Planning for best, preparedness for worst

Sudhinder Thakur

The nuclear power reactors produce power on 24X7 hour basis at stable, predictable and competitive prices with very much lower emissions than fossil fuels and thereby branding nuclear power as low carbon electricity source.

Since reactors handle radioactive substances, protection of workers, public and environment from ionizing radiations assumes greatest significance in nuclear power. The fact that one cannot see, sense or smell radiation further adds to the problem of communication with public. The entire gamut of nuclear safety (prevention, mitigation and preparedness) is directed to ensure safety of public.

Accidents are prevented through well established principles of defense in depth, provision of multiple barriers to release of radioactivity, well documented procedures of operation and above all qualified and licensed operators. The defense in depth is ensured through number of consecutive and independent levels of protection that would have to fail. This ensures no single technical or human failure can cause accidents.

The design principles are applied at all stages from siting till decommissioning. There are multiple barriers (fuel matrix, fuel cladding, the piping systems, containment building and finally the exclusion zone) for release to radioactivity to the environment. The design basis for the natural events like seismicity, floods, tsunami, storm surge are all conservatively established and a liberal margin provided.

Kudankulam reactor components are housed in 1.2 meter thick pre- stressed concrete containment lined inside with 8 mm thick steel plates. The containment is hermetically sealed and tested so as to remain leak tight in environment created during a hypothetical accident.

The aim is to separate 'reactor from environment' and 'environment from reactor' by design; whatever happens inside the reactor, should not impact outside and the other way around.

Dangerous anology

Japan stands on the tip of the so called "Pacific Ring of Fire". Some 1,500 earthquakes are recorded yearly with earthquakes up to magnitude 6 on Richter scale being quite common. March 11 earthquake of magnitude 9 was biggest ever in Japan and 5th largest globally on record. The epicenter was some 130 kms from the coast. The resulting tsunami was more than 7 meters high.

It would be dangerous to extend geological events from one region to another as basis for design or disaster preparedness. India is relatively stable with seismic activity confined to Himalayan regions. The Southern plateau is more stable with nearest active faults at Sunda Arc 1,300 kms away from the east coast. The maximum estimated tsunami height for the east coast is 2.5 meters.

Notwithstanding the low seismic potential of Kudankulam, the reactors have been conservatively designed for a Peak Ground Acceleration (PGA) of 0.15 g and set at 7 meters elevation. Clearly abundant margins have been put in and Fukushima type of accident cannot happen here.

The reactors at Kudankulam have advanced safety features, including for the first time a passive heat removal system. This system ensures cooling of the containment in passive manner; that is without any pumps, valves etc requiring power supply. With these features in place there is no doubt that the design is

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state-of-the-art in nuclear technology.

Emergency preparedness plans have to be in place for a worst case scenario. This is a regulatory requirement for all nuclear power stations which have well documented and rehearsed procedures to cater to accidental situations, however improbable these are. This system also needs to be tested for any improvements periodically through mock up exercises. Demonstration of preparedness is a pre requisite for starting the facility. The Fukushima accident has demonstrated the need for emergency preparedness and associated infrastructure as well as the imperative to keep the public in the vicinity informed regularly in a transparent manner.

The nuclear power business in India is with the Government of India. There is a robust regulatory control over all nuclear activities in the country. The government would not be setting up a facility which cause safety concerns for the public.

While all actions to ensure safety have been undertaken and the country has excellent safety record, recent public concerns at Kudankulam have demonstrated the need for greater communication with the public. In addition to be safe, we also need to be seen as safe.

(The author is Distinguished Scientist & Fellow, Nuclear Power Corporation of India Limited.)

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Safety of Nuclear Power Reactors

While planning is for the best, preparedness has to be for the worst.

