DNA sequencing experiments.
- Perform and analyse amplicon sequencing experiments.
- Detect mutations in target genes.

Course Topics
- Advanced molecular techniques for mutation detection.
- Concepts of marker-assisted selection (MAS) and its deployment in mutation breeding. Next-generation DNA sequencing technologies and their applications in trait discovery and marker development.
- Functional genomics tools and enabling technologies for genetic associations.
- Genomics approaches in plant mutation breeding, including NGS-supported genetic mapping. Whole genome sequencing with Illumina short reads (hands-on).
- Amplicon sequencing with Oxford Nanopore long reads (hands-on).
- Computer installation and sequencer setup. Data analysis for mutation discovery, long and short reads (hands-on, Linux computer).
- Molecular marker development and use for high-throughput genotyping (KASP, hands-on). Introduction to Oxford Nanopore long-read sequencing technology.

- Setting up Oxford Nanopore sequencing equipment. Procuring and managing consumables for DNA sequencing. Performing DNA extraction and preparation for sequencing.
- Overview of molecular biology techniques for sequencing. Bioinformatics tools and techniques for sequence analysis. Mutation detection using amplicon sequencing.
- Applications in crop improvement and biodiversity studies.
- Practical sessions on sequencing and data analysis.
- Case studies and troubleshooting common issues in sequencing.

Who should attend?

- Researchers and molecular biologists actively involved in hands-on research in plant breeding and molecular breeding.

Details

- Duration: 10 days
- Group Size: 8 to 12 participants
- Prerequisites: Participants should have basic knowledge of molecular biology techniques. They should be part of a mutation breeding program that has developed mutant traits and possess a background in molecular biology and/or bioinformatics. Practitioners in molecular biology are preferred. Basic knowledge of the Linux command line is helpful. Participants should bring a suitable laptop, and we can provide assistance in procurement.
- Lead Time: 8 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Molecular Marker Development through Fast-forward Genetics for Accelerated (Plant Mutation) Breeding

Purpose
- To equip participants with knowledge and skills in genomics approaches for mutation identification and molecular marker development.

Objectives
- To understand genomics approaches in Plant Mutation Breeding, including Next-Generation Sequencing (NGS) supported genetic mapping.
- To perform whole genome sequencing with Illumina short reads (hands-on).
- To conduct amplicon sequencing with Oxford Nanopore long reads (hands-on).
- To install and set up sequencing equipment.
- To analyse data for mutation discovery, both long and short reads (hands-on, Linux Computer).
- To develop molecular markers and utilize them for high-throughput genotyping (KASP, hands-on).

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Develop molecular markers for tagging mutant traits within their breeding programs.
- Understand genomics approaches in Plant Mutation Breeding, including NGS-supported genetic mapping.
- Acquire practical skills in whole genome sequencing with Illumina short reads, amplicon sequencing with Oxford Nanopore long reads, computer sequencer installation and setup, and data analysis for mutation discovery on Linux computers.
- Proficiently develop molecular markers and utilize KASP techniques for high-throughput genotyping.

Course Topics
- Genomics approaches in Plant Mutation Breeding, and NGS-supported genetic mapping.
- Whole genome sequencing with Illumina short reads (hands on).
- Amplicon sequencing with Oxford Nanopore long reads (hands on).
- Computer installation and sequencer setup.
- Data Analysis for mutation discovery, long and short reads (hands on, Linux Computer).
- Molecular Marker development and use for high-throughput genotyping (KASP, hands on).

Who should attend?
- Researchers dealing with plant breeding and molecular breeding.

Details
- Duration: 7 days
- Group Size: 10 to 12 participants
- Prerequisites: Applicants for this training should be part of a mutation breeding program that has developed mutant traits and possess basic background in molecular biology and/or bioinformatics. The participants must have attended the above mentioned intermediate level training.
- Lead Time: 8-10 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Diagnostics and Disease Detection for Sustainable Plant Health Solutions

Purpose
- To equip course participants with essential knowledge and skills related to mutation breeding and techniques for combating transboundary crop-pathogen incidences.

Objectives
- To strengthen participant's capacities to combat transboundary pest/ pathogens through early detection, new resistant varieties, and integrated management.
- To acquire hands-on skills in in vitro plant propagation for clonal and perennial crops.
- To optimize irradiation doses through radio-sensitivity tests for mutant population development.
- To perform transplanting of in vitro plantlets and prepare inoculum.
- To apply established methods for inoculating plantlets in the greenhouse using both liquid and solid inoculum.
- To conduct disease rating and phenotyping of inoculated plants.
- To utilize PCR-based molecular diagnostics and interpret the results.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Perform Loop Mediated Isothermal Amplification (LAMP) for rapid and quantitative detection methods.
- Effectively inoculate plantlets in the greenhouse using liquid and solid inoculum.
- Accurately perform disease rating and phenotyping of inoculated plants.
- Apply PCR-based molecular diagnostics for the detection of Foc TR4 disease and interpret the results.

Course Topics
- Basics of in vitro plant propagation for bananas.
- Radio-sensitivity tests to optimize irradiation doses and develop mutant populations in vegetatively propagated crops.
- Screening for TR4 disease and molecular detection methods using advanced tools.
- Scoring methods for disease rating and phenotyping of inoculated plants.

Who should attend?
- Researchers working on mutation breeding activities.

Details
- Duration: 10 days
- Group Size: 10 to 15 participants
- Prerequisites: Participants working on mutation breeding and crop improvement.
- Lead Time: 8-10 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Amplicon Sequencing with Oxford Nanopore Long-read Technology

Purpose
- To equip practitioners involved with molecular genetics laboratory work with the skills and knowledge to adopt Oxford Nanopore long-read DNA sequencing-technology in their respective institutes.

Objectives
- To guide participants through the process of setting up Oxford Nanopore sequencing equipment.
- To instruct participants on procuring necessary consumables for DNA sequencing.
- To train participants on performing DNA sequencing experiments for mutation detection in target genes.
- To cover applications of Oxford Nanopore technology across crop improvement, disease diagnostics, and biodiversity programs.

Course Level
- Expert

What will participants gain?
Upon course completion, participants should be able to:
- Implement Oxford Nanopore long-read sequencing technology in their home institutions.
- Set up and calibrate Oxford Nanopore sequencing equipment.
- Procure and manage consumables for DNA sequencing experiments.
- Perform and analyse amplicon sequencing experiments.
- Detect mutations in target genes using long-read sequencing.
- Apply Oxford Nanopore technology in the areas of crop improvement, disease diagnostics, and biodiversity studies.

Course Topics
- Introduction to Oxford Nanopore long-read sequencing technology.
- Setting up Oxford Nanopore sequencing equipment.
- Procuring and managing consumables for DNA sequencing.
- Performing DNA extraction and preparation for sequencing.
- Overview of molecular biology techniques for sequencing.
- Bioinformatics tools and techniques for sequence analysis.
- Mutation detection using amplicon sequencing.
- Case studies and troubleshooting common issues in sequencing.

Who should attend?
- Molecular Biologists actively involved in hands-on research.

Details
- Duration: 10 days
- Group Size: 8 to 12 participants
- Prerequisites: Participants should be practitioners in molecular biology. Basic knowledge of the Linux command line is helpful. Participant should bring a suitable laptop. PBGL can provide assistance in procurement.
- Lead Time: 8-10 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Functional Genomics in Mutation Research

Purpose
- To provide advanced training in functional genomics techniques for studying the effects of mutations on gene function.

Objectives
- To explore precision genetics tools for targeted mutations.
- To understand functional genomics approaches to assess gene expression and regulation.
- To apply systems biology approaches to unravel the molecular consequences of mutations.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Employ CRISPR-Cas9 and other genome-editing tools for targeted mutations.
- Understand advanced functional genomics techniques for gene expression analysis.
- Use systems biology approaches to study the molecular consequences of mutations.

Course Topics
- Next-generation DNA sequencing technologies and applications in trait discovery and marker development.
- Precision genetics tools for targeted mutations.
- Functional genomics approaches to gene expression and regulation.
- Systems biology approaches for studying molecular consequences of mutations.
- Practical sessions on CRISPR-Cas9 and other genome-editing tools.
- Enabling technologies for genetic associations.
- Case studies on functional genomics in mutation research.
- Data analysis and interpretation in functional genomics.

Who should attend?
- Researchers involved in mutation breeding.

Details
- Duration: 10 days
- Group Size: 8 to 10 participants
- Prerequisites: Participants with mutation breeding background and working knowledge of basic molecular biology techniques.
- Lead Time: 8-10 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Enabling Technologies for Mutation Induction in Vegetatively Propagated Crops (In Vitro Techniques). Advanced

Purpose
- To provide hands-on training in advanced in vitro techniques for mutation breeding in vegetatively propagated and perennial crops.

Objectives
- To master advanced tissue culture methods for random mutation induction.
- To learn different steps of culture initiation, including meristem and ECS cultures.
- To apply mutation induction methods (physical and chemical) on different type of in vitro material (meristems, embryogenic callus, cell suspensions etc).
- To evaluate efficiencies of doses applied on different type of in vitro material.
- To learn high-throughput in vitro systems, e.g. immersion techniques for mass generation of mutant plants.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Participants can independently implement advanced in vitro techniques for mutation breeding.
- Participants understand utilisation and integration of molecular tools for detection of induced mutations.
- Participants can apply advanced in vitro techniques to their specific crops of interest.

