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# IAEA FELLOWSHIP TRAINING IN WATER RESOURCES MANAGEMENT

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(EVT2403251 – MAL7008)

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## **Introduction**

The IAEA Fellowship Training in the field of Water Resources Management under the Technical Cooperation Project MAL7008 was conducted from 12 February to 18 April 2025 at the Universidad de Sevilla, Department of Applied Physics II (Departamento de Física Aplicada II), Spain. The fellowship was organized by the International Atomic Energy Agency (IAEA) as part of its capacity-building initiatives to strengthen Member States' technical competencies in environmental radioactivity monitoring and radiochemical analysis.

The fellowship combined theoretical understanding through literature review with extensive hands-on laboratory work and instrumental analysis, under the supervision of Prof. Rafael Garcia-Tenorio, an expert in environmental radioactivity and radioanalytical techniques.

## **Training Scope and Technical Activities**

A key component of the fellowship involved practical laboratory training on sample pretreatment and radiochemical separation techniques. Microwave-assisted digestion was applied to soil, sediment, and organic matrices using tailored acid mixtures to ensure effective dissolution and minimal analyte loss. Participants gained experience in iron ( $\text{Fe}^{3+}$ ) co-precipitation, solvent extraction using the tributyl phosphate (TBP) method, and ion-exchange chromatography employing AG 1×4 and UTEVA resins for actinide purification.

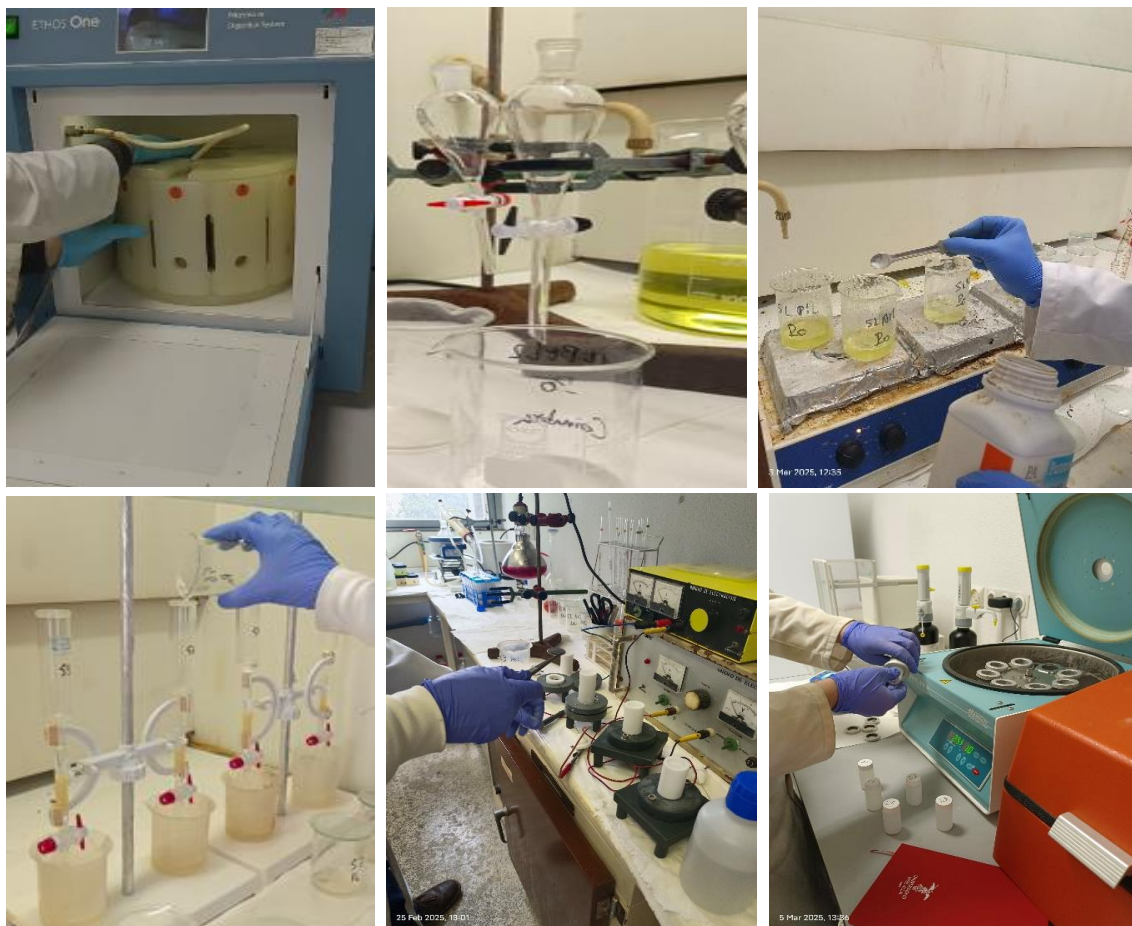
The fellowship also provided extensive exposure to alpha spectrometry, including source preparation through electrodeposition for uranium and plutonium, as well as autodeposition techniques for polonium. Measurements were carried out using silicon surface barrier detectors, enabling high-resolution alpha spectra and reliable activity determination. Complementary analytical techniques included liquid scintillation counting (LSC) for radium and tritium analysis, as well as gamma spectrometry for environmental monitoring samples.

