

Environmental Radioactivity

Maria José Madruga

Under Articles 35 and 36 of the EURATOM Treaty, Portugal has an obligation to conduct a national environmental radiological survey each year. This survey was established in the Decree-Law 138/2005 of 17th August and its execution legally assigned to ITN. The National Radiological Environmental Monitoring Programme has been carried out by the Environmental Radioactivity Unit in collaboration with the Measurement Unit and the Dose Assessment and Dose Registry Unit. Following the work developed in the last years the survey in 2006, consisted on the determination of the artificial and natural radionuclides in the atmosphere, aquatic and terrestrial environments. To carry out this programme a considerable effort of the group has been made in terms of human resources (about 50% of the time consumed). This programme involves a financial cost of about 68 000 €.

In November 2006, under the Article 35 of the EURATOM Treaty an EC verification team visited the ITN and in particular, the Environmental Radioactivity Group. The main objective of this visit was to verify the actions undertaken and the levels of implementation achieved as a result of the 2002 EC Recommendations. The team verified the adequacy of the sampling programmes in place, the laboratory infrastructure and methodologies in use, the analytical written procedures and the data management (traceability and data reporting).

Current research activities are on going to assess the levels of radioactive contamination in the atmosphere (aerosols) aquatic and terrestrial environments. The development and validation of new analytical methods using liquid scintillation counting technique are in progress mainly for the determination of strontium-90 in milk. Studies concerning the determination of indoor radon concentrations, radon exhalation from building materials and radon countermeasures are on going.

The technical services developed by this group are carried out under contract with companies or, by

request from enterprises or Government organizations. Some of these technical services are: the evaluation of the radioactivity levels in public water supplies (Decree-Law nº243/2001) and mineral waters, the radioactivity analyses of foodstuffs and goods to export and building materials, indoor radon measurements and the determination of ²¹⁰Po in humans. The group income of these technical services was about 70 000 €.

During this year the group has given continuity to the elaboration of the analytical technical procedures following the NP EN ISO/IEC 17025 and to the implementation of quality control procedures. The environmental database has been improved.

The group participated in collaboration with the DPRSN/Measurement Unit in an international inter-comparison exercise in the framework of the IAEA/ALMERA group with good results. The results published in 2006 (the determination of ⁴⁰K, ⁹⁰Sr and ¹³⁷Cs in milk powder and the measurements of anthropogenic and natural radionuclides in mussel samples) concerning previous exercises were good.

During this year, the civil works for the construction of the infrastructure for the installation of the Radionuclide Particulate Station at S. Miguel, Azores were concluded. This station will be part of the International Monitoring System, established in the framework of the CTBT (Comprehensive Nuclear Test Ban Treaty).

The main concern of the group is the lack of human resources. To fulfil the State's national and international obligations (Artº 35 and Artº 36 EURATOM Treaty) it is absolutely necessary specialized technical personnel. In the last two years the group lost five technicians. In the mean time an effort has been done to train young students. In 2004, in the framework of the EURATOM/Radiological Environmental Monitoring Programme, five fellows were awarded with FCT grants. However During this year three of these fellows left.

Research Team

Researchers

M.J. MADRUGA, Princ. Researcher, Group Leader
F.P. CARVALHO, Princ. Researcher
M. REIS, Aux. Researcher
J.A. CORISCO, Assist. Researcher

Students

A.R. GOMES, FCT grant
A.S. LEMOS, FCT grant (left in Dec. 2006)
E. OLIVEIRA, FCT grant (left in Sept. 2006)
F. RODRIGUES, FCT grant (left in Nov. 2006)
H. FONSECA, FCT grant
J. MELO, FCT grant (since March 2006)

Technical Personnel

M.M. SEQUEIRA, (Specialist Principal) retired in Jan. 2006
J.M. OLIVEIRA, Technician (1ª) (70%)
A.LIBÂNIO, Professional Technician (1ª)
M.A. PEREIRA, Auxiliar Technician, retired in Dec. 2006