Course Topics
- Advanced tissue culture methods for mutation induction.
- Culture initiation techniques: meristems and embryogenic cell suspensions.
- Application of physical and chemical mutagens to in vitro materials.
- Dose-response evaluation for in vitro mutation induction.
- High-throughput in vitro systems for large-scale mutant plant production.
- Molecular tools for detecting and characterising induced mutations.
- Practical applications of in vitro techniques for specific crops.

Who should attend?
- Researchers dealing with plant breeding and tissue culture.

Details
- Duration: 8 days
- Group Size: 8 to 10 participants
- Prerequisites: Participants have basic knowledge of tissue culture and have prior experience working with clonal crops.
- Lead Time: 8 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Advanced Strategies with Microbial Mutagenesis Towards Developing Biologicals for Crop Improvement (Integration Techniques)

Purpose
- To provide advanced knowledge and skills to participants focusing on strategies involving microbial cultures and biologicals for crop improvement, emphasizing integration techniques.

Objectives
- To explore microbial culture techniques for targeted crop enhancement.
- To understand the role of biologicals in sustainable agriculture and crop improvement.
- To integrate microbial cultures and biologicals into strategies for enhanced crop resilience and productivity.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Participants receive hands on microbial culture techniques for specific crops of interest.
- Participants understand and obtain skills in the principles and applications of biologicals in crop improvement.
- Participants can design and implement integrated strategies for enhanced crop resilience and productivity.

Course Topics
- Microbial mutagenesis for crop improvement.
- Techniques for culturing beneficial microorganisms.
- Role of biologicals in sustainable agriculture.
- Integration of microbial cultures and biologicals into crop strategies.
- Designing strategies for enhanced crop resilience and productivity.
- Practical applications and case studies.

Who should attend?
- Researchers with plant science background.

Details
- Duration: 8 days
- Group Size: 8 to 10 participants
- Prerequisites: Participants with basic knowledge of plant pathology/ microbiology.
- Lead Time: 8-10 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Annual Advanced Update on Innovative Methods in Plant Mutation Breeding: What's New?

Purpose
- To provide an annual forum for plant mutation breeders to receive updates on the latest methods developed within Plant Breeding and Genetics Laboratory research group, fostering knowledge exchange and collaboration.

Objectives
- To share recent protocols developed and advancement in mutation induction and detection techniques developed by Plant Breeding and Genetics Laboratory.
- To provide update with cutting-edge in vitro, mutation induction, molecular and phenotyping methods.
- To facilitate discussions on the integration of innovative methods into practical mutation breeding programs; annual efficient and immediate transfer of techniques developed (strengthen the mutation breeding network).

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Participants gain insights into the latest methods developed by PBGL for mutation induction and detection in plant breeding.
- Participants can implement new methods developed by the PBGL team in their breeding programmes.

Course Topics
- Latest advancements in mutation induction techniques.
- Updates on molecular and phenotyping methods in mutation breeding.
- Cutting-edge in vitro methods for plant breeding applications.
- Recent protocols developed by the Plant Breeding and Genetics Laboratory.
- Integration of innovative methods into practical mutation breeding programs.
- Case studies and success stories of technique application in breeding programs.
- Strengthening the mutation breeding network through knowledge exchange.

Who should attend?
- Participants working on crop mutation breeding.

Details
- Duration: 10 days
- Group Size: 8 to 10 participants
- Prerequisites: Participants with extensive mutation breeding experience.
- Lead Time: 8-10 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Hands-on Workshop on Technological Enhancements in Area of Mutation Breeding

Purpose
- To provide an annual hands-on workshop for participants to implement and apply the latest mutation breeding methods developed by PBGL.

Objectives
- To guide participants in the practical application of newly developed mutation induction and detection techniques.
- To demonstrate the use of such tools for mutant selection.
- To foster collaboration and knowledge sharing among participants (strengthen the mutation breeding network).

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Participants can independently implement new techniques.
- Participants establish connections and collaborations with peers in the field.

Course Topics
- Practical application of advanced mutation induction techniques.
- Tools and methods for efficient mutant detection and selection.
- Recent technological enhancements in mutation breeding.
- Step-by-step guidance on integrating new tools into breeding programs.
- Demonstrations of field and laboratory applications for mutant selection.
- Strategies for fostering collaboration and strengthening the mutation breeding network.
- Case studies showcasing successful implementation of innovative techniques.

Who should attend?
- Participants working on crop mutation breeding.

Details
- Duration: 10 days
- Group Size: 10 to 15 participants
- Prerequisites: Participants with extensive mutation breeding experience.
- Lead Time: 8-10 months
- Training Provider: Plant Breeding and Genetics Laboratory
- Completion Rules: Attendance and successful implementation of exercises during the course.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: PBGL.Training@iaea.org

Human Health

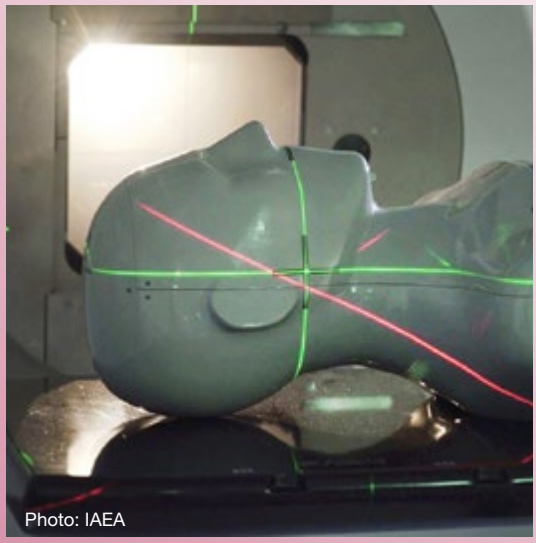

Photo: IAEA


Photo: IAEA

The Dosimetry Laboratory provides specialized training in radiotherapy and dosimetry, focusing on the precise measurement and safe application of ionizing radiation in medical treatments. These programmes are crafted to equip professionals with the latest techniques and quality assurance methods, ensuring accuracy in radiation delivery for optimal patient outcomes in cancer care. Through hands-on learning and expert guidance, participants gain essential skills to maintain high standards in radiotherapy, contributing to improved safety and effectiveness in healthcare settings.

Implementation of Small Field Dosimetry Code of Practice International Atomic Energy Agency (IAEA) Technical Reports Series (TRS) 483

Purpose
- To equip participants with comprehensive knowledge and skills related to the implementation of the IAEA TRS 483 code of practice for small field dosimetry in various forms of radiotherapy.

Objectives
- To understand the physics of small field dosimetry in the context of different radiotherapy techniques.
- To apply the IAEA TRS 483 code of practice effectively in clinical practice across various forms of radiotherapy, including Intensity-Modulated Radiation Therapy (IMRT), Volumetric Modulated Arc Therapy (VMAT), Stereotactic Radiosurgery (SRS), Stereotactic Radiotherapy (SRT), and Stereotactic Body Radiotherapy (SBRT).

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Perform small field measurements following the guidelines outlined in IAEA TRS 483, using appropriate detectors and correction factors.
- Analyse various types of detectors commonly employed in small field dosimetry.
- Address fundamental issues encountered in small field dosimetry.
- Attain competency in radiotherapy medical physics, equipped with foundational knowledge and skills in small field dosimetry.

Course Topics
- Fundamentals of small field dosimetry physics.
- Concepts and formalism of IAEA TRS 483 for small field dosimetry.
- Detectors and equipment used in small field dosimetry for various radiotherapy techniques.
- Characteristics of Flattening Filter Free (FFF) beams.
- Measurements for small fields in linear accelerators (LINAC) using water tanks for reference and relative dosimetry.
- Techniques for uncertainty estimation in small field dosimetry.
- Practical case studies and real-world applications of small field dosimetry in radiotherapy.

Who should attend?
- Clinically Qualified Medical Physicists with basic knowledge in dosimetry with at least 3 years of experience in IMRT/VMAT/SRS/SRT.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Foundational knowledge in small field dosimetry.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of online lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Implementation of International Atomic Energy Agency (IAEA) Technical Reports Series (TRS) 398 Rev 1 for High Energy Photons and Electrons

Purpose
- To provide participants with a comprehensive understanding of the principles and applications of IAEA code of practice TRS 398 Rev 1 for high-energy photon and electron beam dosimetry and its recent updates.

Objectives
- To grasp the fundamentals of reference and relative dosimetry in high-energy photon and electron beams.
- To familiarize participants with the key developments and revisions in IAEA TRS 398 Rev 1.
- To enable participants to implement the IAEA TRS 398 Rev 1 code of practice in their clinical practice.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Gain familiarity with the essential data and concepts outlined in ICRU 90 for radiation dosimetry.
- Perform dosimetry measurements following the guidelines of IAEA TRS 398 Rev 1, utilizing appropriate detectors and correction factors.
- Investigate and address fundamental dosimetry challenges relevant to absorbed dose to water standards.
- Acquire competence in radiotherapy medical physics, possessing basic knowledge and skills in dosimetry.

