



Thailand 's nuclear research centre

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Abstract. The office of Atomic Energy for Peace, Thailand, is charged with three main tasks, namely, Nuclear Energy development Plan, Utilization of Nuclear Based technology Plan and Science and technology Plan. Its activities are centred around the research reactor TRR-1/M1. The main areas of contribution include improvement in agricultural production, nuclear medicine and nuclear oncology, health care and nutrition, increasing industrial productivity and efficiency and, development of cadre competent in nuclear science and technology. The office also has the responsibility of ensuring nuclear safety, radiation safety and nuclear waste management. The office has started a new project in 1997 under which a 10 MWt research reactor, an isotope production facility and a waste processing and storage facility would be set up by General Atomic of USA. OAEP has a strong linkage with the IAEA and has been an active participant in RCA programmes. In the future OAEP will enhance its present capabilities in the use of radioisotopes and radiation and look into the possibility of using nuclear energy as an alternative energy resource.

Introduction

Development of nuclear technology in Thailand could be traced back to the proposal for an 'Atoms for Peace' programme by the US Government in 1953. A national committee was then established to pursue the study and deliberation on atomic energy for proper moves into the atomic age. The first Thai legal instrument concerning nuclear energy, the Atomic Energy for Peace Act, B.E.2504 was enacted and became effective on 26 April 1961. By virtue of this law, the Office of Atomic Energy for Peace (OAEP) came into being as the centralized office governs the work on the utilization of the nuclear based technology in all field including the responsibility on radiation protection, radioactive waste management and nuclear safety. The first Thai research reactor was installed and brought to its initial criticality in 27 October 1962, which was an important milestone in the history of the development of nuclear technology in Thailand.

Since then, the application of nuclear techniques has been gradually increasing. At present, nuclear technology are quite well known by most of Thai scientists, academicians, medical doctors, industrial men, etc. The principal usage of the nuclear technology is those in the medical treatment and diagnosis, scientific research work, agriculture and industry. The prospect for using nuclear energy as a resource for electricity was also introduced since 1974, but it has not been implemented yet.

Past and present situation of NRCs

OAEP, the national nuclear research centre of Thailand, is a governmental institution under the Ministry of Science, Technology and Environment (MOSTE). The principal responsibilities of OAEP are; serving as a competent authority in conformity with the Atomic Energy for Peace Act, B.E. 2504 (1961); acting as an intermediary co-ordinating with in the country and foreign organizations; conducting activities relevant to the atomic energy for peaceful uses; and undertaking study, research and development of nuclear technology as well as maintaining and operating the reactor for the national research.

The reactor building was established in June 1960 and the reactor was completely commissioned in June 1962. The reactor was manufactured by the Curtis Wright Company, USA, and was officially named "the Thai Research Reactor-1 (TRR-1)". It went critical for the first time on 27 October 1962 and has been applied as a principal equipment for nuclear technology study and research, training, and isotope production for the country use, ever since. Later, the OAEP modified and upgraded the reactor by changing the reactor core into TRIGA Mark III Type of General Atomics, USA. and renamed it "the Thai Research Reactor-1 Modification 1 (TRR-1/M1)". The TRR-1/M1 has been mainly used for study, research and isotope production until now.

The TRR-1/M1 situates on the Vibhavadi Rangsit Road, Chatuchak district, about 8 kilometers from the Bangkok International Airport. Over the past decade, OAEP is the centrepiece for conducting the research and development programme in Thailand. But due to the limited office area causes difficulty in expanding the projected researches and studies.

The second research reactor project, has been initiated in 1991. The suitable site for such reactor has been selected and developed, since 1993. The site is located at the Ongkharak District in Nakornnayok Province, about 70 km. from Bangkok. The Ongkharak Nuclear research centre Project was started on 26 June 1997. The contract for the turnkey delivery of the three facilities, the Reactor Island (RI), the Isotope Production Facilities (IPF), and the Waste Processing and Storage Facilities (WPSF), was signed by OAEP with General Atomics (GA) of USA. The Electrowatt Engineering Ltd. (EWE) of Switzerland served as the consultant of OAEP for this ambitious project. The centerpiece of the Reactor Island is a multipurpose, pool-type TRIGA reactor having a steady-state thermal power output rating of 10 MW. The reactor uses low-enriched uranium (LEU) fuel having a U-235 enrichment of about 19.7 wt.%, is cooled and moderated by light water, and reflected by heavy water (D₂O) and beryllium. At the time of this report, the basic design of all facilities has been technically accepted. It is expected that the detail design documents will be submitted for subsequently approval in due time.

At present, OAEP consist of 11 divisions, organized into three groups according to the major task as follow:

Administration and conferences

- Office of the Secretary

Nuclear and radiation safety

- Health Physics Division
- Radiation Measurement Division
- Waste Management Division
- Nuclear Facility Regulatory Center

Promotion of nuclear energy application

- Reactor Operations Division
- Isotope production Division
- Electronic Instrumentation Division
- Physics Division

- Chemistry Division
- Biological Sciences Division

R&D programmes

OAEP has been conducting many R&D activities by using the TRR1/1M research reactor and some other related facilities. The fields of work include:

- Applied nuclear physics
- Nuclear chemistry
- Radiation technology
- Radiation health and safety, waste Management
- Isotope production
- Engineering and industrial application
- Biological sciences, food and agriculture
- Environment and natural resources
- Rare earth production and utilization

In addition, OAEP has been also involved in rendering services on various subjects namely:

- nuclear-based analytical services (special emphasis on medium and heavy element)
- carbon dating
- radiation measurements, including fallout monitors
- health physics services
- waste management and decontamination services (low and medium level)
- gamma irradiation services (for research and project development only)
- nucleonic equipment maintenance
- industrial radiography services (with capability for in-plant / in-field inspection)
- distribution of radioisotopes
- tracer techniques application
- consulting services in peaceful application of radioisotopes and radiation technology.