Sudhinder Thakur

The nuclear power reactors produce power on 24X7 hour basis at stable, predictable and competitive prices with very much lower emissions than fossil fuels and thereby branding nuclear power as low carbon electricity source. Since reactors handle radioactive substances, protection of workers, public and environment from ionizing radiations assumes greatest significance in nuclear power. The fact that one can not see, sense or smell radiation further adds to the problem of communication with public. The entire gamut of nuclear safety (prevention, mitigation and preparedness) is directed to ensure safety of public.

Accidents are prevented through well established principles of defense in depth, provision of multiple barriers to release of radioactivity, well documented procedures of operation and above all qualified and licensed operators. The defense in depth is ensured through number of consecutive and independent levels of protection that would have to fail. This ensures no single technical or human failure can cause accidents. The design principles are applied at all stages from siting till decommissioning. There are multiple barriers (fuel matrix, fuel cladding, the piping systems, containment building and finally the exclusion zone) for release to radioactivity to the environment. The design basis for the natural event like seismicity, floods tsunami storm surge are all conservatively established and a liberal margin provided. Kudankulam reactor components are housed in 1.2 meter thick pre- stressed concrete containment lined inside with 8 mm thick steel plates. The containment is hermetically sealed and tested so as to remain leak tight in environment created during a hypothetical accident.

The aim is to separate ‘reactor from environment’ and ‘environment from reactor’ by design; whatever happens inside the reactor, should not impact outside and the other way around.

The accident at Fukushima has been very serious, involved not one but four reactors. While no one either amongst occupational workers or the public has been exposed to harmful levels of radiation, it is an economic disaster both in terms of written off reactors, clean up costs and resettlement of the evacuees.

Japan stands on the tip of the so called “Pacific Ring of Fire”. Some 1500 earthquakes are recorded yearly with earthquakes upto magnitude 6 on Richter scale being quite common. March 11 earthquake of magnitude 9 was biggest ever in Japan and 5th largest globally on record. The epicenter was some 130 kms from the coast. The

resulting Tsunami was more than 7 meters high. It would be dangerous to extend geological events from one region to another as basis for design basis or disaster preparedness in general. India is relatively stable with seismic activity confined to Himalayan regions. The Southern plateau is more stable with nearest active faults at Sunda Arc 1300 kms away from the east coast. The maximum estimated Tsunami height for the east coast is 2.5 meters. Not withstanding the low seismic potential of the Kudankulam, the reactors have been conservatively designed for a Peak Ground Acceleration (PGA) of 0.15 g and set at 7 meters elevation. Clearly abundant margins have been put in and Fukushima type of accident can not happen here.

The reactors at Kudankulam have advanced safety features including for the first time a passive heat removal system. This system ensures cooling of the containment in passive manner; that is without any pumps valves etc requiring power supply. With these features in place I have no doubt that the design is latest state-of-the-art in nuclear technology and orders of magnitude safer than the reactors designed decades ago.

While planning is for the best, preparedness has to be for the worst.

Emergency preparedness plans have to be in place for a worst case scenario. This is a regulatory requirement for all nuclear power stations. The nuclear installations have well documented and rehearsed procedures to cater to accidental situations however improbable these are. These are in terms of handling of off-site emergencies and provisions of evacuation in extreme cases. This system also needs to be tested for any improvements periodically through mock up exercises. Demonstration of preparedness is a pre requisite for starting the facility. The way to handle “low probability high significance events” is through learning of lessons from accidents. The Fukushima accident has demonstrated the need for emergency preparedness and associated infrastructure as well as the imperative to keep the public in the vicinity informed regularly in a transparent manner.

The nuclear power business in India is with the Government of India. There is a robust Government regulatory control over all nuclear activities in the country. Government of India would not be setting up a facility which safety concerns for the public. While all actions to ensure safety have been undertaken and the country has excellent safety record, a strong functionally independent regulatory oversight, recent public concerns at Kudankulam have demonstrated the need for greater communication with the public. In addition to be safe, we also need to be seen as SAFE.

(The author is Distinguished Scientist & Fellow, NPCIL.)