Course Topics
- Overview of IAEA TRS 398 Rev 1 and its significance.
- Principles of reference and relative dosimetry in high-energy photon and electron beams.
- Key developments and updates in TRS 398 Rev 1.
- Practical dosimetry measurements, including the use of suitable detectors and correction factors.
- Exploration of fundamental dosimetry issues relevant to absorbed dose to water standards.
- Absorbed dose to water standards – reasons for the update.
- Concepts and formalism of IAEA TRS 398 Rev 1.
- Practical use of the code of practice.
- Cross calibration of ionization chambers.
- Expression of uncertainties.

Who should attend?
- Clinically Qualified Medical Physicist with basic knowledge of dosimetry, Metrologists working in dosimetry laboratories.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Foundational knowledge in dosimetry of ionizing radiation.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Implementation of International Atomic Energy Agency (IAEA) Dosimetry Code of Practice Technical Reports Series (TRS) 492 and Brachytherapy Physics

Purpose
- To provide participants with the knowledge and skills necessary for implementing the new international code of practice for brachytherapy dosimetry.

Objectives
- To implement the new international code of practice for Brachytherapy dosimetry.
- To understand the principles and concepts of dosimetry in Brachytherapy.
- To equip participants with the skills to perform well-type chamber calibration, source strength measurement, and estimate uncertainties in Brachytherapy applications.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Familiarize themselves with the quantities and units used in Brachytherapy.
- Understand the instrumentation and framework of the new dosimetry framework and formalism.
- Apply the code of practice for well-type chamber calibration and source strength measurement.
- Estimate uncertainties and apply reference quantities in the hospital.

Course Topics
- Sources used in Brachytherapy.
- Quantities and units in Brachytherapy.
- Instrumentation for Brachytherapy dosimetry.
- Dosimetry framework and formalism in Brachytherapy.
- Code of practice for well-type chamber calibration and source strength measurement.
- Estimation of uncertainties in Brachytherapy dosimetry.

Who should attend?
- Clinically Qualified Medical Physicists and Radiation Metrologists with experience in Brachytherapy.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Foundational knowledge in Brachytherapy dosimetry.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Radiotherapy Dosimetry Audits for Patient Safety and Quality

Purpose

- To enhance the knowledge and skills of participants in radiotherapy dosimetry audit, promote collaboration and scientific exchange among dosimetry audit specialists and clinical radiotherapy medical physicists, and facilitate the implementation of radiotherapy dosimetry audit methodologies based on International Atomic Energy Agency (IAEA) guidance.

Objectives

- To improve participants' understanding of radiotherapy dosimetry audits and their role in quality assurance.
- To provide participants with a comprehensive overview of different dosimetry audit types and methodologies.
- To equip participants with the knowledge and tools necessary for implementing IAEA guidelines for establishing a national dosimetry audit network.
- To familiarize participants with passive solid-state dosimetry systems - thermoluminescent dosimeters (TLD), optically stimulated luminescent dosimeters (OSLD), radiophotoluminescent dosimeters (RPLD), film - and their applications in dosimetry audits.
- To train participants in IAEA methodologies for remote dosimetry audits.
- To enable participants to conduct on-site End-to-End 3D Conformal Radiotherapy (CRT) and Intensity-Modulated Radiotherapy (IMRT) audits, including practical sessions.
- To teach participants how to estimate uncertainties in dosimetry audits.
- To guide participants in reporting audit results and taking appropriate actions when results are out of tolerance.
- To provide insights into quality management systems for dosimetry audits.
- To explore novel approaches to dosimetry auditing.

Course Level

- Intermediate

What will participants gain?

Upon course completion, participants should be able to:

- Demonstrate a solid understanding of radiotherapy dosimetry audits, accuracy requirements, and quality assurance in radiotherapy.
- Differentiate between various dosimetry audit types and methodologies, and apply them effectively.
- Implement IAEA guidelines for establishing a national dosimetry audit network, including its structure, operation, and resource requirements.
- Utilize passive solid-state dosimetry systems (TLD, OSLD, RPLD, film) in dosimetry audits.
- Execute IAEA methodologies for remote dosimetry audits.
- Perform on-site End-to-End IMRT audits, and accurately estimate uncertainties.
- Prepare comprehensive audit reports and take appropriate actions when audit results are out of tolerance.
- Establish and manage quality management systems specific to dosimetry audits.
- Explore innovative approaches to dosimetry auditing.

Course Topics

- Status and global availability of radiotherapy dosimetry audits.
- Accuracy requirements and Quality Assurance in radiotherapy.
- Dosimetry audit types and methodologies.
- IAEA guidelines for establishing national dosimetry audit network – structure, operation, and resources.
- Basics of passive solid-state dosimetry (TLD, OSLD, RPLD, film) systems.
- IAEA methodologies of remote dosimetry audits.
- On-site End-to-End 3D CRT and IMRT audits, including practical sessions.
- Uncertainty estimation.
- Reporting results and following up results out of tolerance.

- Quality management system for dosimetry audits.
- Novel approaches to auditing.

Who should attend?

- Radiotherapy dosimetry audit providers, medical physicists involved in audits or interested in setting up a radiotherapy dosimetry audit programme or expanding their knowledge in this field.

Details

- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Foundational knowledge in dosimetry and quality assurance in radiotherapy.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Commissioning and Quality Assurance of Treatment Planning System for Stereotactic Body Radiotherapy (SBRT), Stereotactic Radiosurgery (SRS), and Stereotactic Radiotherapy (SRT)

Purpose
- To provide course participants with a comprehensive understanding of the commissioning and Quality Assurance (QA) requirements for treatment planning systems used in SBRT, SRS, and SRT, with a focus on clinical implementation and validation.

Objectives
- To acquire a detailed understanding of the commissioning requirements specific to SBRT, SRS, and SRT.
- To gain knowledge about the clinical implementation of treatment planning systems for these modalities.
- To learn the process of clinical validation for SBRT, SRS, and SRT.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand the devices used for delivering SBRT, SRS, and SRT treatments.
- Perform the commissioning of treatment planning systems for SBRT, SRS, and SRT effectively.
- Recognize the complexities associated with small field dosimetry.
- Apply routine quality assurance and quality control procedures for SBRT, SRS, and SRT.
- Conduct patient-specific QA for these treatment modalities.
- Demonstrate proficiency in treatment planning for commonly encountered SBRT/SRS clinical scenarios.

Course Topics
- Physics of stereotactic body radiotherapy.
- Overview of small field dosimetry.
- Commissioning of treatment planning systems for SBRT, SRS, and SRT.
- Clinical validation processes.
- Imaging protocols.
- Quality Assurance techniques.
- Treatment planning for common clinical scenarios in SBRT/SRS.
- Patient-specific quality assurance.

Who should attend?
- Clinically Qualified Medical Physicists with a minimum of 3 years of experience in SBRT, SRS and SRT.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Foundational knowledge in small field dosimetry, and clinical application of SRS and SRT.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Commissioning and Quality Assurance of Treatment Planning Systems for Intensity Modulated Radiotherapy (IMRT) and Volumetric Modulated Radiotherapy (VMAT)

Purpose
- To equip participants with the knowledge and skills necessary for the safe and effective implementation of IMRT and VMAT.

Objectives
- To facilitate the safe and comprehensive commissioning of IMRT and VMAT treatment planning systems.
- To familiarize participants with quality assurance and quality control processes specific to IMRT and VMAT.
- To enhance participants' proficiency in treatment planning, including optimization and dose volume constraints.
- To provide insights into imaging protocols and their relevance in IMRT/VMAT.
- To foster a deeper understanding of clinical case discussions related to IMRT and VMAT.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Justify the rationale for utilizing IMRT and VMAT in radiation therapy.
- Specify the essential beam data requirements for accurate IMRT and VMAT planning.
- Conduct dosimetry and commissioning procedures for IMRT and VMAT treatment planning systems.
- Execute treatment planning processes and optimization techniques for IMRT and VMAT modalities.
- Evaluate treatment plans for IMRT and VMAT in a clinical context.
- Implement patient-specific quality assurance measures tailored to IMRT and VMAT.
- Apply dose value constraints and understand their clinical significance.
- Interpret imaging protocols and their role in IMRT and VMAT.
- Engage in meaningful clinical case discussions relevant to IMRT and VMAT.
- Assess the impact of motion and geometrical uncertainties in IMRT/VMAT treatment planning.

Course Topics
- Rationale for IMRT and VMAT in modern radiation therapy.
- Beam data requirements for IMRT and VMAT.
- Dosimetry and commissioning procedures for treatment planning systems.
- Treatment planning principles and optimization techniques.
- Evaluation of treatment plans for IMRT and VMAT.
- Patient-specific quality assurance strategies for IMRT and VMAT.
- Significance of dose volume constraints in clinical practice.
- Understanding imaging protocols and their role in treatment planning.
- Clinical case discussions highlighting IMRT and VMAT applications.
- Considerations related to motion management and geometrical uncertainties in IMRT/VMAT.

Who should attend?
- Clinically Qualified Medical Physicists with basic experience in quality assurance and dosimetric measurements for conventional radiotherapy, have a general knowledge of treatment planning for 3DCRT.

