Tuesday, September 07, 2004

Indian Express

A fast breeder of danger

M.V. Ramana

On August 29, Prime Minister Manmohan Singh was to preside over the commencement of construction of the 500 MW Prototype Fast Breeder Reactor (PFBR) at Kalpakkam, an event that got cancelled because of his ill-health. Unfortunately that is unlikely to stop the Department of Atomic Energy (DAE) from going ahead with the construction of this reactor despite ample evidence from around the world that fast breeders are uneconomical and pose significant risks of serious accidents. It would still be prudent to abandon constructing the plant and avoid pouring in good money after bad.

The DAE projects a cost of about Rs 3,400 crore for the PFBR and a commissioning date of 2010. Both of these are unrealistic. Even M.R. Srinivasan, former head of the DAE and no opponent of the breeder programme, warns us "for slips in project schedule" and "uncertainty with regard to costs." Both possibilities are very likely given the DAE's history of time and cost-overruns with nuclear reactor construction. The most recently commissioned reactors — Kaiga I & II and Rajasthan III & IV, constructed after experience with eight heavy water reactors — were estimated to cost Rs 730.72 crore and Rs 711.57 crore respectively. They ended up at Rs 2,896 crore and Rs 2,511 crore respectively, with time delays of five to six years. Earlier, the Comptroller and Auditor General concluded that the Narora reactors were "approved on unrealistic cost estimates". The DAE, unfortunately, has failed to heed their advice against such deflated price tags and "optimistic time schedules". The PFBR, an untested design, is very unlikely to be completed within DAE's projected schedule and cost estimate.

The cost of electricity from breeders is increased by the composition of their fuel — a mixture of plutonium and uranium. Plutonium is about 30,000 times more radioactive than the fissile element used in heavy water reactors, uranium-235. Therefore expensive safety precautions are required during fuel fabrication. Just the fabrication cost for plutonium based fuel is many times the total cost of uranium fuel. Add to this the massive costs of reprocessing spent fuel and recovering plutonium. The PFBR needs about two tonnes of plutonium just to become operational.

All of this means that breeder reactors are not an economical way of generating electricity. Breeder reactors are also dangerous. Unlike water moderated thermal reactors, breeder reactors, depending on the design details, can actually explode, though with a yield much smaller than that of a nuclear weapon. And because it uses plutonium based fuel, the public health impacts of a full-scale (beyond design basis) accident are worse.

One important source of potential accidents at the PFBR is the liquid sodium used to remove the heat generated. Since sodium is opaque, burns on contact with air, and reacts violently with water, designing reactors and their maintenance to take these properties into account has made them costly to build and maintain. It also makes them susceptible to serious fires and long shutdowns due to leaks.

The experience of France with the 1240 MW Superphenix breeder reactor, built after experience with a test reactor and the 250 MW Phenix reactor, offers a sobering lesson. The Superphenix became critical in September '85 but went into commercial operation only in April '87. Then, it suffered an impressive series of accidents, including sodium leaks and the roof caving in, staying shut down for the most part, till it was abandoned in '97. Over these years, the Superphenix had a capacity factor of about 6.6 per cent, equivalent to 0.73 years of full power operations. Though France continues mouthing support for breeder reactors, it has no plans for constructing any new ones. Neither does Britain. Russia began to construct one in '87 but has allocated only $20 million in recent years for the $1,300 million project. Japan has not restarted the Monju reactor, which was shutdown in '95 after a major sodium leak and a resultant fire. The US and Germany pursued large breeder programmes for several decades, before stopping altogether. Germany sold its 300 MW Kalkar breeder reactor, constructed at a cost of $5 billion, to a Dutch entrepreneur who converted it into a profitable amusement park.

In his Hind Swaraj Mahatma Gandhi made a remarkably prescient observation: "And it is worthy of note that the systems which the Europeans have discarded are the systems in vogue among us. Their learned men continually make changes. We ignorantly adhere to their cast off systems." The DAE's pursuit of breeder reactors while countries in the West have abandoned it for all practical purposes offers an excellent but unfortunate example of such ignorant adherence.

The writer, a physicist, is fellow, Centre for Interdisciplinary Studies in Environment and Development, Bangalore