Collaborators

I. LOPES
M. M. MALTA

Environmental Radioactivity National Survey

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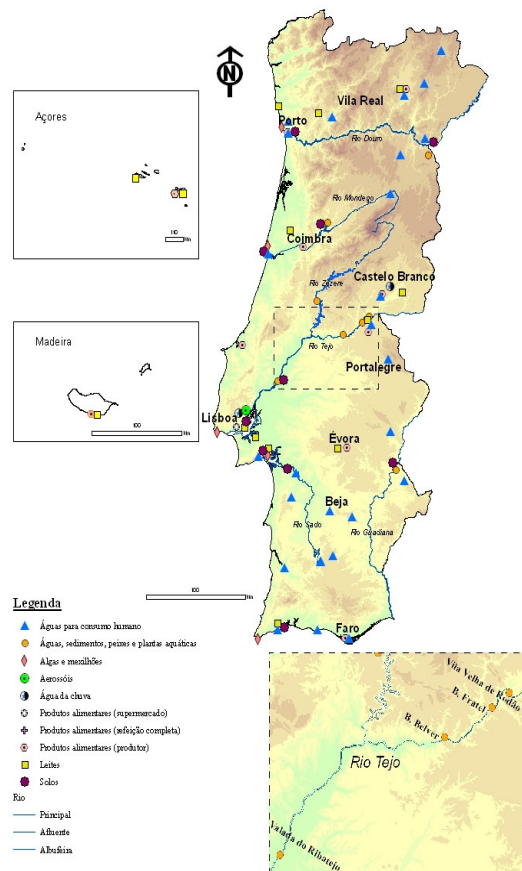
Objectives

The Article 35 of the EURATOM Treaty stipulates that each Member State shall have the facilities necessary to carry out the continuous monitoring of the levels of radioactivity in the air, water and soil and to ensure the compliance with the basic standards. The Article 36 of the same treaty stipulates that the appropriate authorities shall periodically communicate information on the checks referred to in Article 35 to the Commission so that it is kept informed of the level of radioactivity to which the public is exposed. Furthermore, Commission Recommendation 2000/473/EURATOM of 8 June 2000 on the application of Article 36 considers that the exposure related to soil contamination is more directly assessed on the basis of foodstuffs contamination. The radioactivity environmental monitoring programme, which has been planned in according to the Articles 35 and 36 of the EURATOM Treaty requirements and performed since several years ago by DPRSN/ITN, has been established by law in 2005 and the competency for its execution legally attributed to ITN (Decree-Law 138/2005, 17th August). The main objective of this national radiological survey consists on the determination of the artificial and natural radionuclide concentrations in environmental compartments (aquatic, terrestrial and atmospheric environments) considered as direct pathways of contamination to man.

Results

During 2006 about 400 samples (aerosols, rainwater, surface water, drinking water, sediments, fish, mixed diet, complete meals, milk, soils, etc.) were collected (Figure 1) accordingly to international sampling procedures and a total of about 1000 analyses were performed for the determination of artificial and natural radionuclides, using gamma and alpha spectrometry, alpha/beta measurements and liquid scintillation technique. Integrated measurements of the ambient dose equivalent with thermoluminescent dosimeters were also performed. The results show that the Portuguese population was not exposed to radioactive contamination levels higher than the radioactive background. The estimated radiation dose to the Portuguese population due to the inhalation and ingestion of the artificial and natural radionuclides measured in these samples has no significance from the point of view of radiological protection. The values obtained are much lower than the radiation dose limits recommended to the radiological protection of the population (96/29 EURATOM Directive). Therefore, there is no need to adopt any measures for radiological protection of the population. All the data were published in Internal Reports (1), inserted into the database Easy Proteo 4.11 and sent to

the EU Joint Research Centre, ISPRA, to be included in the European Database (REM).



Published work

M.J. Madruga, F.P. Carvalho, M. Reis, N. Pinhão, J. Alves, M.M. Sequeira, G. Ferrador, M.A. Gameiro, J.M. Oliveira A. Libânio, M.A. Pereira, G. Silva, I. Lopes, L. Silva, J. Abrantes, L. Machado, A.R. Gomes, A.S. Lemos, E. Oliveira, F. Rodrigues, G. Carvalhal, H. Fonseca, L. Novais, *Vigilância Radiológica a Nível Nacional (Ano 2005). Internal Report DPRSN, Série A, n°30/2006, ISBN 972-8660-31-6, Depósito Legal 194022/03, pp. 83.*

