Education & Training

To reinforce the competence of ITN in the **field of Radiological Protection and Nuclear Safety a course has been organised by ITN** for 35 students: 20 with high school level and 15 with the university degree. The lectures of this course as well as the laboratory training were given by researchers and technical staff from the Reactor Sector and the DPRSN. This course started in 1999 and continued through the year 2000. It was divided in five *modulae*: (i) Electromagnetic Radiation, (ii) Electrons and the Oscilloscope, (iii) Interaction of Radiation with Matter, (iv) Radiation Protection and Safety, (v) Introduction to Reactor Physics and Nuclear Safety. These *modulae* cover a large spectrum, from basic physics to specialised skills that the technicians will need for their work in ITN. The lectures and practical sessions of *modulae* (i) to (iii) and (v) were given by researchers of the Reactor Sector; the ones of module (iv) by researchers and technicians of the Department for Radiological Protection and Nuclear Safety. All students attended the same lectures.

The modules covered lectures on

(i) Electromagnetic Radiation: Its nature, production and interaction with matter – N.P. Barradas.

(ii) Electrons and the Oscilloscope: Production of electrons. Electrons in electric fields. Oscilloscope – N.P. Barradas.

(iii) Interaction of Radiation with Matter: Types of radiation. Radioactive decay. Nuclear Reactions. Neutrons and neutron sources – N.P. Barradas, A. Vieira.

(iv) Radiation Protection and Safety: Natural and artificial radioactivity. Radiation detection and measurement. Units, dosimetry and calibration of instruments. Biological effects of radiation. Radiobiology. Principles of radiation protection. Basic rules of radiation protection. Personnel dosimetry. Medical surveillance of personnel. Nuclear effluents and waste. Prevention and radiological safety. Procedures for radiological emergencies and accidents. Gamma spectrometry. Radiochemistry, alpha and beta spectrometry. Calibration of dosemeters. Portuguese and European legislation – E. Amaral, A. Bettencourt, A. Brogueira, M.C. Carreiro, A.F. Carvalho, F. Carvalho, M.C. Faísca, G. Ferrador, J.P. Luís, M.J. Madruga, B. Martins, A. Oliveira, J.M. Oliveira, M.L. Pedro, M. Reis, J. Ribeiro e Costa, J. Sebastião, M.M. Sequeira, A. Severo, R. Trindade.

(v) Introduction to Reactor Physics and Nuclear Safety: Moderation and diffusion of neutrons. Heat transfer. Shielding. Basic reactor kinetics. Nuclear reactors. Principles of nuclear safety. Portuguese Research Reactor – N.P. Barradas, F.M. Cardeira, J.G. Marques, A. Vieira.

MSc degree course of the Faculty of Sciences of the University of Lisbon in the field of Applied Nuclear Physics

Co-ordinator: J.C. Soares

The lectures were given by professors from the University of Lisbon, and by researchers from the Reactor and the Physics Sectors:

(i) Advanced Experimental Nuclear Physics, 2 semesters – J.G. Marques.

(ii) Nuclear Reactors and Safety, 1 semester – J.G. Marques

(iii) Radiation Physics, Dosimetry and Radiological Protection, 1 semester – J.F. Salgado.

The weekly seminar of the *curriculum* of this course was given by several researchers from ITN and from other research Institutes.

Lectures given by ITN staff in the following institutions:

Faculty of Dental Medicine, Lisbon (Training Course on Radiological Protection for Dental Radiography) – A.Ferro de Carvalho.

Department of Biotechnology of INETI (Course on Radiological Protection and Safety in Radioisotopes Manipulation) – R. Trindade, A. Oliveira, B. Martins, J. Sebastião.

Technical University of Lisbon (Radiobiology in Biophysical Course) – J. Pereira Luís.

New University of Lisbon (Biological Dosimetry on Radiation Protection) – J. Pereira Luís.

"Biofábrica" (Madeira - Med) (Course on Radiological Protection and Safety) – Berta Martins, A. Oliveira, J. Sebastião.

Department of Geology, Faculty of Sciences of University of Lisbon (Master Course in Dynamic Geology) – Maria da Conceição Faísca.

European Radiopharmacy Course, INSTN, Saclay, France (Protocolo INSTN/ITN), 13-28th November 2000 (Measure of the Mass of Blood and Quality Control of ^{99m}Tc-radiopharmaceuticals) – Maria de Lurdes Gano.

Faculty of Pharmacy of University of Lisbon (Master Course in Advanced Pharmacology) – Maria dos Anjos Neves.

Department of Chemistry and Biochemistry, University of Lisbon (Master Course in Applied Analytical Chemistry; Master Course in Biochemistry) – M. Fátima Araújo.

Department of Zoology and Anthropology, Faculty of Science of University of Lisbon (Advanced Laboratory Techniques Course - Biology Graduation) – M. Teresa Pinheiro.

Department of Physics, Faculty of Science of University of Lisbon (Applied Nuclear Techniques Course - Physics Graduation) – M. Teresa Pinheiro.

Department of Biology, Faculty of Science of University of Lisbon (Course on Sterilisation Procedures in Microbial Biotechnology) – M. Luisa Botelho and S. Cabo Verde.

Participation in *"Ciência Viva" Programme* from the Ministry on Science and Technology. This programme is mainly directed for High School students – Co-ordinator: J. Salgado.

Participation in Juries:

J. Marçalo de Almeida, External Examinateur, European PhD Thesis, Université de Nice-Sophia Antipolis, Faculté des Sciences, France, 9 June 2000.

A. Pires de Matos, External Examinateur, European PhD Thesis, Instituto de Tecnologia Química e Biológica - Universidade Nova de Lisboa, Almada, 12 April 2000.

J.P. Leal, External Examinateur, European PhD Thesis, Instituto Superior Técnico, Universidade Técnica de Lisboa, Lisboa, January 2000.

I. Santos, External Examinateur, European PhD Thesis, Université Paris-XI, Orsay, France, February, 2000.

I. Santos, External Examinateur, European PhD Thesis, Université de Rennes I, Ecole Nationale Superieure de Chimie de Rennes, Rennes, France, October, 2000.

I. Santos, External Examinateur, PhD Thesis, Université de Montréal, Montréal, Canada, November, 2000.

M. Fátima Araújo, External Examinateur, MSc Thesis, Faculdade de Letras, Universidade de Lisboa, Janeiro 2000.

M. Fernanda da Silva, External Examinateur, European PhD Thesis, Lund University, Sweden, 8 December 2000.