

# Measurement Unit

*Nuno Rombert Pinhão*

The Measurement Unit (MU) provides **analytical services in the area of radioactive control of low and medium activity samples**.

The techniques used are high resolution gamma spectrometry; total alpha and beta counting; beta counting of specific radionuclide and alpha spectrometry. Ion chromatography is also used to assist on the evaluation of the residual beta activity.

Together with the laboratories of the Environment Radioactivity group (which is responsible for the collection and chemical preparation of the samples), the MU carries out the Portuguese obligations under Article 35 of the EURATOM Treaty, which requires member states to conduct an annual national environmental radiological survey.

Additionally, the MU provides ion chromatography analysis to other research groups in ITN.

The MU is composed of four laboratories with the following major facilities:

- Gamma Spectrometry laboratory, equipped with six germanium detectors and one Si(Li) detector;
- Alpha Spectrometry laboratory, with a total of 41 surface barrier detectors;
- Total Alpha and Beta Counting laboratory, with two systems equipped with gas flow proportional counters, two liquid scintillation systems and two ZnS solid scintillators;
- Ion Chromatography laboratory, equipped with an ion exchange chromatograph and an ultra-pure water system.

The MU provides radioactivity measurement services:

- For the national environmental radiological survey;
- to assist in the surveillance of the ITN research reactor;
- to support economic activities, such as the control of foodstuff for exporting and of building materials, and
- to support and collaborate with other groups on their research activities.

The MU conducts research and development on the analytical techniques used in this field. The Unit also promotes the professional qualification of the personnel, and other related educational activities.

In the short term, the MU is involved in the accreditation of the laboratories according to the ISO/IEC 17025 standard. A project for financing the reorganization of the laboratories and for equipment upgrade is expected to be approved in the beginning of 2007.

In 2006, the MU has undergone several transformation:

*Equipment acquisition and repair:*

- Acquisition of a detector for alpha spectrometry;
- repair of ion chromatography equipment.

*Measures to implement the ISO 17025 standard:*

- Development of a data reporting software application to allow the reporting of the upper limit of activity in gamma spectrometry;
- requirements analysis for the development of a LIMS (Laboratory Information Management System) adapted to the needs of DPRSN;
- acquisition of calibration sources for gamma spectrometry and ion chromatography;
- development of new routines for the reporting of analysis results and data archiving;
- analysis of the uncertainties and detection levels in total alpha and beta counting;
- implementation of procedures to eliminate gamma – X-ray sums and matrix effects in gamma spectrometry;
- definition of procedures for the measurement of alpha and beta activity with gas proportional detectors;
- organization of equipment records;
- participation in intercomparison exercises.

*Training and education:*

- Some of the group members have been supervising undergraduate and post-graduate thesis and involved in course teaching;
- two group members have attended Master degrees programs;
- one FCUL student is making the final year training in the MU.

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## Research Team

### Researchers

N.R. PINHÃO, Auxiliary Researcher

### Analysis Contractors

L. SILVA, physicist

J. ABRANTES, graduation student in physics engineering

L. TORRES, chemical engineer

### Technical Personnel

J. M. OLIVEIRA, Senior Technician (30%)

G. SILVA, Technician [1\*]

### Informatics Consultant

J. P. SARAIVA (between June and October)

### Students

G. CARVALHAL, FCT grantee

R. MENDES, FC/UL graduation student in physics

## Analytical Services on Radioactivity Measurement and Liquid Ion Chromatography

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### Objectives

The Measurement Unit provides analytical services on radioactivity measurement and evaluation of ion concentration in liquid samples to ITN groups and external entities. These services aim:

- to provide analytical services to support the national environmental radiological survey;
- to assist in the surveillance of the ITN research reactor;
- to provide analytical services to support economic activities, such as export certificates or the control of construction materials, and
- to support and collaborate with other groups on their research activities.

### Results

In 2006, the MU continued efforts to improve the accuracy of the results reported through improvements on the statistical treatment of data, introduction of procedures to eliminate gamma – X-ray sums and matrix effects in gamma spectrometry, and the introduction of quality control practices on laboratory work.

The gamma spectrometry laboratory took part in an proficiency test (IAEA-CU-2006-04 ALMERA) with good overall results.

### Analysis services

In 2006 around 3500 measurement report were emitted. These measurements have required the performance of a total of 9300 analyses, including analysis for calibration, quality control and validation. These analyses were conducted using the following techniques: alpha spectrometry (14%), total alpha or

beta counting techniques (16%), gamma spectrometry (30%), liquid scintillation (39%), and ion chromatography (2%).

About 28% of these analyses were for the national environmental radiological survey, 30% were services for external entities, 22% for research projects, either of DPRSN or other ITN sectors, and the remaining for quality control of the techniques.

It is worth mentioning that, excluding the quality control analysis, 78% of the alpha spectrometry, 22% of the gamma spectrometry analysis and 16% of the liquid scintillation and total alpha or beta counting techniques were on samples for research projects of the DPRSN, Chemistry or Physics sectors. Comparing with last year, this represents a decrease of the number of analyses for research projects and is regarded as a consequence of the freezing of research funds for the last two (2) years.

Services for external entities, mostly companies in the private sector, represent 51% of the analysis based on total alpha or beta counting or liquid scintillation techniques, 6% of the gamma spectrometry analysis and 15% of the alpha spectrometry analysis.

The analytical services provided by the MU to the National Radiological Surveillance Program represent a total net value of 79 kEuros.

The services provided to external entities represent a net income generation to ITN of around 89 kEuros. Considering the operational costs (including salaries and overheads), we estimate that the results obtained in the MU laboratories represent a net added value of over 61 kEuros.