Peaceful uses of Nuclear Energy in India

Nuclear capability is a status symbol, though tremendously expensive. In fact it is both a fetish and a vampire-fetish for the nation which has developed it and vampire if it is put to destructive uses. That is why India's nuclear experiment generated sharp criticism: some remarked that India, by frittering her meager resources on ambitious nuclear programmes, is following ruinous policy. The possible impact of this spectacular nuclear advance on the subcontinent and the rest of Asia is not discernable. Pakistan's reaction clearly shows that she sees nothing but devilish design in India's nuclear experiment. Pakistan stepped up her nuclear programme and used fair and foul means to achieve her goal. Pakistan is misrepresenting our aim. India's hear is, however, in the right place in this respect, it is evident from the reiteration of her strong opposition to the military uses of nuclear power. It cuts along the misgivings developed by Pakistan; the constructive objective of the low yield blast leaves little scope for fear or suspicion, India does not want to aggravate the situation already created by the arms race between the super powers.

Nuclear energy can be put to numerous productive uses. Nuclear powered generators produce electricity. Nuclear energy, in the form of radioisotopes, can be used in medicine, agriculture and industry. It can help in the preservation of food and the production of high-yielding seeds. Recently vaccine for sheep has been developed with the help of nuclear energy.

In the days of energy crisis nuclear energy is a boon. Electricity can be produced even in those areas where there are no natural resources to generate electricity. The heat generated by controlled nuclear reaction can be used to boil water and the steam thus produced can be used to drive turbines for producing electricity. India has one nuclear power station 420 m.w. capacity operating at Tarapur. Two power stations of similar capacity, one at Rana Pratap Sagar in Rajasthan and another at Kalpakkam near Madras are operational. A fourth station at Narora in Uttar Pradesh, on the eastern bank of the Ganga is also operational. Atomic power, besides conserving fossil fuels such as oil and coal and reducing atmospheric pollution, has tremendous economic advantage over coal; because the problem of transport is obviated. The Tarapur station, for example needs only 22 tones of fuel each year whereas a coal-fired station of similar capacity would need 1200,000 tones coal annually. Besides Uranium as fuel, nuclear power stations need heavy water (deuterium oxide) as a moderator. The fast moving atomic particles have to be slowed down by allowing them to collide with heavy hydrogen (deuterium) atoms. Heavy water occurs in very small quantities in natural water and its artificial production is not only complicated but expensive

also. The requirements, at present, are met by a plant with an annual capacity of 14 tones at Nangal in Punjab. The plant makes use of the throw away water from the Nangal Fertilizer. Three more plants are under construction at Kota in Rajasthan, Baroda in Gujarat and Tuticorin in Tamil Nadu. All of these, together, will produce around 240 tonnes of heavy water annually. A fifth plant at Talcher in Orissa is at the planning stage.

Radiation from radioactive substances like radium have for many years been used for the treatment of cancer. Cancerous cells are more sensitive to radiation than normal cells. The nuclear reactor has opened up vast new possibilities because numerous other elements can be made radioactive by `bombarding' them in these reactors. Such substances can be of immense help in medicine, agriculture and industry. Radioisotopes are introduced into a system and their course is traced by means of radiation-detecting equipment. The use of radioactive isotopes has helped in diagnosis and the prevention of diseases, in the development of agricultural methods, for greater production making better fertilizers and efficient methods of insect and pest control, for detection of defects in machinery, better control of industrial processes and in oceanography. For example radioactive iodine (I-131) is the most widely used substance in medicine. The human thyroid gland in the neck selectively concentrates iodine from the blood for hormone synthesis. By using radioactive iodine the function of the thyroid gland can be accurately investigated. The method can also be employed for treating cancerous and other diseases of the gland. Cobalt-60 needles can also be implanted in body to treat cancer. A radiation alternated vaccine has immunised sheep from lungworm disease which used to take a huge toll of sheep. Moreover, young lambs treated with the vaccine have been found to yield more mutton and the wool. A vaccine manufacturing unit set up in Kashmir valley under UNDP assistance programme will go into large scale production soon.

The scientists at Trombay have deposited radioactive sand in various harbours and have followed its movements on the sea-bed and thereby selected some possible sites for dredged silt. Radio-isotopes can save a huge amount of money in the long run. U.S.A. saves nearly $ 100 million through industrial applications of radioisotopes. The Trombay unit produces nearly 320 different types of isotopes and many of them are exported to the U.S. and Western Europe.

Perishable food stuffs if exposed to radiation are found to remain fresh beyond their normal shelf-life. Since canning was discovered (early 19^{th} century) radiation of food is a major break-through in food preservation. This method of preserving food has many advantages over other methods like canning, drying and salting; it preserves flavor and texture of the food stuff. Moreover small doses of radiation can be used to prevent sprouting and the consequent spoiling

of onions and potatoes. Higher doses (25-50 kilo) can be used to delay the ripening of the fruits like mangoes, bananas. In this manner the shelf-life of the fruits can be prolonged. Even fish can be preserved for a longer time with radiation. This process can also be used for disinfecting grains. This can be of tremendous gain to tropical countries like India where the shelf-life of fruits and vegetables is very short. A modern laboratory at the Bhabha Atomic Research Centre, Trombay is doing extensive work and semi-commercial food processing plants are still to be set up. Adverse climatic conditions, inadequate provisions for storage, and transport problems account for a heavy loss of agricultural and marine produce. Thus through food radiation we will be able to improve nutrition of our people and utilise our limited resources to the best advantage.

Radiation can also be used to bring about genetic changes in grain seeds. This in its turn will produce mutant strain, having different properties. Plants, thus grown, will mature earlier and become fruit bearing earlier. It will also be able to stand adverse conditions like bad weather, pests, etc. Trombay Irradiation Centre has produced a new mutant paddy strain, which matures three weeks earlier and yields 20 per cent more. They are carrying on research on groundnut now-a-days. There is another centre which studies the effects of radiation on growing plants.

Nuclear explosions can be helpful in building dams and mining. For building dams and mining deep under the earth nuclear explosion can help a lot. The explosions in which conventional material is used are neither effective nor economical. Obviously oil and natural gas exploration will be quicker and better with the help of nuclear devices. For releasing natural gas this device was used by the U.S.A. in 1967 in New Mexico. Atomic blasts can pulverize the ore, making the extraction of the metal from the low-yielding fields possible. Similarly the water retention capacity of the dry lands can be increased with the help of blasts.

India has vast potential for developing the natural resources and industry. Energy crisis which disturbed the economy of our country can be met only by harnessing the nuclear energy. In one of articles, H.J. Bhabha correctly pointed out, “In a broad view of human history it is possible to discern three great epochs. The first is marked by the emergence of the early civilisation in the valleys of Euphrates, the Indus and Nile, the second by the industrial revolution leading to civilisation in which we live and the third by the discovery of atomic energy and the dawn of the atomic age which we are just entering. Each epoch marks a change in the energy pattern of society”. Clearly he had only the peaceful uses of nuclear energy in mind when he said so. In a practical sense, energy is the prime mover, which makes multitude of our daily activities possible “It makes possible life itself”. Mr. H.J. Bhabha correctly and succinctly summed the Indian point of view

when he said, “The discovery of atoms has brought about a tremendous change in the energy pattern of society. It involves both a hope and danger. However there is not much reason to doubt that the intelligence of man shall overcome his fear and weakness.”