

A Network to enhance Cooperation for Research and Higher Education on Radiation Protection and Nuclear Engineering

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Abstract. The educational capacity of many Institutions of Higher Education in Nuclear Engineering decreased under the combined effect of a declining interest among students as well as from academic and political authorities. An increasing cooperation at the international level on educational efforts is necessary. The CHERNE network is an initiative mainly focussed on teaching and learning activities to develop a wide-scope open academic network to enhance cooperation, competence and equipment sharing between its partners. Typical activities organized within the network include workshops, intensive courses, seminars and conferences. The CHERNE network and its main objectives as well as the activities developed since its foundation are presented. Special attention is given to international intensive courses (SPERANSA, JUNCSS, ICARO, ...) organized for students of the member institutions. The common feature of these courses is a strong practical part in specialized facilities, including in some cases access to large equipment like research reactors and accelerators.

1. Introduction

The educational capacity of many Institutions of Higher Education in Nuclear Engineering has been decreasing sharply during the last decades under the combined effect of a declining interest among students as well as from the academic and political authorities. Furthermore, financial restrictions have made it increasingly difficult to maintain and develop facilities, equipment and academic staff needed for practical training of students as well as for basic research in the involved institutions.

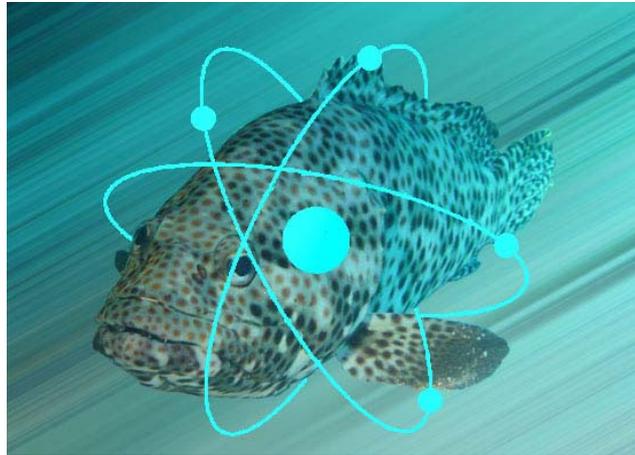
Each university and country presents a different situation, but many departments that were initially able to propose a large panel of orientations in this field had to reduce their offer and to concentrate it on a few specialities. On the other hand, a significant number of professionals at different levels of education continue to be required for safely operating and managing the nuclear industry and all other activities involving the use of radiations.

Industry, research institutes and universities need to work together to co-ordinate more effectively their efforts to encourage the younger generation and to develop and promote a program of collaboration in nuclear education and training. Mechanisms should be set in motion for sharing best practices in promoting nuclear education. The obvious solution is an increasing cooperation at the international level on the educational efforts. For this reason, several networks have been developed, some of them focused on specific domains, others concentrated on high level professional training, some strongly structured and others not.

The CHERNE network, created in 2005 and presently involving 14 Institutions (mostly from Europe), is an initiative mainly focussed on teaching and learning activities to develop a wide-scope open academic network to enhance cooperation, competence and equipment sharing between its partners. The aims and rules of the network were established in a declaration, signed by all partners, containing specific details concerning organization, membership and activities. This declaration can be downloaded from the network web site: www.upv.es/cherne/.

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Typical activities organized within the network include workshops, intensive courses, seminars and conferences on topics like radiation protection, nuclear measurements, radiochemistry, safety analysis, reactor and accelerator operation and applications, etc. In this paper, the CHERNE¹ network and its main objectives are presented as well as activities developed since its foundation. Special attention is given to international intensive courses (SPERANSA, JUNCSS, ICARO, ...) organized for students of member institutions.



2. The CHERNE network

2.1 Members of the network in 2008

The network was created in 2005, involving now 13 European Institutions and one from United States. The list of members in alphabetic order is the following:

- Alma Mater Studiorum - Università degli Studi di Bologna (Italia)
- ČVUT, České Vysoké Učení Technické v Praze (Czech Republic)
- Dipartimento di Fisica ed Astronomia, Università di Catania (Italia)
- Dipartimento di Fisica, Università degli Studi di Messina (Italia)
- Dipartimento di Ingegneria Nucleare, Politecnico di Milano (Italia)
- DIQN-UPV, Departamento de Ingeniería Química y Nuclear, Universidad Politécnica de Valencia (Spain)
- ETSEIB - UPC, Escola Tècnica Superior d'Enginyers Industrials de Barcelona, Universitat Politècnica de Catalunya (Spain)
- ISIB, Institut Supérieur Industriel de Bruxelles (Belgique)
- ITN, Instituto Tecnológico e Nuclear, Lisboa (Portugal)
- KSU, Kansas State University (USA)
- UAS Aachen, University of Applied Sciences Aachen, Campus Jülich (Germany)
- UAS Zittau-Görlitz, University of Applied Sciences Zittau/Görlitz (Germany)
- Universidade de Coimbra (Portugal)
- XIOS, Hogeschool Limburg, Diepenbeek (Belgium)

It is a wide-scope open academic network mainly focussed on teaching and learning activities, whose objectives are to enhance cooperation, competence as well as equipment sharing between partners.

