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COMMENTARY

Nuclear power and safety

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Safety has many aspects to it. Let us start with the standard question, 'How safe is safe enough?' We have to arrive at a satisfactory answer to this question in our own socioeconomic context. There are certain minimum developmental needs of our society. As scientists and technologists we have to find ways of fulfilling these needs in an acceptable manner after considering carefully the options available to us. This acceptance should be based on a scientific evaluation of the comparative environmental impact of the various options based on our own conditions rather than on ideas transplanted from a society whose developmental needs are already largely fulfilled.

Emerging international regime

Safety and environmental issues are fast achieving global dimensions. While this in itself is a good thing, it is also leading to a kind of restrictive international regime which tends to disfavour some of the older technologies which are available to developing countries, and the technology differentials this may create between the developed and the developing countries are likely to have an adverse impact on the economies of the latter. One can see signs of such restrictive technology environment in terms of CFC issues, carbon dioxide and other greenhouse gases-related issues and also in terms of nuclear power technology. For a country like India where the market is very large, it is clear that we must have our own technology which is as much on par as possible with the best technology available outside. At the same time we must try to protect ourselves from the adverse economic impact arising out of the possible restrictive regime created through globalization of safety and environmental concerns.

In this context there is also a need to address issues arising out of the emerging international regulatory regime for nuclear power. From an overall view such a development does appear logical and even necessary. There could however be several implications with regard to its practical application. There are difficulties in adopting a common regulatory approach even in the case of the pressurised water reactors (PWRs) because their evolution has gone on along somewhat different paths in different countries. Then there are questions related to adoption of a common framework for different reactor types being built in different countries. There are also questions relating to the fact that any regulation is normally a matter in the purview of the national body like the Atomic Energy Regulatory Board (AERB) in our case. While there is a lot to learn from one another's experience in the matter of technical aspects of safety, in achieving minimum standards in design and operation of nuclear power plants, etc., we have to necessarily keep enforcement aspects within the frame of the national regulatory agency. We have been, of course, strongly advocating the need to enhance international exchange on various technical aspects of safety including sharing of results of safety research.

Safety of our PHWRs

We have adopted the pressurised heavy water reactor (PHWR) system on account of its favourable characteristics which are better suited to Indian conditions and objectives. Since the number of

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countries building such a reactor system is small as compared to, say, PWR, the extent of information and data in open literature is also correspondingly smaller. This makes international exchange more important for us. At the same time this also underscores the need to optimally utilize our resources to derive maximum benefit from our R&D efforts.

Studies have shown that the PHWR system that we have adopted for our programme has a number of superior safety characteristics. Demonstration of one such characteristic was carried out sometime back at the Narora atomic power station when the capability to remove decay heat purely through the thermosyphon cooling mechanism was demonstrated. Such demonstrations are important since they add to the overall confidence in the safety of our system. We need to pursue such activities further.

Considerable technological inputs are, however, necessary in the operational and maintenance phase of our reactors. This would not only keep the cumulative radiation exposure low but also help in achieving higher availability factor through speedy maintenance when the reactor is down and by a reduction in the number of outages through better in-service inspection. This is one important area where safety and economic performance go hand in hand.

Ageing of nuclear power reactors and their life extension is another important subject receiving international attention. Some of our reactors are also in this category. Systematic studies to assess ageing degradation, methods for delaying ageing effects, means for extension of plant life are areas where we must organize studies specific to our reactors. A large part of this work is already being done.

The safety record of our nuclear programme has been very good. Safety and development have kept pace with each other and we have seen a continuous evolution on both sides. There should, however, be no room for complacency and we must be continuously on the lookout for weak links and strengthen them.

One important aspect of safety is to convince others. It is not enough if we are convinced. We must be able to convince the public at large. Communication of results of safety analysis in a convincing manner is therefore important. This has to be done through many channels.

Evolution of reactor designs

Globally speaking, we are passing through the second stage of evolution in the design of nuclear reactors. The first stage saw a very rapid growth of nuclear power and in the process the only way to resolve emerging safety issues was to add additional systems and equipment. This has perhaps made current reactor systems more complicated and somewhat expensive. While the designs available are being exploited to their full potential, a number of new advanced reactor concepts have also emerged. Most of these are aimed at preventing a severe condition from developing through passive means thus assuring a higher level of safety. These reactor systems are expected to be relatively simpler and may be more economical. One can broadly divide the new reactor designs into two groups. The first group is based on evolution of existing well-proven designs. These designs have the advantage of long and satisfactory experience with hardware of current designs. The Canadian PHWR CANDU-300 and the advanced versions of PWRs and boiling water reactors (BWRs) being designed in USA, Japan and other countries belong to this group. The second group of reactors in contrast with the first group adopts more innovative ideas based on physical principles to ensure a higher level of safety. These designs sometimes involve the use of revolutionary concepts and although they definitely seem very attractive they lack the experience base of the first group. Process inherent ultimate safe (PIUS), modular high temperature gas-cooled reactor (HTGR), power reactor innovation small module (PRISM) are examples of designs in this group. These international developments are worth following. There may be good ideas which we could beneficially utilize. We are also pursuing similar developments in our own way.

We all know that the next stage for us is to work towards commercial fast reactors. Internationally there is some slowing down of fast reactor programmes. This adds to our responsibility towards making a convincing case for safety and commercial viability of fast reactors in India. I am sure that with the expertise and background available, we can do this.

Interrelation between safety and technology

Safety and technology are interrelated. We develop technology to better our standard of living. However, any new technology is attendant with new safety issues. Inaction in development is often mistaken as a path towards increased safety. New technology cannot thus be assessed with a static safety review framework but rather should be looked at with proper understanding of the new technology and I am glad that AERB has a very good team of specialists to back them up. For projects which last over a considerable period, it is possible that the evolving situation in terms of technology and safety ideas can lead to conflicting situations. In the development of our nuclear power programme, we have had a good tradition of a balanced approach in the matter of assuring safety through participation of experts with independent scientific minds rather than a purely administrative way of safety enforcement. We must enrich this process. After all, the current phase is only the first stage of our programme and decidedly we have to deploy reactors of different types at different stages.

The challenge before the country today—and not only in the field of nuclear technology—is how to achieve rapid development without compromising safety and while protecting the environment.

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