Details

- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Foundational knowledge in commissioning and quality assurance practices.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Artificial Intelligence in Ionizing Radiation for Medical Physicists

Purpose
- To equip medical physicists with the theoretical knowledge and skills necessary for the safe and effective implementation of AI-based technologies in radiation medicine.

Objectives
- To provide medical physicists with a contemporary overview of AI-based clinical applications.
- To introduce medical physicists to theoretical principles essential for the conscious implementation of AI-based tools in radiation medicine.
- To familiarize participants with practical aspects of integrating AI into medical physics practice.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Demonstrate a comprehensive understanding of the theoretical principles of Artificial Intelligence as applied to Medical Physics in radiation medicine.
- Develop the skills necessary to assess and choose suitable AI-based tools tailored to specific clinical scenarios in radiation medicine, ensuring their safe and effective utilization.

Course Topics
- Overview of AI-based clinical applications.
- Statistical methods in AI.
- Data management, curation, and quality assurance for AI applications.
- Machine learning models and analytics tools.
- Introduction to deep learning.
- Clinical implementation of AI-based tools in radiation medicine.

Who should attend?
- Clinically Qualified Medical Physicists and Medical Physics Residents.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Basic understanding of AI and relevant applications in Medical Physics.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Film Dosimetry in Radiotherapy

Purpose
- To provide participants with the necessary knowledge and skills to effectively utilize film dosimetry for quality assurance in radiotherapy.

Objectives
- To understand and implement best practices for accurate and consistent measurements using film dosimetry.
- To become proficient in handling film, including calibration and processing.
- To commission and operate film scanners for dose reporting.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Apply best practices for precise and consistent measurements using film dosimetry.
- Demonstrate proficiency in handling film, from preparation to processing.
- Successfully commission and operate film scanners for accurate dose reporting.

Course Topics
- Overview of radiochromic film dosimetry.
- Good practice guidelines for film dosimetry.
- Film handling techniques.
- Scanner commissioning.
- Calibration methods and their impact.
- Uncertainties.

Who should attend?
- Clinically Qualified Medical Physicists with basic understanding of film dosimetry.

Details
- Duration: 5 days
- Group Size: 10 to 15 participants
- Prerequisites: Foundational knowledge in film dosimetry and its applications in radiotherapy.
- Lead Time: 6 months
- Training Provider: Dosimetry Laboratory
- Completion Rules: Successful completion of lectures and assessment.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: DOL.Training@iaea.org

Water Resources

The IAEA, through its Water Resources Programme is committed to advancing the science of isotope hydrology for comprehensive water resource assessment and sustainable management. At the forefront of this initiative is the Isotope Hydrology Laboratory, a centre of excellence specializing in utilizing water's natural isotopic "fingerprint" to map and determine the source, age, movement, and interactions of water systems. Through our extensive expertise and specialized training programmes, we equip countries with the knowledge and tools necessary to leverage isotope hydrology effectively. Our laboratory provides analytical services and training opportunities, empowering nations to enhance their capacity in water resource management and contribute to global water sustainability efforts.

Photo: IAEA

Training Course on the Fundamentals of Tritium Analysis and Data Processing for Hydrological Applications: Part 1

Purpose
- To provide participants with fundamental knowledge and understanding of tritium analysis in water samples for hydrological applications. Additionally, participants will be trained in the use of the Tritium Information System (TRIMS), a laboratory management software designed for standardized tritium analysis.

Objectives
- To introduce the theoretical concepts of measuring environmental radioactivity using liquid scintillation counting.
- To familiarize participants with tritium electrolytic enrichment and the use of tritium enrichment units.
- To introduce the use of deuterium and laser spectrometry for determining the enrichment factor.
- To introduce and train participants in the use of TRIMS for tritium data processing and reporting.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Understand the theoretical concepts of measuring environmental radioactivity using liquid scintillation counting.
- Comprehend tritium electrolytic enrichment techniques.
- Gain knowledge of the use of tritium enrichment units.
- Understand the use of deuterium and laser spectrometry to determine the enrichment factor.
- Operate TRIMS for tritium data processing and reporting.

Course Topics
- Overview of tritium analysis for hydrological applications.
- Liquid scintillation counting for tritium measurement in environmental waters.
- Tritium electrolytic enrichment techniques.
- Tritium enrichment units and their operation.
- Application of deuterium and laser spectrometry for enrichment factor determination.
- Quality assurance and quality control (QA/QC) in tritium analysis.
- Data processing and reporting using TRIMS for tritium analysis. tritium analysis.

Who should attend?
- Ideally the candidates should be technicians responsible for one or various stages of tritium measurement and/or reporting, or laboratory managers interested in future applications of the method.

Details
- Duration: 5 days, 3 hours per day
- Group Size: 5 to 10 participants
- Prerequisites: Participants should have a relevant technical / scientific profile showing proven experience in the analysis of environmental radioactivity or tritium for hydrological applications and good computational proficiency.
- Lead Time: 6 months
- Training Provider: Isotope Hydrology Laboratory
- Completion Rules: Participants are required to attend 60% of the course sessions and actively engage in discussion and exercises. It is necessary to complete a course evaluation to provide feedback on the course content, instructors, and overall learning experience. Passing a certification exam specific to the course is required.
- Language: English
- Location: Online
- Contact Details: IHL.Training@iaea.org

Training Course on the Fundamentals of Tritium Analysis and Data Processing for Hydrological Applications: Part 2

Purpose
- To advance participants' knowledge in tritium analysis for hydrological applications and provide hands-on experience in utilizing the Tritium Information Management System (TRIMS) for standardized tritium analysis, building upon the fundamental concepts covered in Part 1.

Objectives
- To instruct participants in the utilization of liquid scintillation counters for tritium analysis in environmental waters.
- To educate participants on tritium electrolytic enrichment techniques.
- To familiarize participants with the operation of tritium enrichment units.
- To demonstrate the application of deuterium and laser spectrometry for determining the enrichment factor.
- To train participants in the use of TRIMS for tritium data processing and reporting.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Perform tritium analysis in environmental waters using liquid scintillation counting.
- Understand the principles and techniques of tritium electrolytic enrichment.
- Operate tritium enrichment units proficiently.
- Apply deuterium and laser spectrometry to determine the enrichment factor.
- Effectively utilize TRIMS for tritium data processing and reporting.

Course Topics
- Introduction to tritium analysis and hydrological applications.
- Liquid scintillation counting for tritium measurement in environmental waters.
- Tritium electrolytic enrichment techniques.
- Operation of tritium enrichment units.
- Deuterium and laser spectrometry for enrichment factor determination.
- Quality assurance and quality control (QA/QC) in tritium analysis.
- Data processing and reporting using TRIMS for tritium analysis.

Who should attend?
- Ideally the candidates should be technicians or laboratory managers responsible for one or various stages of tritium measurement and/or reporting.

Details
- Duration: 5 days
- Group Size: 5 to 10 participants
- Prerequisites: Completion of Part 1 of the course.
- Lead Time: 6 months
- Training Provider: Isotope Hydrology Laboratory
- Completion Rules: Participants are required to attend 60% of the course sessions and actively engage in discussion and exercises. It is necessary to complete a course evaluation to provide feedback on the course content, instructors, and overall learning experience.
- Language: English
- Location: Vienna, Austria
- Contact Details: IHL.Training@iaea.org

Training Course on Water Isotope Analysis by Laser Spectroscopy

Purpose
- To enhance participants' proficiency in installing, operating, maintaining, and processing data from laser instruments for water stable isotope analysis.

Objectives
- To provide comprehensive hands-on training in the installation, operation, and maintenance of laser spectrometry analyzers for the analysis of stable isotopes of water.
- To train participants in isotope data post-processing, Quality Assurance/Quality Control (QA/QC) practices, and the use of the Laboratory Information Management System for Lasers (LIMS) software, a laboratory management system designed for the standardized analysis of oxygen-18 and deuterium in water samples.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Install, operate, and maintain laser spectrometry analyzers for the analysis of stable isotopes of water.
- Carry out data post-processing and apply QA/QC practices.
- Utilize the Laboratory Information Management System for Lasers (LIMS) software for the standardized analysis of oxygen-18 and deuterium in water samples.

Course Topics
- Overview of isotopes and isotope hydrology fundamentals.
- Overview of Los Gatos Research (LGR) and Picarro laser spectrometry measurement technologies.
- Self-installation of Los Gatos and/or Picarro instruments, autosampler, and peripherals in the laboratory.
- Overview of Los Gatos and Picarro software interfaces and options.
- Utilize LIMS for Lasers 2015 Data Processing Software (e.g., installation, adding instruments, customization, and preparation of analysis templates).
- Client data reporting, audits, invoicing, QA/QC monitoring.
- Client sample submission spreadsheets.
- Maintenance of autosampler, calibration, and repair.
- Vaporizer and injector block issues (e.g., troubleshooting, cleaning and maintenance).
- Introduction to Picarro ChemCorrect Software.
- Introduction to Los Gatos Research Spectral Contamination Identifier Software.
- CTC Pal maintenance and repair.
- Preparation and storage of measurement and lab standards.
- Laboratory working standard calibration to VSMOW/SLAP scales.