A declaration, signed by all partners, contains details concerning organisation, membership and activities. This declaration can be consulted at the web site www.upv.es/cherne/

¹ CHERNE stands for Cooperation for Higher Education on Radiological and Nuclear Engineering. CHERNE is also the name of a fish, in Portugal and the Canary Islands

2.2 Origin of the CHERNE network

The CHERNE network has its origin on some ERASMUS Intensive Programmes (IP) organised during last years [1] with the participation of CVUT, DIQN-UPV, ISIB, XIOS and UAS Aachen. The IP “PAN: Practical Approach to Nuclear techniques” was organised in 2002, 2003 and 2005 in Prague, and in 2004 in Mol-Brussels. A second IP (SPERANSA, Stimulation of Practical Expertise in Radiological and Nuclear Safety) was supported by the Erasmus programme in 2006 (Mol-Jülich), 2007 (Prague) and 2008 (Mol-Brussels).



TOF line associated to GELINA Accelerator (IRMM, Geel)



Underground radwaste laboratory (HADES)



Radwaste treatment facility (Belgoproces)

A larger partnership was considered necessary to extend the scope of this collaboration, and it was initiated with the constitution of the CHERNE network in 2005 during a workshop organised in Valencia (Spain) by UPV [2].



SPARROW, training reactor of CVUT, Prague



Students at SCK-CEN, Mol, Belgium

2.3 CHERNE organisation and membership

CHERNE has a minimal administrative organisation, ensured by the secretary elected at the annual meeting. The secretary manages a Web page through which the activities of the network are communicated. The partners of CHERNE meet once a year to evaluate the activities of the network and discuss any proposal to extend or modify them. For the moment no fee is foreseen for CHERNE membership.

Academic institutions, research institutions, companies or individuals are accepted as members on presentation by two members, including at least one European academic member. Documents for this presentation as well as the list of partners can be found at the official Web site.

3. CHERNE activities

3.1 Description

Cooperation between the institutions should enhance the mutual support by learning from each other, by exchanging experiences, and by regular mutual reflections on what we can do to counteract the 'less interest among students' and the 'less interest among the academic and political authorities' and also on what we can learn from more successful or from less successful partners.

The scope of CHERNE is not limited and any activity related to higher education in radiological and/or nuclear engineering can be proposed.

CHERNE activities will be organised mostly for students of members, mainly at Master level. They should include at least a one-week/2 ECTS module. It's necessary to include practical training in activities for students, including when possible access to large facilities. Teaching modules are clearly seen as a possible kind of activity, but other types of cooperation may be also developed such as material for modules conveniently adapted in each university, e-learning, etc. The language used in CHERNE activities is English.

The CHERNE activities will be organised at no cost, or very low fee, for students coming from other partner institutions. The organising partner will find and propose cheap accommodation for the students coming from abroad. When possible, the organisation of CHERNE activities will be included in ERASMUS exchanges. Therefore, the partners are encouraged to sign bilateral ERASMUS agreements.

Research collaborations are not the main goal of the network. However, they are quite naturally developed as a consequence of the frequent exchanges for educational cooperation. [3, 4, 5]

3.2 CHERNE activities developed or proposed

Activities already realised or planned for the near future as well as a resume of the collaborations between the CHERNE partners can be consulted at the official Web site. They include seminars, courses, intensive courses, and research collaborations.

Activities developed at each partner institution are usually presented at the annual workshops held in Valencia (2005) [2], Valencia (2006) [6], and Prague (2007) [7], and foreseen next 26-28 May 2008 in Favignana Island (Italy). Furthermore, the activities developed by the network have been presented at previous conferences: ETRAP 2005 [1], First EUTERP Platform Workshop [8], European Nuclear Conference 2007 [9], and NESTet Conference 2008 [10].



1st CHERNE Workshop, Valencia 2005



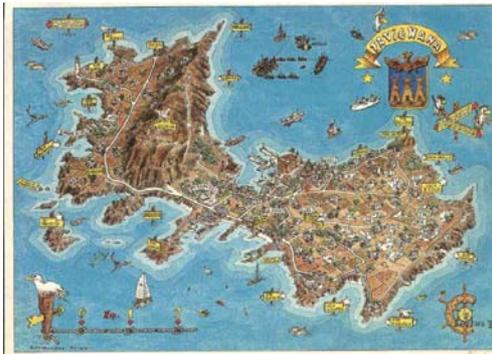
Visit to Cofrentes NPP during the 1st CHERNE Workshop, Valencia 2005



2nd CHERNE Workshop, Valencia 2006



3rd CHERNE Workshop, Prague 2007



4th CHERNE Workshop, Favignana, Sicily (Italy) 2008

In the next paragraphs a special attention is given to the international intensive courses organized. The common feature of these courses is a strong practical part in specialized facilities, including in some cases access to large equipment like research reactors and accelerators.

