

PRESENT SITUATION OF NUCLEAR EDUCATION IN MEXICO

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ABSTRACT

Background

At present, there is no specific initiative from the government to promote or motivate nuclear education in Mexico. However, CONACyT, a governmental agency offering scholarships to outstanding students willing to perform postgraduate studies at local and foreign universities, is still providing support to those applicants interested in nuclear postgraduate studies. Also, CONACyT has several programmes to fund well-defined research projects in science and technology. Recently CONACyT launched a new programme aimed at improving the faculty and staff of universities and research institutes by increasing the exchange of professors and researchers from abroad. Then one would expect a realistic plan to follow for the universities in the coming years which would consider scholarships for outstanding students, funds to develop good quality research, high level full-time professors related to the nuclear field, and at least one Ph.D. programme in nuclear engineering to motivate students to continue their studies.

The nuclear R&D is carried out by the National Institute for Nuclear Research (ININ) and the Electric Research Institute (IEE). Three main fields have received attention: nuclear thermalhydraulics of boiling-water reactors (BWR), core neutronics and probabilistic safety analysis.

The main research facilities are located at the nuclear centre (ININ) which has been in operation since 1968 and has among its facilities a 1 MW research reactor, a 12 MeV Tandem Van de Graaf accelerator, a 500 000 curie gamma irradiator, a metrology centre for ionising radiation and a fuel fabrication pilot plant.

The Mexican regulatory body (CNSNS) has taken steps to train its staff in the nuclear field (on topics like radiation protection, nuclear reactor safety, thermalhydraulics, health physics, etc.) by providing local courses to enable its staff to keep up their basic skills in the kind of job they will be responsible for. Occasionally, it makes use of international agreements (IAEA, NRC) to send them abroad on specialised courses and they also attend short courses at universities. The lack of applicants with a formal knowledge in nuclear engineering has resulted in the need for the nuclear industry to provide training for its new

applicants (mechanical engineers, chemical engineers, electrical engineers, and physicists) in the nuclear technology basics.

At the National Institute for Nuclear Research (ININ) things have been very similar but its framework is different because the main objective is to develop science and technology, provide services to the nuclear industry and also short training courses, mainly in the area of radiation protection. No training courses in nuclear engineering, nuclear reactor physics nor any other fields directly related to nuclear, are offered. With respect to in-house training, the increase in annual man-hours provided by the trainers or instructors responds more to the need to satisfy an increasing market in the use and application of radio-isotopes (hospitals and industry) than to the nuclear field itself. On the other hand, this institute allows BSc, MSc and also Ph.D. students of some universities to be involved in research projects that will enable them to get their corresponding degrees. This practice has given good results and quite recently a postgraduate programme leading to MSc and Ph.D. degrees in several fields, including nuclear, was opened. Unfortunately, the nuclear field is almost empty and most of the applicants go into material sciences research.

In addition, the Electrical Research Institute (IIE) has run a fellowship programme similar to that of ININ, allowing students to do their thesis at bachelor, master or doctorate level. It has also given economical support to its staff undertaking postgraduate studies in and out of the country, but this is coming to an end.

Finally, the utility (CFE) also offers its personnel continuing education through local courses given by its own staff and whenever necessary by private companies. It also has a simulator to provide training to its reactor operators and staff. It is important to keep in mind that the first nuclear unit started to be commercially operated in 1990 and the second one in 1995. There is a strong probability that the increase in the number of trainees and trainers between 1995 and 1998 is closely related to this fact.

