Panel on Security Meeting on Tuesday, 3 April 2012
Daya Bay Contingency Plan and exercise preparation
Views from Hong Kong Nuclear Society

The Great East Japan Earthquake in March 2011 triggered a major nuclear accident at the Fukushima Dai-ichi Nuclear Power Plant. The event raised questions again on the safety of nuclear power and contingency planning. With the presence of nuclear power plants nearby, the general public in Hong Kong is rightly concerned with the safety of these power plants and the adequacy of our contingency plan. Some of the questions include:

- Is the Fukushima accident preventable?
- Should a major nuclear accident occur, what are the potential impacts to Hong Kong?
- What can be done to minimize the negative impacts?

Recently, the Government conducted a comprehensive review of the Daya Bay Contingency Plan. There were many views, including some misunderstandings. The key is that there are lessons-learnt from the Fukushima accident available to improve contingency planning for Hong Kong.

Hong Kong Nuclear Society would like to offer our opinions on the lessons learnt from the Fukushima nuclear accident, based on official information and reports from international experts.

Consequences of the Fukushima nuclear accident

Triggered by the 'once in a thousand year' natural disaster, the Fukushima accident resulted in seriously damaged reactors, radiation releases and evacuation. Despite the comments on the less than well-prepared emergence response, the consequences were reasonably controlled. Although some workers and nearby residents had received radiation above the usual regulatory limits, the official reports confirmed that:

- No radiation casualties have been reported.[1]
- Of the 20,549 people who had worked on the site since 11 March, 6 workers received doses over 250 mSv.[2]
- No harmful health effects were found in the 9,747 residents near Fukushima by July 2011. Of these residents, 5,636 received within 1 mSv which is a fraction of the global average radiation dose of 2.4 mSv per year from natural sources, and 10 received over 15 mSv, a level equivalent to 6 years of global average radiation dose from natural sources but much below world maximum.[3]
- The evacuation zone was 20km and some contaminated areas within a range of some 20-50 km northwest of the plant was also evacuated.[4]

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[1]Report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety, June 2011
[2]Staff radiation dosage information published by the Tokyo Electric Company, 30 March 2012
[3]IAEA Fukushima Daiichi Status Report, 23 Feb 2012,and United Nations Scientific Committee on the Effects of Atomic Radiation Report to the UN General Assembly, Vol 1 Annex B, 2011
[4]Japanese Ministry of Economy, Trade and Industry, Japan's Challenges Towards Recovery, Mar 2012

The Daily Yomiuri in Japan reported on 5 February 2012 that 573 deaths were classified as "disaster-related" as a consequence of the Fukushima accident. These deaths were not radiation casualties. They were caused by fatigue or the aggravation of chronic disease due to evacuation. For comparison, there were over 15,850 deaths[4] caused by the natural disaster. A lesson learnt is that evacuation, particularly for the elderly and those suffering from chronic medical condition, may present a higher risk.

We opine that despite the severity of the Fukushima accident, radiation dose to the general public was within safety limit. A 20 km emergency planning zone (EPZ) appears to be appropriate, in accordance with international best practices and in view of the experience from Fukushima. Due considerations should also be given to actions to mitigate the impacts of an unlikely event of radioactive release extending beyond 20 km.

Was the accident preventable?

Despite the fact that the scale of the natural disaster was well beyond the design basis, the safety design of Fukushima Dai-ichi Nuclear Power Plant worked to minimize the impact. In fact, the accident was avoidable if the plant had been duly 'upgraded' to incorporate the latest understanding of the potential hazard (tsunami) and safety technology. Over the last decade or so, evidence of much larger "once in a thousand years" tsunamis in the area has emerged, for example, the 8.3 magnitude Jogan earthquake in 869AD. Study in 2008 revealed that tsunami hazard to the plant had been severely underestimated.[5] The Japanese Ministry of Economy, Trade and Industry issued a press release on 2 September 2011, notifying that the Tokai-Danni Nuclear Power Station located about 100km south of Fukushima suffered only partial flooding from the same tsunami in March 2011[6] , as a result of the partially completed improvement work in response to the latest review of flooding hazard. The Japan Atomic Power Company had partially completed adding a wall and water-proofing to prevent tsunami flooding of the two pump rooms for the cooling systems. As a result, the tsunami flooded the pump room undergoing the upgrade and led to a sea water pump failure; whereas the other pump room with improvement work completed did not suffer flooding and its equipment functioned normally to prevent a major nuclear accident.

We opine that the safety measures at Daya Bay Nuclear Power Station should be continually reviewed and upgraded, as it has been undertaken in the past and in line with world best practices.

[5] JM Acton and M Hibbs, Why Fukushima was preventable, Carnegie Endowment for International Peace, March 2012

[6] Receipt of a Report regarding a legally reportable event that occurred at the Tokai-Danni Power Station owned by the Japan Atomic Power Company, Japanese Ministry of Economy, Trade and Industry, 2 Sept 2011.

DBNPS and Hong Kong

The Daya Bay Nuclear Power Station (DBNPS) is located in a geologically more stable region and is designed to withstand various natural hazards such as the effect of historical maximum earthquake plus a margin[7].

DBNPS being of Pressurized Water Reactor (PWR) type is different from the Boiling Water Reactor (BWR) of Fukushima. The DBNPS PWR type has a more effective containment of radioactivity released from the reactor cooling system than the Fukushima BWR type and the corresponding likelihood of a major core damage accident is expected to be10 times less likely. The DBNPS is installed with passive cooling equipment for the reactor as well as a passive sand filter which could significantly reduce radioactivity released into the environment.[8]

The safety design of a nuclear power station has a direct control over the severity of the consequence in an accident. Take Iodine-131 as an example, of the three severe nuclear accidents, Chernobyl released 10 times more Iodine-131 than Fukushima, while Three Mile Island is about 100,000 times less than Fukushima.

We opine that the contingency plan should take due consideration of the specific safety characteristics of DBNPS. Our view is that the Government should use whatever means available to support continual safety improvement of DBNPS. Furthermore, the Government should ensure that information on the improvements, implemented and planned, is effectively disseminated to the public.

Contingency plan

Despite the continuing effort of the nuclear industry to make nuclear power ever safer, chance of a nuclear accident still remains. We opine that the Government should make best use of the contingency plan and exercise to enable the Hong Kong public to understand how to respond in the event of a serious nuclear accident. The Government should take any further lessons learnt from the Fukushima accident into consideration in planning as well as reviewing exercise results to make the contingency plan most appropriate for our local situation.

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[7] HKNIC pamphlet – seismological and geological conditions of Guangdong Daya Bay Nuclear Power Station, April 1995
[8] HKNIC pamphlet – safety features of the Guangdong Nuclear Power Station, Dec 1993