3.2.1 Radiation protection and nuclear measurement in non conventional sectors

Two editions (2007 and 2008) have been held of this 2-week course organised by ISIB Brussels and XIOS Diepenbeek (Belgium). Students from UAS Aachen, Bologna, UPV, ISIB and XIOS participated in these courses.

The program developed includes lectures on natural radiation, exposure of air crews to cosmic rays, indoor radon, natural radioactivity in building materials, radioactivity in the waste and recycling sector, and exposition to NORM/TENORM in the non nuclear industry. As well practical exercises are proposed on the following topics: software calculation of air crew dose, indoor radon measurements (charcoal, track-etch, continuous), soil radon measurements, radon risk evaluation (ECSR software), visit of detection portals for radioactivity in scrap or waste, simulation of intervention, measurement of NORM by gamma spectrometry, and measurements by liquid scintillation.

3.2.2 SPERANSA: Stimulation of Practical Expertise in Radiological And Nuclear Safety.

The third edition of the IP SPERANSA, a 2-week course sponsored by EU and coordinated by CVUT Prague (Czech Republic) has been organised at SCK-CEN, Mol and ISIB Brussels from 24 February to 7 March 2008, participating 24 students from Czech Technical University of Prague, Universidad Politecnica de Valencia, Politecnico di Milano, Fachhochschule Aachen in Jülich, XIOS Diepenbeek, and ISIB Brussels.

The lectures (approx 6 h) introduced the theoretical and regulatory aspects of the practical exercises (approx. 45 h), which include: reactor operation, accelerator operation and applications, hot cell operations on radioactive material, radiation emergency (in SCK-CEN Mol and IRMM Geel); and X-rays non-medical applications, neutron measurements, decontamination, indoor and soil radon measurements, TL dosimetry, quality control and patient protection in nuclear medicine and radiotherapy, and control of environmental radioactivity (in Brussels). For some facilities such as underground radwaste laboratory, and radwaste treatment facility, where a direct operation by the students is not possible, visits with demonstrations were done. Finally, 3 round tables (approx. 6 h) were organized, on two topics: ethical aspects of radiological and nuclear safety; and nuclear/radiological techniques and safety for sustainable development; and also for synthesis and evaluation of the course.

3.2.3 JUNCSS: Jülich Nuclear Chemistry Summer School.

The success of the Summer School (2-week course) organised by UAS Aachen in Jülich from 19 to 31 August 2007 stimulated to organisers together with other CHERNE partners to submit an Erasmus IP to the EU for the 2nd edition, in fact for academic years 2008-2010. The program was approved for 2008 and the course will be held from 17 to 29 August with the participation of ISIB, XIOS, UPV, Bologna and UAS Aachen.

The contents of the course include some theoretical lectures, but mainly practical exercises to acquire skill in working techniques in the radiochemical laboratory. And this on the following topics: measurement and shielding of radioactivity, radiation safety, practical measurement of nuclear radiations (α , β , γ , n), working with open sources, production of radionuclides, radiochemical separation and radioanalytical techniques, radiolabelling techniques, applications of tracers, and chemistry of radioelements.

3.2.4 ICARO: Intensive Course on Accelerator and Reactor Operation and applications.

Another Erasmus IP project has been submitted for the 2009-2011 period, coordinated by Politecnico di Milano with a first organisation (2009) proposed to ITN Lisbon and approved by the European Commission on 20 July 2008. Almost all CHERNE partners are involved in this project, as foreseen participants will be students and professors from XIOS Hogeschool Limburg, Universidad Politécnica de Valencia, Università degli Studi di Catania, Alma Mater Studiorum Università di Bologna, České Vysoké Učení Technické V Praze, Universidade de Coimbra, Universitat Politècnica de Catalunya, Institut Supérieur Industriel de Bruxelles, Aachen University of Applied Sciences, and Politecnico di Milano.

The program includes lectures (about 15 hours) on radiation protection, radiation shielding, radiation safety, interaction of radiation with matter, ion beam techniques, reactor physics – statics and kinetics, and accelerator principles. Nevertheless, the major feature of the course is represented by experiments (about 32 hours) divided in three groups: accelerator-related experiments (accelerator operation and calibration, Rutherford backscattering spectrometry, and PIXE –particle induced X-ray emission); reactor-related experiments (start-up, rod calibration, and isotope production and measurement); and exercises related to radiation protection, radiation safety, radiation shielding, dosimetry, and radiation detection and measurement.

4. Conclusions

On the basis of an existing collaboration between some institutions, the creation of the CHERNE network permitted to enhance the educational cooperation among partners.

The main target of the CHERNE network is to develop teaching activities for the benefit of students of the institutions belonging to the network.

The network is still young and small, and does not yet propose many activities, but already represents a clear added value for the students, in particular with the intensification of Erasmus exchanges between the partners. Consequently, the exchange of students has been clearly increased.

A clear result obtained so far with the network, more specifically with the intensive courses already developed, is the enhancement of the interest of students and academic authorities on Nuclear Engineering.

The perspective of the network is to gradually propose more activities, while admitting new partners who can contribute to the network's life with new activities and more students benefiting of them.

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