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## ADVANCES IN THE APPLICATION OF NUCLEAR ENERGY FOR PEACEFUL PURPOSES

### Information received from Pakistan

On 15 September 1978, the Director General received from the Pakistan Atomic Energy Commission, for the information of the General Conference, material on the advances made in its country during the year 1977-78 in applying nuclear energy for peaceful purposes. The material in question is reproduced below.

### REPORT ON THE PEACEFUL USES OF NUCLEAR ENERGY IN PAKISTAN

1. Pakistan's nuclear energy programme is aimed at: (i) generating nuclear power to meet ever-growing electricity requirements; (ii) harnessing nuclear energy for the enhancement of agricultural production and improving public health; and (iii) introducing the latest nuclear techniques for relevant industrial applications. With a view to achieving these objectives the Pakistan Atomic Energy Commission was established in 1955. Since then the Commission's activities have expanded severalfold.
2. Here is a brief description of the activities of the Pakistan Atomic Energy Commission during the year ending July 1978.

#### Nuclear Power Generation

3. Pakistan is among the poorest countries of the world in terms both of energy resources and of per capita energy consumption. The picture has not been altered significantly even by the reported additional discoveries of gas, because these have at best increased the per capita fossil fuel reserves from 13 tons to 15 tons of coal equivalent. The annual consumption of electricity per head remains very low, at 150 kWh. The Government is anxious to increase this to a fairly reasonable

level of about 800 kWh per head by the end of this century, which requires more than 30 000 MW of installed capacity at that time. It has been estimated that at least half of this installed capacity will have to come from nuclear energy. This necessitates a well-planned and sustained nuclear energy development programme, which is being undertaken by the Commission.

4. Pakistan's first nuclear power plant, at Karachi (KANUPP), functioned satisfactorily during the year and met about 25% of Karachi's electricity needs. It attained an average availability factor of about 50% and generated 230.5 million kWh of electric power during this period. The lower availability factor was due to plant shutdown for three months for overhauling and maintenance.
5. Another plant, called Chashma Nuclear Power Plant, of 600 MW capacity, is planned for the Mianwali district.

#### AGRICULTURE

6. The Commission has already set up two nuclear agriculture centres, one each at Faisalabad and Tandojam, to plan and carry out research programmes, aimed at developing new, high-yielding and disease-resistant, varieties of wheat, cotton, rice and pulses. Research is also being carried out on the economic storage of food grains through disinfestation by nuclear irradiation.
7. Another nuclear agriculture centre is under construction at Tarnab (near Peshawar) in the North West Frontier province. It is expected to be partially functional before the end of the current year. The centre will concentrate on the preservation of the abundant fruit and other foodstuffs grown in the area.
8. Work at the existing centres has been progressing satisfactorily. The Kashmir Basmati developed by radiation-induced mutation which was released last year for cultivation in Azad Kashmir is now also being extended to Swat Valley in the Frontier province. A Triticale variety, NIAB-77, which has given good yields even in poor soils and under stressed conditions is being multiplied for cultivation in rain-fed areas. Another wheat mutant, NIAB-546 is rust-resistant and has been approved for multiplication and release to farmers.

9. Research carried out at the Faisalable agriculture centre has established the beneficial effects of zinc on rice. The results of the findings are being disseminated among farmers through the Agricultural Research Council.
10. A series of experiments on the estimation of nitrogen losses and fertilizer efficiency has also been started with the help of a  $^{15}\text{N}$  analyzer. The findings are expected to be of great value to Pakistan's famers.

#### MEDICINE

11. Five nuclear medicine centres set up by the Commission in different parts of the country are providing diagnostic and treatment facilities for unconventional diseases to a large number of people. The construction of a sixth centre, at Larkana in Upper Sind, has also been completed.
12. The construction of yet another nuclear medicine centre, at Islamabad, has also been approved by the Government. Construction work will begin this year. When completed in about three years' time, at a cost of over Rs. 30 million, the Islamabad nuclear medicine centre will be the country's most modern and largest nuclear medicine centre so far. It will include a linear accelerator and other facilities for the treatment of in-patients.

#### SYMPOSIA/SEMINARS

13. During the past year the Commission organized several international meetings. Seminars on "Solid State Physics" and "Nuclear Safety and Radiological Protection" were attended by a large number of experts. The seminar on "Nuclear Safety and Radiological Protection" was organized in collaboration with KFK Karlsruhe, Federal Republic of Germany.
14. The Third International Summer College on Physics and Contemporary Needs was held from 17 June to 6 July at Nathiagali, about 50 miles from Islamabad. It was attended by 120 participants from 25 countries. The major theme was "Energy systems with specific emphasis on nuclear energy". It is expected that the Summer College will become a regular feature.