¹DPRSN/Measurement Unit; ²DPRSN/Dose Assessment and Dose Registry Unit

Atmospheric Radioactivity¹

M. Reis, F. P. Carvalho, J. M. Oliveira, H. Fonseca, M. Malta

Sampling of the atmosphere in situ atmospheric measurements over Portugal and of the East Atlantic were performed on board of the BAe450 airplane, operated by European Union Facilities for Atmospheric Research (EUFAR) in the framework of an EU funded project (VPRACOP). Aerosol samples were analyzed for naturally occurring radionuclides and trace metals. Results will be used to assist with the interpretation of the influence of desert dust from North Africa in the summer period.

Environmental Radioactivity in Alentejo¹

F. P. Carvalho, J. M. Oliveira, M. Reis, M. Malta

Two counties, Serpa and Ourique, were investigated in 2006 as an extension of the work carried out in the framework of MinUrar project for comparison of the natural radiation background with the region of past uranium mining. Naturally-occurring radionuclides were measured in samples of soils, water, vegetable products, and aerosols. Radon was measured in indoor and outdoor air in a selection of sites. Samples of human blood and hair were collected also in inhabitants of these counties for measurement of biological parameters and radioactivity in the hair.

Radioactivity in the Marine Environment¹

F. P. Carvalho, J. M. Oliveira, M. Malta, A. Sousa, A. Libânio

Research on the radioactivity in the marine environment has continued as part of the effort to deepening the knowledge on cycling of radionuclides in the marine environment and as part of the environmental radiological surveillance. Marine mammals (common dolphin) found along shore were sampled and analyzed for radioactivity. Common fish species from the harbour of Peniche, were sampled for radionuclide analysis. Bio-indicator species from the shore (mussels) were collected also in several points along the west and south coast and in estuaries of rivers and analyzed for naturally-occurring radionuclides and long lived radionuclides, such as plutonium isotopes and ¹³⁷Cs, in order to follow trends of radioactive contamination from past dumping operations of radioactive waste in the marine environment.

SERVICES

1. Radioactivity in Drinking and Mineral Waters¹

M.J. Madruga, E. Oliveira, J. Melo, A.R. Gomes, F. Rodrigues, J.M. Oliveira, I. Lopes

Following the Portuguese Law (Decree-Law nº243/2001) it is compulsory the evaluation of the radioactivity levels in drinking waters. For this purpose the DPRSN was requested by Water Suppliers to carry out the determinations of global alpha, global beta, Tritium, ²³⁸U, ²³⁴Th, ²²⁶Ra and ²¹⁰Po and the Total Indicative Dose parameter in drinking waters. The determination of Radon in same water samples was also carried out. In order to obtain license to the commercialisation of mineral waters, an evaluation of its radioactive levels should be performed (Decree-Law nº84/90). The radiological study included analyses of ²³⁸U, ²³⁴Th, ²²⁶Ra, ²¹⁰Po and global beta. Several enterprises often request this radiological study.

During 2006, a total of about 1200 analyses were performed.

2. Radioactivity in Foodstuffs and other Samples¹

M.J. Madruga, A.S. Lemos, A. Libânio

By request of public and private enterprises, different kind of samples, mainly food samples to be exported and building materials were monitored. In 2006, 67 samples were analysed.

3. Indoor Radon

M.J. Reis, H. Fonseca

By request of public and private enterprises indoor radon measurements were performed in buildings. Since November 2003 a collaborative Protocol was established between DPRSN-ITN and DECO to answer the associate's indoor radon requests. A total of 66 measurements were performed during this year.

4. Polonium-210 in Humans Following a Poisoning Act in London¹

F. P. Carvalho, J. M. Oliveira

Following the poisoning act against a Russian citizen exiled in London, carried out in November 2006 using ²¹⁰Po, DPRSN was requested to assess internal contamination by ²¹⁰Po of several Portuguese that were in London at the time of events. It was possible to provide in a timely manner an assessment of the contamination (negative) of those people. An international analytical intercomparison, organized by the IAEA, is now underway amongst laboratories to test the capability to measure ²¹⁰Po in human samples.

¹ In collaboration with DPRSN/Measurement Unit