Who should attend?
- Selection priority is given to technical staff of counterparts of IAEA Technical Cooperation projects currently conducting stable isotope analysis by laser spectrometry. External participants are accepted based on space availability and at their own cost.

Details
- Duration: 5 days
- Group Size: 5 to 10 participants
- Prerequisites: Participants should have a relevant or a technical/scientific profile showing proven previous experience in the analysis of stable isotopes for hydrological or climatological applications. It is highly recommended that the candidates are the technicians directly responsible for stable isotopes measurement and/or reporting, with good computational proficiency.
- Lead Time: 6 months
- Training Provider: Isotope Hydrology Laboratory
- Completion Rules: None.
- Language: English
- Location: Vienna, Austria
- Contact Details: IHL.Training@iaea.org

Training Course on Nitrate Isotope Analysis by Laser Spectroscopy and Isotope Ratio Mass Spectroscopy: Part 1

Purpose

- To provide participants with an understanding of how nitrogen and oxygen isotopes of nitrate can be used in isotope hydrology. To enhance the proficiency of participants in sample collection and preservation. To introduce participants to the methods available for nitrate isotopic analysis via laser spectroscopy and isotope ratio mass spectrometry.

Objectives

- To provide participants with a comprehensive understanding of the theoretical principles behind nitrate isotope analysis.
- To equip participants with the knowledge and skills required for proper sample collection, preservation, and shipping.
- To introduce participants to various laboratory techniques for measuring nitrate concentration and preparing samples for isotopic analysis.

Course Level

- Fundamental

What will participants gain?

Upon course completion, participants should be able to:

- Understand why nitrate isotopes are used in hydrological studies.
- Learn how to collect and preserve samples for nitrate isotopic analysis.
- Familiarize themselves with various methods for measuring the concentration of nitrate, nitrite, and other nitrogen-bearing species in water.
- Gain knowledge of various methods used to convert nitrate to nitrous oxide for isotopic analysis.
- Learn the principles of nitrate isotopic analysis by laser spectroscopy and isotope ratio mass spectrometry.

Course Topics

- Overview of the use of nitrate stable isotopes in hydrological studies.
- Guidelines for sampling methods and sample preservation.
- Methods for measuring nitrate concentration.
- Preparation of samples for nitrate isotopic analysis with an emphasis on the Ti reduction method.
- Nitrate isotopic analysis by laser spectroscopy and isotope ratio mass spectrometry (pros and cons).

Who should attend?

- Researchers and water resource managers who want to learn more about the use of nitrate in isotope hydrology as well technicians who will carry out the analyses and who will want to move on to Part 2.

Details

- Duration: 5 days, 3 hours per day
- Group Size: 10 to 20 participants
- Prerequisites: Participants should have a relevant or a technical/scientific profile showing proven previous experience in the analysis of stable isotopes for hydrological or climatological applications. It is highly recommended that the candidates are the technicians directly responsible for stable isotopes measurement who have a good computational proficiency.
- Lead Time: 6 months
- Training Provider: Isotope Hydrology Laboratory
- Completion Rules: An assignment will need to be submitted.
- Language: English
- Location: Online
- Contact Details: IHL.Training@iaea.org

Training Course on Nitrate Isotope Analysis by Laser Spectroscopy and Isotope Ratio Mass Spectrometry: Part 2

Purpose
- To enhance the proficiency of participants in the chemical preparation of samples for nitrate isotope analysis, as well as the operation, maintenance, and data processing functions related to nitrate isotope analysis via laser spectroscopy and isotope ratio mass spectrometry. This course focuses on hands-on training.

Objectives
- To provide participants with hands-on experience in the analysis of nitrate isotopes so that they can set up and run a laboratory facility for this type of analysis.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Analyze the nitrate concentration of water samples using ion chromatography.
- Choose and prepare nitrate isotopic standards.
- Chemically convert dissolved nitrate to nitrous oxide using the Ti reduction method.
- Operate, maintain, and troubleshoot a laser spectroscopy analyzer designed for the analysis of nitrous oxide.
- Analyze the isotopic composition of nitrous oxide via isotope ratio mass spectrometry.
- Post-process data from both laser and mass spectrometry systems, as well as conduct QA/QC.

Course Topics
- Brief review of the use of nitrate stable isotopes in hydrological studies, as well as sampling methodologies.
- Measuring nitrate concentration by ion chromatography.
- Conversion of nitrate to nitrous oxide using the Ti reduction method.
- Nitrate isotopic analysis by laser spectroscopy and isotope ratio mass spectrometry.
- Data reduction, quality control, and troubleshooting.

Who should attend?
- Technicians who are directly responsible for the analysis of stable isotope samples.

Details
- Duration: 5 days
- Group Size: 5 to 10 participants
- Prerequisites: Participants must have taken Part 1 of this course.
- Lead Time: 6 months
- Training Provider: Isotope Hydrology Laboratory
- Completion Rules: None.
- Language: English
- Location: Vienna, Austria
- Contact Details: IHL.Training@iaea.org

Training Course on the Use of the Noble Gases in Hydrological Studies: Part 1

Purpose
- To provide an introduction to the applications of noble gas isotopes in hydrology, impart foundational knowledge in groundwater dating using noble gas isotopes, and offer practical training in handling and interpreting noble gas isotope data from groundwater samples.

Objectives
- To introduce participants to the role and significance of noble gases in isotope hydrology.
- To provide basic knowledge on the principles of groundwater dating using noble gas isotopes.
- To offer hands-on training in data handling and interpretation of noble gas isotope data from groundwater samples.
- To facilitate the use of computer software for basic inverse modeling necessary for age and paleo-temperature calculations.
- To cover theoretical concepts related to the application of noble gas isotopes in environmental studies.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Understand and articulate the role and significance of noble gases in isotope hydrology.
- Apply basic principles of groundwater dating using noble gas isotopes in practical scenarios.
- Effectively handle and interpret noble gas isotope data from groundwater samples.
- Utilize computer software for basic inverse modeling tasks, aiding in age and paleo-temperature calculations.
- Grasp theoretical concepts related to the application of noble gas isotopes in environmental studies.

Course Topics
- Tracers in groundwater research.
- Origins and properties of noble gas isotopes.
- Components of noble gases in aquatic systems.
- General concepts of noble gas recharge temperature and excess air.
- Principles and applications of groundwater age dating with noble gas isotopes.

Who should attend?
- Selection priority is given to technical staff of counterparts of IAEA Technical Cooperation projects currently conducting noble gas isotope analysis for groundwater dating purposes. External participants are accepted based on space availability and at their own cost.

Details
- Duration: 4 days, 3 hours per day
- Group Size: 6 to 10 participants
- Prerequisites: Participants should have a relevant or a technical/scientific profile showing proven previous experience in the analysis of stable isotopes for hydrological or climatological applications. It is highly recommended that the candidates are directly responsible for interpretation of Isotope Hydrology data and its use in decision making and policy revision. Also, as the training course is conducted in English, participants should have sufficient proficiency to follow lectures and express themselves in the English Language: without difficulty.
- Lead Time: 6 months
- Training Provider: Isotope Hydrology Laboratory
- Completion Rules: Participation and Attendance: To successfully complete the course, participants must attend a specified minimum of the sessions and actively participate in discussions and practical exercises. Course Evaluation: Participants are required to complete and submit all work assigned during the course and provide a course evaluation at the end.
- Language: English
- Location: Online
- Contact Details: IHL.Training@iaea.org

Training Course on the Use of the Noble Gases in Hydrological Studies: Part 2

Purpose
- To build upon and deepen the knowledge gained in Part 1, this segment of the training course specifically focuses on providing practical experience in the application of noble gas isotopes in hydrology.

Objectives
- To enhance understanding of field sampling techniques for noble gas analysis in groundwater.
- To develop skills in handling and preparing samples for mass spectrometric analysis.
- To provide hands-on experience in mass spectrometric analysis of noble gases.
- To train participants in the evaluation and interpretation of noble gas data.
- To apply acquired knowledge to water resource management strategies.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Proficiently conduct field sampling for noble gas isotopes in groundwater.
- Effectively handle and prepare samples for mass spectrometric analysis.
- Gain hands-on experience in the entire data production process using mass spectrometers for noble gas analysis, while understanding the underlying principles.
- Evaluate and interpret noble gas data, particularly in the context of groundwater dating.
- Apply the acquired knowledge to water resource management strategies.

Course Topics
- Field sampling techniques for groundwater dating with noble gas isotopes.
- Operation of field mass spectrometer for on-site isotope analysis.
- Sample handling and preparation for mass spectrometric analysis.
- Practical mass spectrometric analysis of noble gases.
- Data evaluation and interpretation in groundwater dating.

Who should attend?
- Selection priority is given to technical staff of counterparts of IAEA Technical Cooperation projects currently conducting noble gas isotope analysis for groundwater dating purposes. External participants are accepted based on space availability and at their own cost.