## **Environmental Radioactivity Monitoring Practices**

In addition to laboratory-based training, the programme emphasized environmental radioactivity monitoring practices implemented by the host institution. This included airborne monitoring using high-volume air samplers for radionuclides such as Pb-210, Be-7, and Cs-137, as well as low-flow charcoal-based sampling for iodine-131. Water monitoring activities covered rainwater and tap water analysis, including cesium determination using ammonium phosphomolybdate (AMP) precipitation and total alpha and beta measurements by LSC with pulse shape analysis.



Environmental radioactivity monitoring facilities, including high-flow air samplers with 4 ft × 4 ft filters, large-volume water tanks for routine surveillance of gamma-emitting radionuclides in drinking water, and rainwater samplers.



Laboratory facilities used for radiochemical analysis during the IAEA Fellowship Training at Universidad de Sevilla.



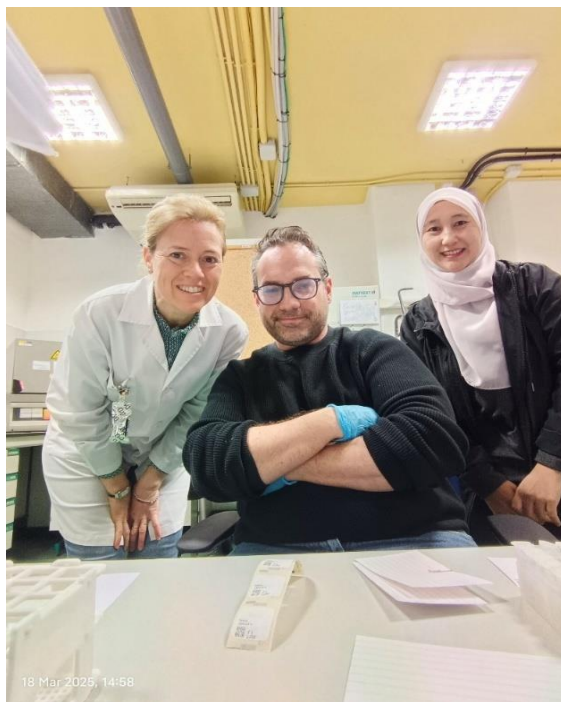
Group photo with academic supervisors and research colleagues at the Department of Applied Physics II, Universidad de Sevilla, Spain, during the IAEA Fellowship Training.

### Technical Visit to Centro Nacional de Aceleradores (CNA)

An important highlight of the fellowship was a technical visit to the Centro Nacional de Aceleradores (CNA), where the MiCaDaS accelerator mass spectrometry (AMS) system is operated for radiocarbon ( $^{14}\text{C}$ ) dating. The visit provided valuable insight into sample preparation, graphitization, and isotopic measurement using AMS, broadening understanding of isotope applications in environmental and climate studies.



The MiCaDaS accelerator mass spectrometry (AMS) system at the Centro Nacional de Aceleradores (CNA), Seville, is used for radiocarbon ( $^{14}\text{C}$ ) analysis.



Laboratory staff from the Centro Nacional de Aceleradores (CNA), Seville, providing technical guidance on AMS sample preparation and system operation during the IAEA Fellowship Training.

### **Outcomes and Relevance to Malaysia**

The IAEA Fellowship Training provided tangible outcomes that are directly relevant to strengthening national capabilities in environmental radioactivity monitoring and water resources management. The advanced radiochemical techniques, analytical methodologies, and quality assurance practices acquired during the fellowship can be adapted and applied to routine laboratory operations at the Malaysian Nuclear Agency, particularly in the analysis of low-level radionuclides in environmental and drinking water samples.

The exposure to established laboratory workflows, method optimisation strategies, and laboratory management practices supports ongoing efforts to enhance analytical reliability, method validation, and technical competence within national laboratories. Furthermore, the fellowship strengthened professional networks with international experts and research institutions, creating opportunities for future technical collaboration, knowledge exchange, and capacity-building initiatives under IAEA programmes. Overall, the outcomes of this fellowship contribute to Malaysia's long-term objectives in safeguarding environmental and public health through robust and sustainable radiological monitoring frameworks.

### **Cultural Exposure and Personal Reflection**

In addition, exposure to the historical and cultural landscape of Seville and the surrounding regions offered a meaningful complement to the technical training. The architectural heritage and layered history of places that were previously unfamiliar left a lasting impression, fostering a deeper appreciation of the region's civilisation and environment and enriching the fellowship experience beyond the scientific and laboratory context.



Members of the Muslim community gathering for Eid al-Fitr prayer at Alamillo Park, Seville, Spain.



Historic and contemporary landmarks in Seville, Spain, including Plaza de España and the Metropol Parasol.



Natural landscapes of Andalusia, Spain, including El Tajo Gorge in Ronda and the Zahara–El Gastor Reservoir.



Roman heritage sites in Andalusia, Spain, including Italica and the Roman Bridge of Cordoba.



Architectural landmarks of Andalusia, Spain, featuring the Mezquita-Catedral of Cordoba, the Courtyard of the Maidens at the Real Alcazar of Seville, and the Alhambra, reflecting the region's layered Islamic and historical architectural heritage.