

# GENERAL OVERVIEW OF NUCLEAR ACTIVITIES IN MOROCCO

K. KAROUANI  
CNESTEN, Agdal,  
Rabat, Morocco



XA9846707

## Abstract

Nuclear activities have been introduced in Morocco since the early seventies. These activities concern the utilization of nuclear techniques in medicine, food and agriculture as well as training and research in nuclear physics. In 1984, Morocco decided to undertake a technical and economic feasibility study as well as the site study of the first nuclear power plant. Two years after, he decided to create the "Centre National de l'Energie des Sciences et des Techniques Nucléaires" as a technical and research support for the nuclear power program and as a promoting institute of nuclear techniques. Obviously, he also decided to set up a regulatory framework.

### 1. Training and research in nuclear physics

Morocco, being conscious of the long lead-times involved in developing qualified manpower, started teaching basic and applied nuclear physics for two years during the undergraduate studies in the faculty of Sciences, Rabat, since 1968 and later on in other faculties.

To improve the graduate students background, post graduate nuclear studies have been set up in Morocco and/or students sent abroad. Included in these post graduate studies, there are some research works in fundamental nuclear physics, reactor physics, radiochemistry, etc. which were published in scientific journals.

### 2. Medical applications

For the benefit of his citizens, Morocco introduced the nuclear techniques for the medical applications, especially for radio-diagnosis using Tc-99m and I-131, radioimmunoassay (RIA) using I-125, radiotherapy by the use of Co-60 sources or linear accelerator, curithery using Cs-137 and Ir-192, and for some biology investigations.

These techniques are now utilized in about eight hospitals and medical units, located in the majority in Rabat and Casablanca cities.

### 3. Food and agriculture

The nuclear techniques are also applied in the field of food and agriculture. These concern:

- \* radiation induced mutation with the aim of improving the field, quality and resistance of cereals and other plants to drought,
- \* investigations on optimal conditions of applying, fertilizers to sugar beet and to study

- soil nitrogen supply,
- \* improvement livestock breeding through hormone dosing and monitoring the major diseases affecting livestock,
- \* assessment of nitrogen fixation in various species of trees in order to develop methods for improving fertility of marginal soil,
- \* food irradiation processing (a pilot food irradiation facility is being built in Tangier city).

#### **4. Industry application**

The industry in Morocco has been using some nuclear techniques in:

- \* non destructive testing using X Ray and gammaradiography,
- \* sugar factories, cement factories, phosphate industry, mines, hydrology using radiometric gauges.

#### **5. Nuclear power plant project**

In 1984, Morocco undertook a site and technical and economic studies of the first nuclear power plant which were completed in 1994. The site study allowed to qualify one site among seven potential sites that were considered at the beginning. The technical and economical study covered the three commercially approved, reactor systems (PWR, BWR and CANDU). This study concluded that the first commercial nuclear power plant in Morocco could be built starting from year 2010.

#### **6. Promotion of nuclear techniques and support for nuclear power program**

Although nuclear techniques were introduced in the country since the early seventies, their utilization remained limited to a few applications. To widen their applications, Morocco created in 1986 the “Centre National de l’Energie, des Sciences et des Techniques Nucléaires (CNESTEN)” which has the responsibility to promote the nuclear techniques in the divers social and economic sectors of the country. Besides this, CNESTEN has also the role of technical assistance to the national nuclear power program in the matter of site selection, manpower training, technology transfer, nuclear safety and choice of reactor system. To cope with his missions, CNESTEN is building its first nuclear research center which includes a TRIGA Mark II reactor of 2 MW thermal power and some laboratories such as radioisotope production laboratory, radioactive waste processing facility, nuclear techniques laboratory, safety and radiation protection laboratory, and electronic and mechanical workshops.

#### **7. Regulatory framework**

Nuclear regulation constitutes an essential component of a national nuclear program. Thus Morocco designated a regulatory body which set up a regulatory framework for nuclear activities. Hence some decrees have been or are being promulgated. These concern:

- \* setting up of a National Council for Nuclear Energy (CNEN),
- \* authorization and control of nuclear facilities,
- \* protection against ionizing radiation,
- \* radioactive material transport,
- \* physical protection of nuclear materials,

- \* civil responsibility in case of nuclear damage,
- \* emergency planning.

## 8. Seawater desalination feasibility study

Being conscious of the water shortage he will face in the coming years, Morocco took part of the feasibility study of seawater desalination using nuclear energy was carried out from 1991 to 1995 for the north African countries in collaboration with the IAEA's experts, which covered the following aspects.

- \* geography and demography,
- \* water resources and demand,
- \* energy resources and demand analysis,
- \* site selection,
- \* overview of desalination processes,
- \* desalination units and nuclear reactors coupling,
- \* local participation.

The results of this study are summarized in the following reference "Nuclear desalination as a source of low cost potable water in North Africa. SP. (IAEA Report) Draft, January 1995, Regional Meetings: Egypt, Morocco, Algeria, Tunisia, Austria.

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