Details
- Duration: 5 days
- Group Size: 8 to 12 participants
- Prerequisites: Completion of Part 1 of the course.
- Lead Time: 6 months
- Training Provider: Isotope Hydrology Laboratory
- Completion Rules: Participation and Attendance: To successfully complete the course, participants must attend a specified minimum of the sessions and actively participate in discussions and practical exercises. Course Evaluation: Participants are required to complete and submit all work assigned during the course and provide a course evaluation at the end.
- Language: English
- Location: Vienna, Austria
- Contact Details: IHL.Training@iaea.org

Environment

The Terrestrial Environmental Radiochemistry Laboratory specialises in providing expertise, training and support dealing with radioactive, industrial and other pollution. Our trainings, led by experienced instructors, equip professionals with essential skills and knowledge for effective implementation. Participants gain practical and theoretical understanding in various areas, including quality assurance, laboratory best practices, sample preparation, radionuclide separation, and advanced analytical and radiometric techniques. By focusing on accurate and reliable results, our training ensures that professionals are well-prepared to apply these technologies in diverse applications, from laboratory to infield measurements.

Photo: IAEA

Data Quality Assurance in Stable Isotope Laboratories

Purpose
- To teach participants the types, correct use and storage of reference materials (RMs), data processing and calculations when using RMs as well as other laboratory best practices.

Objectives
- Introduce the fundamentals of reference material (RM) production.
- Familiarize participants with of the principles of isotope delta scale definition and realisation.
- Develop a comprehensive understanding of the processes of using and selecting RMs for isotope delta scale definition and realisation.
- Explain the importance of storage and handling of RMs in the laboratory.
- Provide hands-on experience on data calibration, calculation and normalization and on uncertainty calculation.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand the key concepts and principles of RM production and isotope delta scale definition and realization using RMs.
- Manage the storage and selection of RMs.
- Perform stable isotope analysis by selecting the suitable RMs for isotope delta scale realisation.
- Understand the calculation and normalisation of the delta data of the samples.
- Evaluate the uncertainty associated with the stable isotope analysis.

Course Topics
- Introduction to reference materials (RMs).
- Fundamentals of RM production.
- Principles of isotope delta scale definition and realization.
- Processes for using and selecting RMs for isotope delta scale definition.
- Storage and handling of RMs in the laboratory.
- Data calibration, calculation, and normalization.
- Uncertainty calculation in stable isotope analysis.
- Analysis of organic and inorganic samples within different application fields.
- Best practices in stable isotope laboratories.
- Practical sessions on RM handling and data processing.

Who should attend?
- Scientists from laboratories with instrumentation for analysing stable isotope ratios of light elements installed in the laboratory.

Details
- Duration: 5 days
- Group Size: 10 to 20 participants
- Prerequisites: Experience with Stable Isotope Ratio Analysis of light elements (H, C, O, N and S).
- Lead Time: 6 months
- Training Provider: Terrestrial Environmental Radiochemistry Laboratory
- Completion Rules: Full course attendance.
- Language: English
- Location: Vienna and Seibersdorf, Austria
- Contact Details: TERC.Training@iaea.org

Gamma-Ray Spectrometry - Basic Level

Purpose
- To teach participants basic knowledge on gamma-ray spectrometry as a testing method in laboratories.

Objectives
- Implement gamma-ray spectrometry method in routine laboratory practice.
- Implement QMS in accordance with ISO 17025 requirements.
- Perform gamma spectrometry analysis of the unknown sample.
- Understand importance of sampling and sample preparation and their influence on reliability of measurement results.
- Compose and calculate the comprehensive measurement uncertainty budget.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Understand key concepts and principles of gamma ray spectrometry.
- Develop and work by using QMS documents in line with good laboratory practice.
- Provide reliable testing result.

Course Topics
- Basic principles of gamma ray spectrometry.
- Sampling and sample preparation.
- Spectrum analysis and activity calculations.
- Measurement uncertainty.
- Corrections – introduction.
- ISO 17025 requirements.

Who should attend?
- Training participants should have a bachelor`s degree in physic or related natural science. Working as beginners (less than three years) in a testing laboratory, in gamma-ray spectrometry field.

Details
- Duration: 10 days
- Group Size: 5 to 10 participants
- Prerequisites: The training is design to facilitate and enhance laboratory work for participants not so experienced in gamma ray spectrometry field, but with some experience in radioanalytical methods application.
- Lead Time: 6 months
- Training Provider: Terrestrial Environmental Radiochemistry Laboratory
- Completion Rules: Participants are required to attend all course sessions and actively engage in discussions, practical exercises, and hands-on laboratory work.
- Participants must demonstrate understanding of gamma spectrometry measurement.
- Participant needs to complete a course evaluation to provide feedback.
- Language: English
- Location: Vienna and Seibersdorf, Austria
- Contact Details: TERC.Training@iaea.org

Gamma-Ray Spectrometry - Efficiency Calibration, Corrections of the Results

Purpose
- To teach participants how to perform efficiency calibrations and to calculate different kinds of correction factors.

Objectives
- Perform energy and efficiency calibration of the gamma spectrometry system empirically, as well as by using different available software for numerical and semi-empirical efficiency calibration.
- Determine self-attenuation correction.
- Calculate decay corrections.
- Compose and calculate the comprehensive measurement uncertainty budget.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Understand ways of efficiency calibration of gamma spectrometers.
- Use available software for creating the efficiency curve for a specific sample.
- Perform a self-absorption experiment.
- Analyse and calculate decay corrections.
- Provide reliable testing results.

Course Topics
- Energy and efficiency calibration.
- Self-attenuation correction.
- True coincidence summing corrections.
- Peak interferences.
- Decay correction.

Who should attend?
- Training participants should have a bachelor`s degree or higher in physics or related natural science. Working more than three years in a testing laboratory, in gamma ray spectrometry field.

Details
- Duration: 10 days
- Group Size: 5 to 10 participants
- Prerequisites: The training is design to facilitate and enhance laboratory work for participants experienced in gamma ray spectrometry field, with the already acquired knowledge of topics covered in the previous two training courses.
- Lead Time: 6 months
- Training Provider: Terrestrial Environmental Radiochemistry Laboratory
- Completion Rules: Participants are required to attend all course sessions and actively engage in discussions, practical exercises, and hands-on laboratory work.
- Participants must demonstrate understanding of efficiency calibration of gamma spectrometry measurement system.
- Participant needs to complete a course evaluation to provide feedback.
- Language: English
- Location: Vienna and Seibersdorf, Austria
- Contact Details: TERC.Training@iaea.org

Gamma-Ray Spectrometry - Naturally-Occurring Radioactive Materials (NORM) and Artificial Radionuclides Analysis, from Sampling to Testing Results

Purpose
- To teach participants gamma-ray spectrometry of NORM and samples containing artificial radionuclides.

Objectives
- Perform comprehensive analysis of NORM and samples containing artificial radionuclides by gamma ray spectrometry.
- Understand importance of NORM sampling and sample preparation and their influence on reliability of measurement results.
- Compose and calculate the comprehensive measurement uncertainty budget.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand all steps in radiological analysis of NORM and samples containing artificial radionuclides.
- Understand sampling and do sample preparation.
- Provide reliable testing result.

Course Topics
- Sampling of NORM.
- Analysis of NORM by gamma ray spectrometry.
- Analysis of artificial, including short lived, radionuclides.
- Background subtraction.
- Decay correction-simple case.

Who should attend?
- Training participants should have a bachelor`s degree or higher in physics or related natural science. Working more than three years in testing laboratory, in gamma ray spectrometry field.

Details
- Duration: 10 days
- Group Size: 10 to 20 participants
- Prerequisites: The training is design to facilitate and enhance laboratory work for participants experienced in gamma ray spectrometry field, with more than three years of experience.
- Lead Time: 6 months
- Training Provider: Terrestrial Environmental Radiochemistry Laboratory
- Completion Rules: Participants are required to attend all course sessions and actively engage in discussions, practical exercises, and hands-on laboratory work.
- Participants must demonstrate understanding of NORM analysis.
- Participant needs to complete a course evaluation to provide feedback.
- Language: English
- Location: Vienna and Seibersdorf, Austria
- Contact Details: TERC.Training@iaea.org

Alpha Particle Spectrometry for Natural Radionuclides in Water

Purpose
- To provide theoretical and practical hands-on training, sample preparation techniques, radionuclide separation, source preparation techniques, counting techniques, QA/QC, decay correction using Bateman equations.

Objectives
- To teach radiochemical methods including sample preparation, separation (columns, resins, co-precipitation), source preparation, and counting.
- To train participants on the analysis of results and decay corrections.
- To instruct on result interpretation, quality control and assurance, and method verification.

Course Level
- Advanced

What will participants gain?
Upon course completion, participants should be able to:
- Perform practical laboratory work related to alpha particle spectrometry.
- Prepare and separate radionuclide samples using various techniques.
- Prepare sources and count radionuclides accurately.
- Analyze results, apply decay corrections, and interpret results using computer-based tools.
- Implement quality control and assurance protocols in their laboratories.
- Verify methods and ensure accurate spectrometry results.

Course Topics
- Introduction to radiochemistry.
- Overview of naturally occurring radioactive materials (NORM).
- Fundamentals of alpha spectrometry.
- Sample preparation techniques for radionuclides in water.
- Radionuclide separation methods: columns, resins, and co-precipitation.
- Source preparation techniques.
- Counting techniques for alpha particles.
- Quality assurance and quality control (QA/QC) in alpha spectrometry.
- Decay correction using Bateman equations.
- Practical sessions on radiochemical methods and alpha spectrometry.
- Analysis and interpretation of spectrometry results.
- Method verification and validation.

