Nuclear Data Needs in Thailand

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The major nuclear facilities in Thailand are composed of nuclear research reactor , neutron generators, electron linear accelerators and 1 GeV Synchrotron facility, which is under construction. The other small facilities are radioisotope sources and X ray tubes for X ray diffraction and fluorescence studies. Nuclear data activities in each institutions are mainly for application purposes, e.g., utilization of 2 nanosecond pulsed neutron time-of-flight facility at Chiangmai University, research reactor utilization at Office of Atomic Energy for Peace, and nuclear data for industrial applications.

Office of Atomic Energy for Peace (OAEP) is the function arm for nuclear institutions in Thailand. Its major roles are nuclear regulatory, coordinating for nuclear affairs and foreign relations, R&D for nuclear science and technology and giving nuclear services. Nuclear data activities concerning Thai Research Reactor (TRR-1/M1) are for examples : neutronics and thermalhydraulics for reactor operation, neutron energy spectrum and neutron flux measurement for neutron activation analysis and isotope production, neutron and gamma doses, shielding and material testing for radiation safety, and neutron beam experiments.

OAEP is taking part in the areas of regional cooperation on utilization of nuclear research reactors, education and training, sharing of research reactor experimental facilities, establishment of nuclear data program and information exchange. The nuclear data reports have been shared among institutions in Thailand through OAEP, which is served as a central nuclear data depository including e.g., the data bank of International Nuclear Information Services (INIS) IAEA, IAEA-NDS, Joint Research Centre Commission of the European Communities and Japanese Nuclear Data Committee (JNDC).

This report shows the nuclear facilities in Thailand, the roles of the Office of Atomic Energy for Peace on nuclear data depository and nuclear power development program. The main activities at the Thai Research Reactor TRR-1/M1 concerning nuclear data needs for specific uses in both theoretical and experimental aspects are also described.

1. Introduction

In order to support the research and utilization in nuclear technology, many institutions have exploited nuclear facilities and man power to perform this task. The major facilities in Thailand are composed of these followings :

1) Thai Research Reactor (TRR-1/M1) - 2 MW TRIGA Mark III type at the Office of Atomic Energy for Peace (OAEP) which has been utilized for the production of radioisotopes mainly for medical use, neutron activation analysis, reactor physics research, and radiation technology application [1].
2) Neutron generators at Chulalongkorn and Chiangmai Universities, e.g., utilization of 2 nanosecond pulsed neutron time-of-flight facility [2].
3) Electron beam accelerators, using for medical therapy, sterilization of medical supplied products and for gems coloration.
4) 1 GeV Synchrotron facility of Ministry of Science Technology and Environment (MOSTE), which is under construction [3].
5) The other small facilities which using radioisotopes, in more than 100 industries, 30 medical institutes, 30 R&D institutes and 10 agriculture institutes.

Nuclear Data activities in each institutions are manly aiming for basic nuclear studies and application purpose. The Office of Atomic Energy for Peace (OAEP) is taking part in the areas of regional cooperation on utilization of nuclear research reactors, education and training, sharing of research reactor experimental facilities, establishment of nuclear data program and information exchange. The nuclear data reports have been shared among institutions in Thailand through OAEP, which is served as a central nuclear data depository including e.g., the data bank of International Nuclear Information Services (INIS) IAEA, IAEA-NDS, Joint Research Centre Commission of the European Communities and Japanese Nuclear Data Committee (JNDC).

