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Is the nuclear power option safe for India?

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The country is well equipped, both in terms of regulatory mechanisms and manpower, to exploit nuclear power safely and efficiently.

In the context of a possible increase of nuclear power in India, some people have asked whether this is a safe option. This is a legitimate question and needs to be addressed in all seriousness. It is common knowledge that some of the pioneers who experimented with radioactivity, including Marie Curie, suffered serious radiation ailments. Those engaged in making luminescent watch dials and early X-ray technicians suffered radiation-induced sicknesses. In the early years of the nuclear weapons programmes in the United States, the Soviet Union, and the United Kingdom, radioactive discharges from military facilities contaminated the surrounding countryside.

Two important accidents at nuclear power installations, at Three Mile Island in the U.S. in 1979, and at Chernobyl in the former Soviet Union (now in Ukraine) in 1986, stand out in public memory.

At Three Mile Island, while there was public panic and some evacuation of people in the neighbourhood, there was no serious spread of radioactivity, nor was there any death. Of course, the electric utility that owned the plant suffered serious financial losses.

In Chernobyl, the reactor installation exploded and a considerable amount of radioactive material spread over a wide area. Given that secrecy was part of the Soviet culture, even before an official confirmation came the outside world guessed that a serious nuclear accident had taken place. The post-accident management was, of course, very efficient as the extensive resources of the Soviet defence establishment were deployed. There were a number of deaths of the operating personnel and some of those deployed to manage the accident also died due to severe radiation exposure. Not far from the nuclear power station (which had four 1,000 MW units), the town built for the plant personnel was completely evacuated and became a ghost town.

Following these two accidents, nuclear industry leaders from all over the world got together for serious introspection. They realised that another major accident would sound the death knell of the industry. In a rare gesture of solidarity, unknown in the Cold War era, industry leaders from all over the world, including the U.S., Europe, Japan, the USSR and Eastern Europe, gathered in Moscow in the summer of 1989 to launch the World Association of Nuclear Operators (WANO). Its objective was to spread the culture of safe operation of nuclear power plants through the sharing of operating experience, emulation of best practices, and peer reviewing of operating plants to identify improvements to enhance performance. WANO has achieved significant success in improving nuclear safety worldwide. Additionally, this sharing of operating experience has resulted in better utilisation of installed capacity. Incidentally, the author was the Foundation Member of WANO from India at its inaugural conference in Moscow in 1989.

Regulatory mechanism

A key requirement for ensuring nuclear power plant safety is a nuclear safety regulatory mechanism that is independent of the plant management system. In India, the Atomic Energy Regulatory Board (AERB), set up in 1984, has evolved into a strong professional organisation. It reviews the design, construction, and operation of all nuclear installations and certifies the acceptability of operations and maintenance personnel. In addition to the safety of nuclear power stations, it is concerned with the safety of nuclear fuel activities and heavy water plants, and the

safe management of industrial and medical radiographic equipment. While making full use of the talent and expertise available in all units of the Department of Atomic Energy (DAE), the AERB uses extensively the services of outside consulting organisations and academic groups.

There are environmental survey laboratories at all the nuclear installations and continuous monitoring of the environment (through the sampling of air, water, milk, vegetables, fish, and so on) is done.

At all our installations, the off-site radioactive impact is far below the limits set as per international norms. Similarly, the occupational exposure of plant personnel is well within the limits set by the International Commission on Radiological Protection.

In the aftermath of the Chernobyl disaster, Prime Minister Rajiv Gandhi, told me (I was then Chairman, Atomic Energy Commission, and Secretary, DAE) that he would sanction new nuclear power projects only after he was satisfied with our emergency preparedness plans. The DAE interacted intensively with the Chief Secretaries of the States where nuclear installations were located, along with the district administrations concerned, and drew up detailed plans to deal with any emergency. An off-site emergency could include, as a very low probability, evacuation of people living in the immediate surroundings of the installation and providing them with food and medical care. Detailed plans are prepared for each site in conjunction with the District Collector and his principal officers and these are updated periodically. Plant emergency exercises are carried out four times a year, site emergency exercises are carried out once a year, and off-site emergency exercises once in two years. It will be good if some of our hazardous chemical industries adopt a similar approach while preparing for emergencies. It is also highly desirable for such industries to cooperate in exchanging safety-related experiences as nuclear plant operators do under the WANO system.

Another concern in the public mind relates to the disposal of the radioactive waste products that result from the nuclear fission process. India's policy is to use what is called a "closed fuel cycle." The fuel after irradiation in a reactor is reprocessed to remove the plutonium and unburnt uranium. These two are fuel materials, which can be used in a fast breeder reactor. The high level, long-lived waste product is fixed (or immobilised) into a glass, which is then encapsulated in stainless containers of high integrity. This immobilised waste can initially be stored at the site of the reprocessing plant and eventually at a geological repository. France, which operates one of the largest commercial reprocessing plants, has been successfully storing the immobilised waste in a safe manner. India has built waste immobilisation plants as adjuncts to its reprocessing plants. While fast breeder reactors reduce the amount of waste that needs ultimate storage under surveillance, a further reduction is possible when using Accelerator Driver Systems (ADS). These are sub critical assemblies containing thorium and can be made to yield energy, using high energy protons from an accelerator. India has plans to develop such systems in the third phase of the programme.

Systematic studies on relative risks to human health from different sources of energy, including coal, oil, gas, and wind, and those from nuclear, hydel, and solar sources show that risks with gas, and hydel and nuclear-based ones, are much lower than with coal, oil, wind and solar-based ones. But the last-mentioned ones are suited only for small scale production of energy.

Finally, safe exploitation of nuclear power depends on the availability of competent manpower. India is well placed in this respect: it has a large pool of talented young men and women who when trained, can manage nuclear installations in a safe, reliable, and efficient manner. So the answer to the question: "Can India manage nuclear power safely?" is a definite "yes."