Who should attend?
- Minimum bachelor's degree in chemistry, with 2 years' experience in a radiochemistry laboratory.

Details
- Duration: 5 days
- Group Size: 4 to 6 participants
- Prerequisites: Radiochemistry training, laboratory training, dangerous chemicals training, radioactivity training.
- Lead Time: N/A
- Training Provider: Terrestrial Environmental Radiochemistry Laboratory
- Completion Rules: Participants are required to attend all course sessions and actively engage in discussions, practical exercises, and hands-on laboratory work.
- Participants must demonstrate understanding of radiochemical separations and alpha spectrometry analysis.
- Participant needs to complete a course evaluation to provide feedback.
- Language: English
- Location: Vienna and Seibersdorf, Austria
- Contact Details: TERC.Training@iaea.org

Radiation Technology

The IAEA Non-Destructive Testing (NDT) Centre is dedicated to assessing the integrity, safety, and longevity of civil infrastructure and investigating industrial process flow without causing damage to the structures being tested or disrupting the flow system under study. In addition to coordinating the IAEA's Non-Destructive Testing (NDT) emergency response for disaster recovery in affected countries, our training courses provide participants with knowledge and practical experience in advanced techniques such as NDT, radiotracer, and sealed source methods. These trainings contribute to civil infrastructure maintenance, cultural heritage preservation, and industrial process improvement, combining theoretical instruction with hands-on application in both laboratory and industrial environments.

Photo: IAEA

Training and Certification Course in Residence Time Distribution (RTD) and Column Scanning Techniques

Purpose
- To build capacity in industrial applications radiotracer technology.

Objectives
- To train and certify participants in Radioactive Tracer Method – Residence Time Distribution Technique (RTM/RTD).
- To train and certify participants in Sealed Sources Methods – Column Scanning Technique (SSM/CST) as applied to industrial process units and columns.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand the concepts and theories of residence time distribution and column scanning.
- Perform RTD experiments in the lab and in the field, and analyze and interpret the results.
- Apply column scanning techniques in industrial settings and analyze the data from experiments.

Course Topics
- Overview of industrial applications of radioactive tracer techniques including key theoretical concepts and principles underlying the techniques as well as case studies and common process flow anomalies (dead volume, channelling etc).
- Residence Time Distribution (RTD) modelling - Data acquisition and treatment, interpretation and RTD modelling of the experimental data.
- Introduction to detectors and data acquisition systems for RTD measurements.
- An overview of industrial and environmental applications of gamma scanning/nucleonic gauges including key theoretical concepts and principles underlying the techniques as well as case studies including sediment transport/dynamics investigations.
- Scan profiles, data treatment, interpretation of the data from experiments in process column.
- Overview of regulatory constraints (such as safety and security) and need for proper planning of radiotracers and sealed sources investigations.

Who should attend?
- Degree holders in Chemical/Process Engineering, petrochemical /or Petroleum Engineering. Designed for process plant managers.

Details
- Duration: 10 days
- Group Size: 10 to 20 participants
- Prerequisites: The participants must have basic knowledge in industrial applications of radiotracer and sealed sources and be involved in its practical application. The participants should have a minimum qualification of a university degree or diploma in chemical engineering, petroleum engineering, nuclear engineering, mechanical engineering, physics, or nuclear sciences, and applied mathematics. Applicants must provide evidence that they are covered by a radiological safety system and if possible, a certificate of training on radiological safety. As this training course will be conducted in English, participants must be proficient in English Language: .
- Lead Time: 2 months
- Training Provider: ISTRA as the only certification body in this domain.
- Completion Rules: Full attendance and participation in both lectures and lab work and passing of exams will attract 2 certificates - certificate of participation and certificate of competence.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: NDT-Tracer.Training@iaea.org

Non-Destructive Testing (NDT) Techniques for Civil Engineering

Purpose
- To build capacity in Non-Destructive Testing Techniques applications for civil engineering.

Objectives
- To train participants in the main NDT techniques applied in Civil Engineering.

Course Level
- Fundamental to intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand the concepts and theories of the main techniques applied in Non-Destructive Testing for civil engineering.
- Perform NDT techniques such as Rebound Hammer, thermography, ultrasonic testing, ground penetrating radar, and rebar detector in the lab and in the field and analyze and interpret the results.

Course Topics
- Mechanical characteristics of concrete, steel, masonry and construction methods for civil engineering.
- Introduction to NDT techniques applied in civil engineering.
- Principles of operation, and applications of a Rebound Hammer.
- Principles of operation, and applications of a Rebar detector.
- Principles of operation, and applications of Ultrasonic pulse velocity Testing.
- Principles of operation, and applications of Thermography.
- Principles of operation, and applications of Ground Penetrating Radar.
- Hands-on sessions on NDT techniques in laboratory with concrete samples.
- Data analysis, reporting and Interpretation.

Who should attend?
- Degree holders in Civil/Chemical/ Engineering, Physics. Structural engineer. Construction Technicians.

Details
- Duration: 5 days
- Group Size: 8 to 12 participants
- Prerequisites: The participants have basic knowledge in non-destructive testing techniques in civil engineering and perform some applications in lab or in the field. The participants should have a minimum qualification of a university degree or diploma in physics, chemistry, civil engineering, technicians; structural, materials engineer. As this training course will be conducted in English, participants must be proficient in English Language: .
- Lead Time: 3 months
- Training Provider: Radiochemistry and Radiation Technology experts
- Completion Rules: Full attendance and participation in both lectures and lab work will attract only certificate of participation.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: NDT-Tracer.Training@iaea.org

Nuclear Science and Instrumentation

The Nuclear Science and Instrumentation Laboratory (NSIL) offers expertise, training, and support in nuclear instrumentation and analytical techniques. We provide comprehensive courses on X-ray techniques, radiation monitoring, neutron generators, and digital electronics. Trainees learn to operate instruments, prepare samples, and process data for various applications, including X-ray fluorescence, gamma spectrometry, and neutron instrumentation. We also conduct periodic proficiency tests to enhance analytical capabilities in fields such as research, industry, health, agriculture, environment, cultural heritage, and forensics. These tests help analytical laboratories identify challenges, pursue accreditation, and facilitate networking.

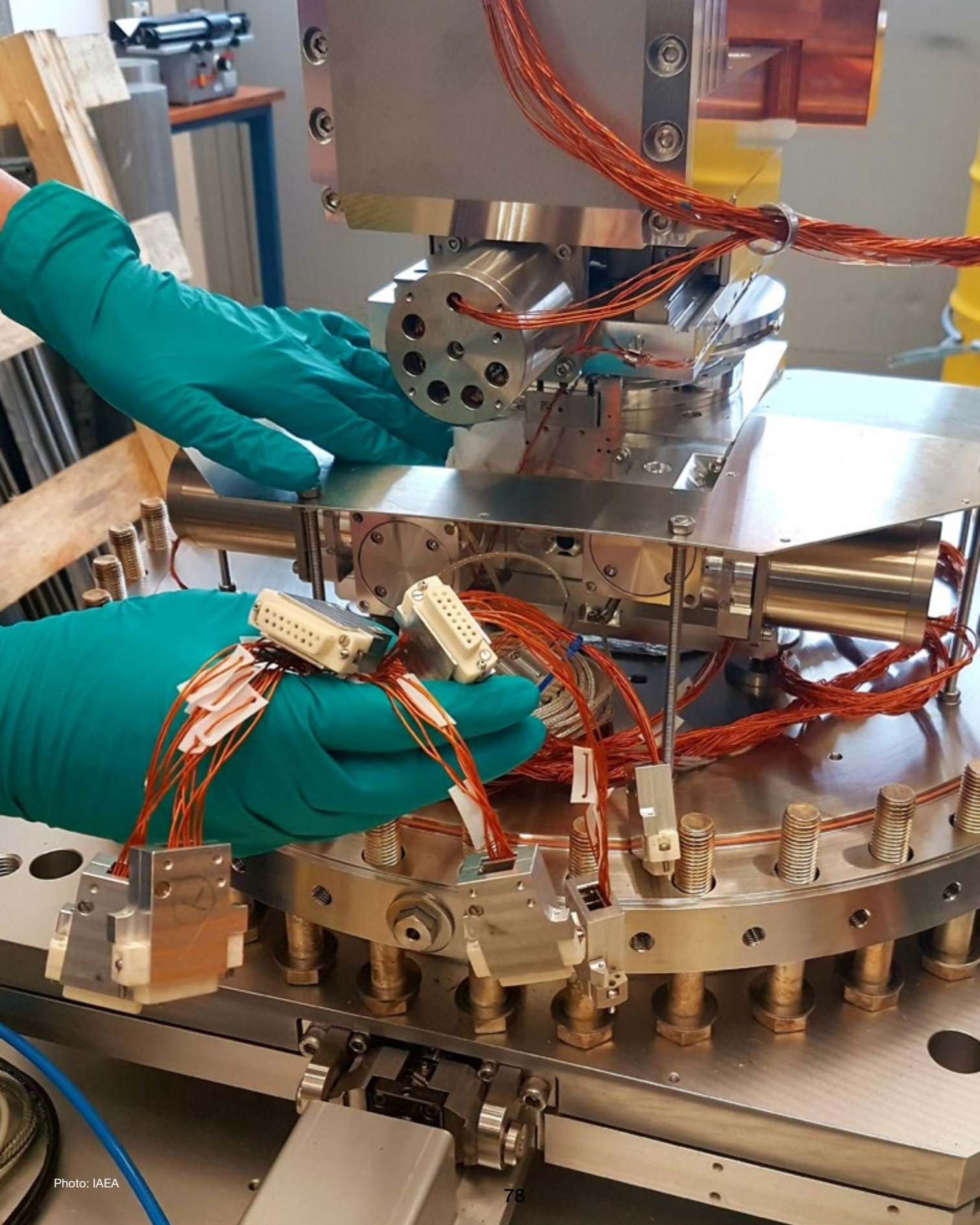

Photo: IAEA

Training Workshop on Method Validation and Quality Control for X-Ray Fluorescence (XRF) Laboratories

Purpose
- To continue offering assistance to X-ray fluorescence laboratories that require further support in improving their analytical performance.