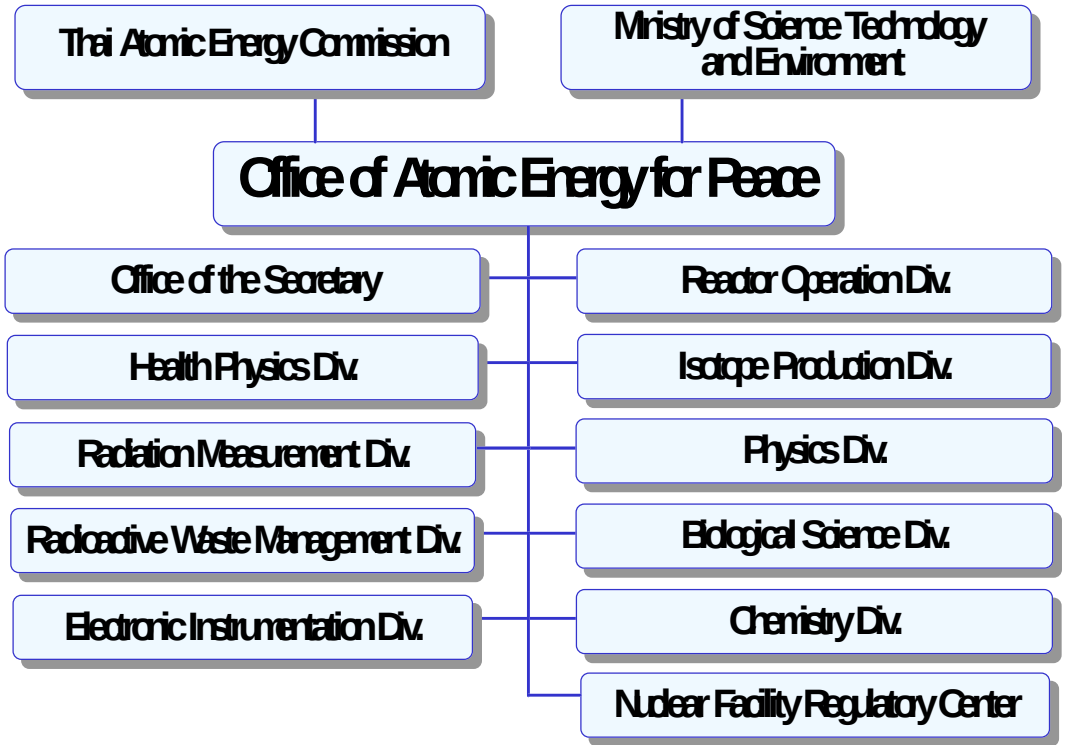
2. Organization of OAEP

The execution of the country atomic energy program has been centered by the Office of Atomic Energy for Peace (OAEP), which was established since 1961. Its duties were given in compliance with the resolution of the Thai Atomic Energy Commission (Thai A.E.C.), the policy making organ of the government of Thailand. In accordance with its statutory function, OAEP responsibilities comprise three main aspects of activities, mamely :

1) regulatory role persuant to the Atomic Energy for Peace Act.
2) co-ordinating role for nuclear affairs and foreign relations.
3) research and development in nuclear technology.

At present, OAEP consists of 11 divisions, as shown in the chart.

Organization Chart



Thai Atomic Energy Commission

Sub Committees

1. Reactor Safety
2. Medical Application
3. Agricultural Application
4. Industrial Application
5. Irradiated Food Testing
6. Nuclear Material Safeguard
7. Nuclear Law
8. Licensing of Radioisotopes
9. Nuclear Power Plant Program
10. Cooperation in Nuclear Science with Science Technology Agency, Japan

3. Nuclear Power Development Program

The electricity demand in Thailand is rapidly increasing roughly 1,000 MW every years since last two decades. Thailand was first introduced the nuclear power as an electricity generation option in 1967, but the nuclear industry in the country was slowly developed due to various problems, e.g., public opposition, economic repercussion and the uncovering of the indigenous petroleum resources. Nonetheless, the Electricity Generating Authority of Thailand (EGAT), the main power producer, still continued to follow-up the nuclear power program, implementation and nuclear technology studies [4].

In 1984, the International Atomic Energy Agency (IAEA) assisted Thailand in undertaking of an energy and nuclear power planning study. The result showed that the proper time of introducing nuclear power around the year 2004 with units capacity of 900 MW and this provided the basis for the long range power planning.

Faced with dwindling indigenous fossil resources and restrictions on the use of further hydro as an energy source, EGAT has essentially reconsidered introducing nuclear power plants to provide a significant fraction of the long-term future electricity demand. The first nuclear power station of 2,000 MW was originally planned for commissioning by 2006. Study on the viability of such plan was conducted in 1992 on the preliminary basis of comparing the nuclear option with the equivalent thermal generating alternatives. In conjunction with this, the justification to conduct the studies on feasibility, siting and environmental impacts was perused. The study revealed that the nuclear option is economically viable and that the respective studies are justified.

Led by a team of expert from IAEA, a workshop seminar on launching a nuclear power program in Thailand was organized for the decision makers in August 1993. Conclusion was drawn that top priority must be given to the implementation of the following three activities :

1) Legislation of nuclear power laws and establishment of independent and competent nuclear regulatory body
2) Extensive public acceptance campaign
3) Proceeding of manpower development, siting and feasibility study.