Manpower, finances and infrastructure

In 1999, the total number of OAEP's employees, is about 500, divided into technical staff of 250, the remaining are administrative officers and supporting staff.

Since OAEP is a governmental organization, the financial support for all activity is from the government. The budget for the year 199 is totally US\$ 46 million and can be divided into three main task namely, nuclear energy development plan; utilization of nuclear based technology plan; and science and technology development plan.

At OAEP, the divisional structure is observed only to an extent of compliance with civil services normal practices. But, in order to attain maximum and efficient utilization of a very limited resource of well-trained manpower, OAEP encourages its personnel to work in team rather than keeping strictly to the routine work assigned to their respective divisions. Apart from carrying out routine divisional work, most medium and senior-level scientists and engineer are normally assigned to joint R and D projects, in which more than one division within OAEP and one or more organization outside OAEP participate.

Strengths and limitations

As a governmental institution, OAEP is expected to conduct activity on nuclear aspect to render the service to the publics and society as a whole. Research and development work of any subject can be performed subjected to the interest of OAEP scientists and engineer. But in reality, there is a limitation of human resources in the organization. Knowledgeable people capable to conduct the R&D are rare. Since there is no formal education course on nuclear in under-graduate level. The budget for conducting the R&D is also a problem. Researchers could do only the small projects in a small group of a few people. Big project for investigation of more important problem is rarely the case.

The vision for R&D in nuclear science and technology has been set but not fully implemented.

Challenges faced by NRCs

New directions

Due to past experiences with some of the success and failure on conducting R&D in nuclear, a plan for a new direction was purposed:

- *Organization:* the promotion of peaceful uses of nuclear energy should be separated from the regulation authority i.e. the Thailand Atomic Energy Research Institute as a public governmental organization was purposed.
- *Planning:* the comprehensive nuclear energy utilization plan will be purposed including the vision for the new organization—to be:
- To expand the applications of nuclear technology to medical, agricultural, and industrial areas.
- To study the application of nuclear energy as an alternative resources of energy.
- To secure nuclear safety and radiation safety
- *Co-ordination:* establishing R&D work as a joint research programs with other organizations and institutions.

Interaction of NRCs with their environment

Social and economic sector

The Thai government has devised various instruments and development infrastructure to support research and development of science and technology for benefits of the general populace. The key emphases have been those contributing to development of agricultural produce, improved public health and welfare, and industrial productions. Contributions of science and technology have been increasingly essential to present quality of life of Thai society as globalization prevails and economic turmoil continues.

Among other science disciplines, nuclear science has been recognized to be an important extension of the basic sciences from which number of advance technologies are developed and utilized for peaceful purposes. In the past 37 years, there have been substantial progresses made on peaceful and safe utilization of atomic energy in various Thai research institutions including OAEP. Their main contributions have been in areas of education and training, and for agricultural produce development and treatments, nuclear medicine and nuclear oncology, health care and nutrition, and increasing industrial productivity and efficiency. The important association to the contributions, apart from tangible economic and social benefit, has been a national asset of a cadre of competent personnel in nuclear science and technology community where successful future development are assured. Furthermore, their expertise has been internationally recognized and contributing to regional peace and development as well.

Such progresses are assured by only with sufficient safety measures. Enforcing of radiation and nuclear safety measures has been a major commitment to the public of the safety inspectors and safety officers at OAEP and the Department of Medical Science. It has been clearly successful, as there has been no record of any nuclear accident in Thailand since 1962. It has also been well recognized among users of the technology that the inspectors and officers have always been attentive, careful, and decisive on radiation and nuclear safety implementation to maintain public safety standard.

Academia

OAEP has a good relationship with the Universities in Thailand, both in Bangkok and in the provinces. Some R and D programs are worked jointly among various institutions and the NRC. The scientists and engineer from OAEP are invited to be the lectures and co-supervisor in many thesis and special problems for the student in many graduate schools.

Public

To achieve the public understanding or acceptance on nuclear energy, efforts had been made through activities of public information and public understanding. OAEP keeps on conducting many technical training courses, seminars, workshops, conferences, exhibitions and etc. for many target groups such as, university lecturers, school teachers, scientists, engineers and general public. Up to now, it seems that achievement of public acceptance is satisfactory in certain level only for some target groups of higher education. It is still unsatisfactory for the general public and few targets group especially the non-governmental organization that opposes nuclear.

Collaboration and co-operation

IAEA role

OAEP recognized IAEA role for providing assistance on various R&D programme in many sector, via the channel of Technical co-operative program, and RCA. Thailand has participated in many project activities generating social and economic benefits as well as welfare to the people in the country. Subjects for the on going activities are as follows:

- Radiation protection infrastructure
- Thematic health care program
- Agriculture-related projects

- Industry and environment-related projects
- Energy and research reactor-related projects.

Conclusion

OAEP is a centralized office, governs the work on the utilization of the nuclear-based technology in all field including the responsibility on nuclear safety, radiation protection and radioactive waste management and nuclear safety. OAEP, by its statutory functions, is a nuclear research centre of Thailand, undertaking research and development in nuclear science and technology including the operation of the national research reactor. At the same time, it acts as a regulatory organization, performing regulatory roles pursuant to the Thai Atomic Energy for Peace Act.

For the 21st century, it is expected that nuclear energy will play a major role as an alternative energy resource as well as the high technology tool in various sectors namely, medicine, agriculture and industry. R&D in nuclear field will be increase and enlarge substantially, to meet the demand of the technology. NRCs will still be a good place for commence the development and maintain the high standard of technology, subjected to the well-established plan.