Nuclear Education in Mexico

Nuclear education in Mexico is limited to just a few institutions, namely:

- Instituto Politécnico Nacional (IPN)
- Universidad Nacional Autónoma de México (UNAM)
- Universidad Autónoma Metropolitana-Iztapalapa (UAM-I)
- Universidad Autónoma de Zacatecas – Centro Regional de Estudios Nucleares (UAZ-CREN)
- Universidad Autónoma del Estado de México (UAEM)

The oldest master level program in nuclear engineering in our country is still offered by IPN. The academic program was created in 1961. In the first half of its life, the Nuclear Engineering Department (DIN), a department of the School of Physics and Mathematics (ESFM), had a numerous collegiate body with a top level and quality required for this kind of studies. It was one of the best postgraduate departments in the nuclear engineering field in Latin America during the 1965-1975 period. Today, it has only three full-time professors and three part-time. The research side has practically vanished and most of it is limited to BSc and MSc theses. In 1979, the DIN started to offer courses in the nuclear engineering field at BSc level. The idea behind it was twofold: first, to prepare students with a wider knowledge than the one offered to students involved only in physics, and second, to have better prepared applicants for the postgraduate studies of the master's programme. This proved to be successful for almost 15 years but at present, students would rather be more involved in the traditional studies of physics and mathematics than in nuclear engineering. In the near and medium-term future, nuclear education in Mexico is not promising and there is a strong possibility that in the next years, the nuclear engineering programme offered at IPN

will come to an end like some of the others in the country. Before 1990 there was also a master's degree in nuclear medicine at IPN's School of Medicine (ESM) that started in 1980 and was finally cancelled around 1988. The reasons for its closure are not clear but were probably due to the lack of specialists in the area and to the low number of students who succeeded in finishing a master's thesis.

UNAM offered a master's in nuclear sciences with three options (nuclear engineering, nuclear fuel, and nuclear chemistry) that was cancelled in 1997, and a master's and a Ph.D. program in chemical sciences with an option in nuclear chemistry appeared in its place. The main contribution of the old program was in nuclear chemistry and not in nuclear engineering or nuclear reactor physics. Very recently there has been an increasing concern to offer programs at the bachelor and master level in medical physics at UNAM's Faculty of Sciences (FC) and Institute of Physics (IF). The School of Engineering has recently hired a group of nuclear engineers in order to promote this area of the engineering, and plans are being developed to offer a Nuclear Systems option in the Energy Postgraduate Program of this school.

The program offered by UAM-I deals with the energy sector, and not only the nuclear field, and covers subjects related to the study of conventional energy sources (oil, natural gas, hydraulic, mineral, coal, etc.) and unconventional ones (sun, eolic, nuclear, geothermic, etc.). In fact only a low percentage of the students enrolled in this programme (bachelor level) are involved in fields such as nuclear engineering, nuclear reactor physics, radiation safety and protection. Even in this case, the students are not compelled to take the whole body of courses in this area.

The program that UAZ-CREN offers in the nuclear field started in 1995. It follows 4 main lines of specialisation: nuclear medicine, nuclear measurements, nuclear electronics, and nuclear engineering. Although several students were enrolled at the beginning of this programme, only two managed to see it through. Since then, the programme has had two students per year involved mainly in nuclear electronics and nuclear engineering.

There was also a master level program in radiation metrology at UANL (Universidad Autónoma de Nuevo León) in the northern part of the country that was definitively cancelled out.

Finally, the postgraduate programs that UAEM offers in nuclear sciences and health physics are offered by a joint effort with the Instituto Nacional de Investigaciones Nucleares (ININ).

The future of nuclear education in Mexico in the coming years is somewhat uncertain if no measures are taken. To face up to this situation, several round tables have been organised with the support of governmental institutions, academic societies, and the universities to identify: the needs of the nuclear industry, the desired profile of the people they want, and new lines of research. Very recently the idea to establish the foundations for a Multi-Institutional Graduate Program came up, where the different above-mentioned universities will share their human and material infrastructure to set up a national graduate program on nuclear sciences. This program would receive the financial support of CONACyT, mainly for students fellowships and research projects. It is expected that this national program will become an international one with the participation of foreign universities. To achieve this last goal, different co-operation agreements must be set up between universities. This kind of panel or meeting could be the starting point for an international effective co-operation on nuclear sciences education.