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ADVANCES IN THE APPLICATION OF NUCLEAR ENERGY FOR PEACEFUL PURPOSES

Information received from Pakistan

The Director General has received a communication, dated 5 September 1982, from the Pakistan Atomic Energy Commission, Islamabad, enclosing the following material on the nuclear programme of Pakistan with the request that it be circulated for the information of the General Conference.

REPORT ON THE PEACEFUL USES OF NUCLEAR ENERGY IN PAKISTAN

Nuclear programme of Pakistan

1. The national nuclear programme of Pakistan has three main themes: (i) nuclear power for economic development; (ii) nuclear technology to support the nuclear programme; and (iii) applications of atomic energy in agriculture, medicine and industry. These goals have been vigorously pursued by the Pakistan Atomic Energy Commission (PAEC) since its establishment.

2. Following is a brief review of activities of the Commission during the last year.

Nuclear power generation

3. Pakistan is short of indigenous energy resources, and needs large energy inputs for meeting its developmental needs. It is among the poorest countries in the world in terms both of energy resources and of per capita energy consumption. Electricity demand in Pakistan during the last 20 years has been increasing at an average rate of about 12% per annum. According to World Bank estimates, electricity demand in oil-importing developing countries will grow at a rate of about 8.5% per annum during the 1980s. Taking this lower figure as the basis for electricity growth in Pakistan for the next 20 years, the country's installed

capacity requirements will grow from 3800 MW in 1980 to 8600 MW in 1990 and 19 500 MW in 2000. After making full allowance for the possible contributions from hydro, coal and available gas resources to meeting the projected electric power needs, Pakistan will still have a gap of about 10 000 MW in its national grid; to fill this it will have to turn either to imported oil or to nuclear energy. Pakistan is one of the countries most dependent on energy imports, spending about 60% of its foreign exchange on oil imports. That is why nuclear energy has a special significance and considerable potential in Pakistan.

Karachi Nuclear Power Plant

4. The Commission's first nuclear power plant, KANUPP (of 137 MW(e) capacity), was inaugurated at Karachi in 1972. This plant is run and maintained by Pakistani engineers and technicians and is now meeting a considerable part of the electricity needs of Karachi. During the year under review it was thoroughly overhauled. The entire maintenance and overhauling was done by Pakistani engineers and technicians.

5. Pakistan has started local manufacture of fuel based on indigenous supplies of uranium; such fuel has already been fed into the plant and its performance is being carefully watched.

Chashma Nuclear Power Plant

6. The successful operation of KANUPP has given the country valuable experience for setting up further similar plants. A much larger plant, CHASNUPP (of 900 MW(e) capacity), is being set up on the River Indus, at Chashma. It is expected to be completed by 1989. The project has been approved by the Government and preliminary investigations have been completed and some basic support facilities at site provided. International tenders for CHASNUPP will be invited soon.

Agriculture

7. In Pakistan, whose economy is basically agrarian, agricultural production is beset with numerous problems like low productivity, destruction by insects and other pests, and post-harvest losses. Since nuclear radiation techniques have been found quite effective in overcoming some major problems in agriculture, PAEC has established three agricultural research centres where nuclear techniques are employed to improve agricultural output. These centres are at Faisalabad (Punjab), Tandojam (Sind) and Tarnab (near Peshawar, in the North-West Frontier Province). The centre at Tarnab has started functioning partially and will be completed by early next year. Research is being carried out at these centres to evolve high-yielding and disease-resistant varieties of main crops. Research is also being carried out on the nuclear disinfestation and commercial storage of food grains, vegetables and fruit and on the efficient utilization of water and fertilizers.

8. The research work progressed satisfactorily during the year under review at these centres. The new variety of rice evolved by the Nuclear Institute of Agriculture and Biology (NIAB) at Faisalabad, called Kashmir Basmati, is now being cultivated over a large area in the northern region, particularly in the Swat, Malakand and Hazara districts of the North-West Frontier Province. The

variety had already shown good results in northern areas, where its yield was 30% higher than that of the local varieties. The triticale (a cross of wheat and rye) evolved at NIAB has better grain which lends itself easily to bread-making. Triticale is being developed as a suitable crop for barani (rain-fed) areas, where it has given yields 10-15% higher than wheat.

9. A new variety of wheat called Jauhar-79 has been approved by the Government for cultivation in the Hyderabad region in Sind Province, where its performance has been extremely good. Mutants of cotton, mung bean and chickpea have also been evolved and are being submitted to provincial authorities for approval.

10. Some of Pakistan's rice soils have been found to be deficient in zinc. Using radioactive zinc, Pakistani scientists have already found the best methods for applying zinc in rice soils.

11. NIAB was also able to develop a method for utilizing saline and saline-sodic lands. It is based on a plant succession system starting with a highly salt-resistant grass called Kallar grass.

Medicine

12. The six nuclear medicine centres set up by the Commission in different parts of the country are providing diagnostic and treatment facilities to patients suffering from various malignant and other diseases. About 80 000 patients were registered at these centres for treatment during the year under review. Construction of the seventh nuclear medicine centre, at Islamabad, is expected to be partly functional by the end of this year. It will be the country's most modern and largest nuclear medicine centre, with up-to-date facilities for diagnosis and treatment, including facilities for indoor treatment. Work on an eighth nuclear medicine centre, to be located at Lahore, has already started.

Manpower training

13. Pakistan needs trained manpower to maintain and run its nuclear establishments in the power, agriculture and medicine sectors. In order to meet this demand, the Commission has established a Centre for Nuclear Studies, which gives post-graduate training to graduate engineers and scientists in various nuclear engineering subjects. A Nuclear Training Centre, at Karachi, is training technicians and operators in plant maintenance and operation. In addition, the Commission has been holding special courses for various industrial workers in the latest industrial techniques, such as industrial radiography and ultrasonic testing, and in medical physics and basic physics.

Uranium exploration

14. The programme for the prospection, exploration and mining of uranium was stepped up and new areas with promising anomalies were discovered and primary drilling work was done. The existence of economic and exploitable deposits was confirmed at some locations. Also the available facilities for ore processing and refining were improved.

International conferences

15. The Commission, with the co-operation of the International Centre for Theoretical Physics, Trieste, arranged the Seventh International Summer College on Physics and Contemporary Needs from 31 July to 19 August at Islamabad. The College was attended by 50 prominent scientists from abroad and about 150 Pakistani engineers and scientists.