In July 1996, the National Committee comprising various concerned government and private agencies has been set up and chaired by the Ministry of Science, Technology and Environment. Under the steering of this committee would be four sub-committees namely : Sub-committee on economic viability & infrastructure; sub-committee on technology & safety; sub-committee on environmental impact and sub-committee on public information. The committee is responsible for all the work and activities related to the development of nuclear power including all studies and recommendations for government decision.

4. Nuclear Data Needs in Thailand

The main nuclear facilities in Thailand which are under construction are the nuclear research reactor and the synchrotron facility. The nuclear data needs for both facilities will be described accordingly.

4.1 **Research Reactor**

Office of Atomic Energy for Peace is in the process of establishing a new Nuclear Research Center, the major project will be the construction of a 10 MW Research Reactor, on Isotope Production Facility and a Centralized Waste Processing and Storage Facility. The objectives of the reactor are as follows :

- Beam experiment : Neutron Scattering (NS), Neutron Radiography (NR), and Prompt Gamma Neutron Activation Analysis (PGNAA)
- Medical therapy of patients through the Boron Neutron Capture Therapy (BNCT) technique.
- Radioisotope production for medical, industrial and agricultural
- Applied research and technology development in the nuclear field
- Training in reactor physics (neutron physics, thermal hydraulics, reactor experiments, etc.).

The existing 2 MW TRIGA Mark III research reactor is still in operation and will be decommissioned soon after the completion of the new reactor commissioning approximately in the year 2001. The nuclear data needs will be mainly on the specific purposes, e.g., reactor operation, spent fuel transportation and radioactive waste management.

a. **Reactor Operation**

Besides the nuclear data needs for the design and development of reactor core, reactor dosimetry is the topic much relating to nuclear data. Reactor dosimetry studies are critical examination of evaluated neutron fluence and neutron spectrum.

Non-destructive measurement and calcuation of fuel burnup are interesred for the point of view of control and management of reactor fuels by using correlation between activity ratio of fission products from post irradiation examination.

b. **Spent Fuel Transportation**

The cast to contain the spent fuels should have enough shielding ability against the intense radiation of the fission product contained. Fission yield data the product nuclides and nuclear decay data of those are used to calculate the fission product inventory in the spent fuel.

For the purposes of shielding analysis, the intensity of radiation source in the spent fuel, that is of neutron and gamma rays, has to be evaluated with confidence.

c. **Waste Management**

In order to establish adequate management system of the radioactive waste, it is necessary to evaluate various factors of the waste, e.g., generation and inventory, heat generation, shield calculation, criticality both in the treatment process and in the disposal, and long term safety analysis. The nuclear data requirements involve basic decay data of the actinide nuclides as will as the daughter nuclides in the radioactive decay chains and those of the fission products.

4.2 **Synchrotron Facility**

The Siam Photon Project promoted by the National Synchrotron Research Center of Thailand which composes of a) 40 MeV electron Linac b) 1 GeV Booster Synchrotron and c) 1 GeV electron storage ring will be built. The major facilities are transferred from the shut down SORTEC Laboratory in Tsukuba, Japan. The building construction and facility commissioning will be finished around begin of the year 2001. The project aims at promoting the scientific researches based on spectroscopic methods in the vacuum ultraviolet and soft X-ray regions.

Radiation safety is the main task of the Project as followings : Radiation Shielding Analysis, Radiation Safety Control, Radiation Measurement, Analysis and Control, Research on Radiation Production, Transport and Shielding. The verification of shielding calculation for Linac tunnel shielding, Booster Synchrotron and Storage Ring will be done for design analysis. Thus the specific nuclear data is needed for high energy electron and Bremsstrahlung shielding design.

5. Conclusion

This report shows the nuclear facilities in Thailand, the roles of the Office of Atomic Energy for Peace on nuclear data depository and nuclear power development program. The main activities at the Thai Research Reactor TRR-1/M1 and 1 GeV Synchrotron facility concerning nuclear data needs for specific uses in both theoretical and experimental aspects are also described.

In addition to elaborate the base data file for the calculation codes, it might be much helpful to provide such a code system involving necessary data library and indicating confidence limit to the results obtained by the code in connection with its applicability range.

References

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[4] Electricity Generating Authority of Thailand, “Electric Energy Situation” EGAT Annual Report (1997).