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ADVANCES IN THE APPLICATION OF NUCLEAR ENERGY FOR PEACEFUL PURPOSES

Information received from Pakistan

On 9 September 1976, the Director General received from the Government of Pakistan, for the information of the General Conference, material on the advances made in its country during the year 1975-76 in applying nuclear energy for peaceful purposes. The material in question is reproduced below.

REPORT ON THE ADVANCES IN THE APPLICATION OF NUCLEAR ENERGY FOR PEACEFUL PURPOSES IN PAKISTAN

1. Established in 1955, the Pakistan Atomic Energy Commission (PAEC) is the sole organization responsible for harnessing nuclear energy for the economic development of the country and for promoting its peaceful uses in the fields of agriculture, medicine and industry. With these objectives in view, the Commission has embarked upon research and development as follows:

(i) Nuclear power generation;

(ii) Development of nuclear technology to support the nuclear power programme;

(iii) Promoting the peaceful uses of atomic energy in the field of agriculture, medicine and industry.

NUCLEAR POWER GENERATION

2. Pakistan has low per capita energy and power consumption and its fossil fuel reserves are very limited. Its per capita consumption of energy is as low as 140 kWh compared with more than 9000 units in several industrialized countries. Again its fossil fuel reserves (oil, coal and gas) of 13 tons of coal equivalent per capita also constitute only 1% of the world average. Hydro is the main source of power generation but even this cannot be economically exploited beyond a certain limit to meet the increasing demands for energy. The country has thus no practical choice other than harnessing nuclear energy to meet its increasing power requirements.

3. A study of the long-term nuclear power requirements and programming has been completed in collaboration with the International Atomic Energy Agency (IAEA), which envisages an increase in per capita consumption of power by 2000 A.D. to about 800 kWh as compared to 140 kWh at present. PAEC has since firmly established a comprehensive programme for the construction of 24 nuclear plants (17 of 600 MW and 7 of 800 MW capacity each); these when completed will raise the share of nuclear power capacity to 16 000 MW, out of a total of 26 500 MW by the end of the century.

Karachi Nuclear Power Plant (KANUPP)

4. The performance of the Karachi Nuclear Power Plant (KANUPP) for the 12-month period from July 1975 to July 1976 showed an impressive availability factor of 85% and a new record of continuous operations of 95 days was set. Cumulative energy produced by the Plant from the time of commissioning up to 30 June, 1976 was 2 155 244 680 kWh.

Chashma Nuclear Power Plant (CHASHNUPP)

5. In pursuance of the objective to provide the country with an adequate supply of nuclear power for economic development, PAEC is planning to set up another nuclear power plant of 600 MW(e) capacity near Chashma Barrage in Mianwali District.

6. The necessary geotechnical investigations at the site have been carried out in association with foreign consultants. Simultaneously, subsoil studies have also been undertaken and completed. Preliminary site preparations and arrangements for construction of various facilities are in progress.

7. The project already stands formally approved by the Government. A number of nuclear power plant suppliers from different countries have shown keen interest in the project and have visited Pakistan to familiarize themselves with the existing conditions and assess the industrial and engineering potential of local participation in the execution of the project.

AGRICULTURE

8. The Agricultural Research Programme has essentially remained the same as in the previous years. The two research centres at Tandojam and Lyallpur have continued to make use of conventional and radiation techniques for improving such crops as wheat, cotton, rice and pulses, etc. which play an important role in the economy of Pakistan. The problems of evolving high yielding varieties better suited to regional conditions, insect ecology and control, utilization of saline land, and optimization of fertilizer and water use, have continued to engage the attention of the scientists working at these centres. A third agricultural research centre, namely the Nuclear Institute for Food and Agriculture (NIFA) is presently under construction at Tarnab - near Peshawar in the North-West-Frontier Province.

9. Two promising wheat mutants were included in co-ordinated yield trials under the supervision of an independent Government agency; one of these out-yielded the rest of the cultivars and has shown great adaptability, whereas the other mutant has out-yielded in areas with poor soil conditions. A number of cotton mutants showing pest resistance, earlier and uniform maturity have been selected. A mutant of Basmati rice maturing about three weeks earlier has enhanced the possibility of growing two rice crops in a year.