Objectives
- To address deficiencies in quality assessment and control processes implemented by participating laboratories.
- To enhance participants' skills in treating statistical and systematic uncertainties in data analysis for XRF techniques.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Understand how to treat statistical and systematic uncertainties in their data analysis.
- Apply 1-2 XRF techniques with a focus on data treatment and interpretation.
- Implement effective quality assurance/quality control (QA/QC) measures in XRF analytical processes.
- Improve the overall analytical performance of their XRF laboratories.

Course Topics
- Principles of method validation in XRF laboratories.
- Quality assurance and quality control (QA/QC) measures and best practices in XRF analysis.
- Treatment of statistical and systematic uncertainties in data analysis.

Who should attend?
- Junior or senior scientists with experience in XRF techniques, usually physicists with at least a MSc degree.

Details
- Duration: 5 days
- Group Size: 8 to 12 participants
- Prerequisites: Experience with at least one XRF technique and prior participation in NSIL proficiency tests.
- Lead Time: 2 weeks
- Training Provider: Nuclear Science and Instrumentation Laboratory
- Completion Rules: An anonymous questionnaire is handed out at the end of the training to evaluate NSIL performance and receive feedback on improvements. No tests on acquired knowledge are performed.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: NSIL.Training@iaea.org

Quality Assurance of TXRF Spectrometer Analysis of Food and Environmental Samples to Monitor Toxic and Heavy Metals

Purpose
- To support laboratories with Total Reflection X-ray fluorescence techniques, who either start with it or have little experience.

Objectives
- To demonstrate TXRF sample preparation strategies for the analysis of food and environmental samples.
- To study specific caseworks related to TXRF quantification of interfering heavy metals using deconvolution, cross-correlation, and external standard calibration.
- To address recommendations for compliance with the technical requirements of the ISO17025 guide to quality in analytical chemistry.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Understand and implement appropriate sample preparation strategies for TXRF analysis.
- Gain experience in instrument calibration and data treatment/interpretation.
- Apply quality control practices and validate data according to the ISO17025 standards.

Course Topics
- TXRF basic principles and practical considerations.
- TXRF sample preparation of food and environmental samples: appropriate sample preparation strategies.
- Quality control practices and data validation in TXRF analysis.
- Instrument calibration and maintenance for TXRF.
- Data treatment and interpretation in TXRF, including deconvolution and cross-correlation techniques.
- Quantification of interfering heavy metals using TXRF.
- Compliance with ISO17025 guide to quality in analytical chemistry.
- Hands-on practical sessions for TXRF sample preparation and analysis.

Who should attend?
- The training is aimed at XRF laboratories equipped with the TXRF method that require initiation or additional work to implement, maintain and improve efficient processes and trained staff to provide quality analytical results.

Details
- Duration: 15 days
- Group Size: 5 to 12 participants
- Prerequisites: Familiarity with the basics of XRF technique and sample preparation.
- Lead Time: 2 months
- Training Provider: Nuclear Science and Instrumentation Laboratory
- Completion Rules: An anonymous questionnaire is handed out at the end of the training to evaluate NSIL performance and receive feedback on improvements. No tests on acquired knowledge are performed.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: NSIL.Training@iaea.org

In-Situ Characterization of Radioactive Materials and Objects Using Portable High Purity Germanium Detectors

Purpose
- To provide a comprehensive understanding of the effective use of high purity germanium detectors for in-situ analysis of radioactive materials and objects that may contain such materials.

Objectives
- To provide trainees with information on the use of the HPGe detectors to obtain the activity of objects and surfaces.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Properly use the instrumentation and calculate activity of studied samples.

Course Topics
- Overview of the HPGe detectors, their setup, operation, and maintenance.
- Calculation of activities of objects and surfaces.
- Energy and efficiency calibration, spectrum analyses, peak/radionuclide identification, and background subtraction.

Who should attend?
- Workers and teachers in radiological laboratories, reach back officers. Junior or senior scientists with experience in radiation detection, with at least a MSc.

Details
- Duration: 5 days
- Group Size: 8 to 12 participants
- Prerequisites: Familiarity with basic instrumentation, radiation detectors.
- Lead Time: 2 months
- Training Provider:Nuclear Science and Instrumentation Laboratory
- Completion Rules: An anonymous questionnaire is handed out at the end of the training to evaluate NSIL performance and receive feedback on improvements. No tests on acquired knowledge are performed.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: NSIL.Training@iaea.org

Training Workshop on Mobile Radiological Mapping Using Instrumented Unmanned Aerial and Unmanned Ground Vehicles

Purpose
- To share the latest knowledge and good practices in using mobile uncrewed aerial (UAV) and ground (UGV) technologies for radiological mapping, including practical in-situ demonstration and training exercises.

Objectives
- To demonstrate basic and advanced mobile radiological mapping techniques.
- To provide hands-on training on field measurement and data processing.
- To acquire new skills that participants will use in their profession.

Course Level
- Intermediate

What will participants gain?
Upon course completion, participants should be able to:
- Perform radiological mapping using nuclear instrumentation and mobile platforms.
- Correctly select and use nuclear instrumentation for specific applications.
- Work with data in the post-processing phase.

Course Topics
- Introduction to field measurement and radiological mapping.
- Nuclear instrumentation for radiation detection and gamma spectroscopy.
- Mobile radiological techniques using UAVs and UGVs.
- Hands-on field measurement and data collection exercises.
- Data processing and analysis techniques for radiological mapping.
- Case studies on the application of mobile radiological mapping.
- Practical considerations and challenges in mobile radiological mapping.
- Safety and regulatory considerations for using UAVs and UGVs in radiological mapping.
- Integration of radiological data with geographic information systems (GIS).

Who should attend?
- Workers in radiological laboratories, workers responsible for monitoring the radiation situation or the environment, as well as specialists in related professional fields. Junior or senior scientists with experience in radiation detection and field measurement, with at least a MSc.

Details
- Duration: 5 days
- Group Size: 15 to 20 participants
- Prerequisites: Familiarity with basic instrumentation, radiation detectors.
- Lead Time: 1 month
- Training Provider: Nuclear Science and Instrumentation Laboratory
- Completion Rules: An anonymous questionnaire is handed out at the end of the training to evaluate NSIL performance and receive feedback on improvements. No tests on acquired knowledge are performed.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: NSIL.Training@iaea.org

Safe Operation and Applications of Neutron Generators

Purpose
- To train the participants in the safe operation and use of neutron generators, including demonstration of their applications and related modelling tools, through lectures and practical hands-on exercises.

Objectives
- To provide trainees with an overview of what it takes to build and run a small neutron generator facility.
- To educate trainees in the physics principles of neutron applications.

Course Level
- Fundamental

What will participants gain?
Upon course completion, participants should be able to:
- Understand the pros and cons of design choices for a neutron generator facility.
- Operate neutron generators safely with an understanding of the necessary safety and radiation protection considerations.
- Gain a good understanding of neutron applications, including the limitations when these are performed at a low flux source.

Course Topics
- Neutron production using neutron generators.
- Neutron detection principles.
- Neutron spectrometry.
- Introduction to Neutron radiography.
- Introduction to neutron activation analysis (NAA).
- Introduction to delayed neutron counting (DNC).
- Safety and radiation protection considerations when operating neutron generators.
- Practical hands-on exercises in neutron generator operation.
- Design and operational considerations for neutron generator facilities.
- Case studies and real-world applications of neutron technology.

Who should attend?
- This training workshop is intended for newcomers to the field of operating and using neutron sources of low-medium intensity, either already established at their organizations or in the planning stages. Representatives of regulatory bodies or radiation protection agencies, involved in oversight and regulation of similar facilities, might also find this event beneficial.

Details
- Duration: 10 days
- Group Size: 8 to 12 participants
- Prerequisites: Basic knowledge in the field of nuclear/neutron physics, gamma and neutron detection.
- Lead Time: 6 weeks
- Training Provider: Nuclear Science and Instrumentation Laboratory
- Completion Rules: An anonymous questionnaire is handed out at the end of the training to evaluate NSIL performance and receive feedback on improvements. No tests on acquired knowledge are performed.
- Language: English
- Location: Seibersdorf, Austria
- Contact Details: NSIL.Training@iaea.org

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