10. A compound, having insect repellent property, has been extracted from a wild growing tree. Its composition and structure are being analysed.

11. The laboratory-scale investigations on the preservation of potato, onions and some vegetables by use of radiations have been completed, and attempts are being made to use the collected information on a commercial scale. Similar work on the preservation of fresh fish is also in progress.

12. A symposium on the Control of Genetic Diversity in Plants was organized by PAEC in collaboration with the United States Science Foundation, which was attended by many eminent scientists from the United States of America, the United Kingdom, Australia, Germany and other countries.

NUCLEAR MEDICINE

13. The Institute of Radiotherapy and Nuclear Medicine (IRNUM) at Peshawar, was formally inaugurated in November 1975. With its opening, the Commission has been able to provide most modern diagnostic and therapeutic facilities to the people in the northern region. After Jamshoro in Sind Province, this would be the second centre of the Commission equipped to provide radio-therapy facilities. Other centres at Karachi, Lahore and Multan have continued to provide diagnostic facilities for various diseases of kidney, liver, lungs, thyroid and brain, etc. In addition to the routine diagnostic services, these centres have also been engaged in a number of research programmes.

14. Construction of yet another nuclear medical centre at Larkane in Sind is nearing completion. The Commission is also planning to establish one more medical centre at Lahore for providing added facilities in the fields of nuclear medicine and radiotherapy.

NUCLEAR MINERAL SURVEY

15. Search for indigenous mineral deposits was further intensified during the period under review. The known uranium-bearing prospect in Dera Ghazi Khan District was investigated to assess the nature of mineralization, its distribution pattern, the mode of occurrence and its mineral potential, etc. The investigations were carried out with the assistance of the United Nations Development Programme. Some new paleo-channels were located at the site. Efforts were continued to locate similar radiometrically anomalous prospects in other parts of the country which were amply rewarded.

16. Simultaneously, a mineral-sands programme was also followed along the coast at Karachi and at other places in the country resulting in the discovery of zircon-bearing sands containing other economic minerals as well. Preliminary examination of some of these prospects have already confirmed the presence of commercially exploitable deposits. Plans are now in hand to assess their mineral potential and for setting up a small-scale facility for studying the feasibility of their economic exploitation.

TRAINING

17. A large number of trained engineers/scientists are required by PAEC for manning its various on-going and planned projects; PAEC has, therefore, floated several schemes in this respect in order to encourage and facilitate enrolment of suitably qualified candidates for higher studies and training locally before their absorption in regular employment of the Commission. A large number of engineers/scientists were also sent abroad for specialized/academic training under various aided programmes and bilateral arrangements.

18. PAEC has also established its own training centres, viz. the Reactor School at the Pakistan Institute of Nuclear Science and Technology (PINSTECH), Rawalpindi and the KANUPP Training Centre at Karachi. These Centres make use of modern techniques, instruments and laboratories in imparting knowledge to the trainees.

19. Participating in the international collaboration programme, PAEC has offered six Type-II fellowships to IAEA to be awarded to candidates from developing countries.

INTERNATIONAL SUMMER COLLEGE ON PHYSICS AND CONTEMPORARY NEEDS

20. The PAEC sponsored and arranged an international summer college on "Physics and Contemporary Needs" which was held from 2-20 August 1976, at Nathiagali - a hill station in Pakistan. A large number of eminent scientists from Pakistan and abroad participated in the college. Professor Abdus Salam, Director, International Centre for Theoretical Physics, Trieste, Italy, also attended. In all 30 countries were represented in the summer college.

21. The scientific programme of the college consisted of lectures and seminars in such areas as physics and technology, physics and energy and natural resources, and physics and frontiers of knowledge, etc. The Swedish International Development Authority (SIDA) contributed $30 000 towards the expenses of the college but the bulk of the expenditure was borne by the host country.

22. The summer college was a great success and was acclaimed by the participants as a valuable and positive contribution towards broadening the horizon of knowledge of the participants in general and those from the developing countries in particular. It has been decided to hold the summer college in Pakistan again next year.