

For discussion
on 2 December 2014

Legislative Council Panel on Security Contingency Plan for Nuclear Incidents near Hong Kong

Purpose

This paper aims to expound the contingency plan and related measures of the Hong Kong Special Administrative Region (HKSAR) in the event of nuclear incidents at nuclear power stations near Hong Kong.

Nuclear Power Stations in Neighbouring Regions of Hong Kong

Daya Bay Nuclear Power Station

2. Located at about 50 kilometres (km) north-east of Hong Kong urban area, the Daya Bay Nuclear Power Station (“DBNPS”) comprises the Guangdong Nuclear Power Station (“GNPS”) and the Lingao Nuclear Power Station (“LNPS”). The GNPS is owned by the Guangdong Nuclear Power Joint Venture Company, Limited (“GNPJVC”), as a 75/25 joint venture between the Guangdong Nuclear Investment Company, Limited (“GNIC”) under the CGN Power Company, Limited (CGN Power) and the Hong Kong Nuclear Investment Company Limited (“HKNIC”) under the CLP Holdings Limited. LNPS is owned by the GNIC and its parent company the CGN Power. The Daya Bay Nuclear Power Operations and Management Company, Limited. (“DNMC”) is responsible for the management and operation of the GNPS and LNPS.

3. The GNPS has two pressurised water reactor (“PWR”) nuclear power generating units of French design, with a generating capacity of 984 megawatts (MW) per unit. Each reactor is installed with three barriers to prevent the escape of radioactive materials from the reactor core. In addition, there are multiple protections. In the event of failure of one of the systems, there are still multiple means to maintain the necessary safety functions. The design of the LNPS is similar to that of the GNPS. There are four PWR units in the LNPS: the two PWR units in Phase 1 have a unit generating capacity of 990 MW while the two PWR units in Phase 2 have a unit generating capacity of 1 080 MW.

4. Since the commencement of commercial operation of the GNPS and the LNPS in 1994 and 2002 respectively, the two nuclear power stations have maintained outstanding safety records without any incident of radioactive release. The two stations excel in their reliability, performance and safety.

Other nuclear power stations newly constructed or under construction in Guangdong Province

5. In addition to the DBNPS, there are other nuclear power facilities being developed in Guangdong Province in recent years, including:

- (a) **Yangjiang Nuclear Power Station (“YNPS”)** – Located at Shahuan, Dongping Town, Yangjiang City, Guangdong Province, the YNPS is approximately 220 km from Hong Kong. Built and operated by Yangjiang Nuclear Power Company Limited under the China General Nuclear Power Group (“CGN”), the YNPS has a planned capacity of six 1000MW-class PWR units. Unit 1 of the YNPS has started commercial operation in March 2014;
- (b) **Taishan Nuclear Power Station (“TNPS”)** – Located at Chixi Town, Taishan City, Guangdong Province, the TNPS is approximately 130 km from Hong Kong. Six PWR units are planned to be built in phases. The two PWRs in Phase 1, each with a generating capacity of 1 750 MW, are under a joint venture project between the CGN and Électricité de France. Construction is currently in progress;
- (c) **Lufeng Nuclear Power Station (“LFNPS”)** – Located at Tianwei Mountain, Jieshi Town, Lufeng City, Guangdong Province, the LFNPS is approximately 170 km from Hong Kong. To be developed by phases, it has a planned capacity of six 1000MW-class nuclear power generating units. The LFNPS is to be developed and operated by CGN Lufeng Nuclear Power Company Limited under the CGN. The initial work of the two nuclear power generating units of Phase 1 is in progress.

6. The construction and operation of nuclear power stations in the Mainland are regulated by relevant national regulations for civilian nuclear facilities, and have to comply with national regulatory requirements before the plants could be awarded construction and operation licences. The requirements on construction and operation were set in accordance with international standards. The National Nuclear Safety Administration established under the Ministry of Environmental Protection is responsible for overseeing the safety operation of nuclear power stations and carrying out inspection.

7. With the exception of DBNPS, all Mainland nuclear power stations are at least 130 km from Hong Kong urban area. As indicated in the assessments based on general international standards, the risk posed by such nuclear power stations to Hong Kong in case of a nuclear accident is far lower than that by DBNPS. Even in the event of an off-site radioactive release

caused by a nuclear accident, the possibility of having to take full-scale countermeasures against the impact of radioactive plume on Hong Kong would be very low, as radioactive materials will be continuously diluted as they disperse from the nuclear power station.

Incident Notification Mechanism

8. Regular co-operation and communication channels are in place between the HKSAR Government and the Guangdong authorities for periodic review of issues like nuclear incident monitoring and notification arrangements. This is to ensure that in case of a nuclear incident, the Administration could receive the relevant information as early as possible for implementation of corresponding measures. In the mid-90s, the Hong Kong Government and the Guangdong authorities established an official contingency notification channel for nuclear accidents in the DBNPS. In case of an emergency incident or accident at a nuclear power station in Guangdong Province, the DBNPS operator will immediately notify the Prevention and Emergency Administrative Commission Office of Guangdong Province for Nuclear Accident of Civil Nuclear Facility (“PEACO/GD”) and other relevant state organisations. The PEACO/GD will then notify the Hong Kong authorities in accordance with the agreements between the two sides and the established mechanism applicable to various “emergency situations”. The classification of “emergency situations” follows the four-category system of the International Atomic Energy Agency (“IAEA”) for classifying nuclear emergencies according to their impact on safety in ascending order of severity –

Classification of emergency situation	Description
Emergency Standby	Safety levels may be reduced at the plant.
Plant Emergency	Radiological consequences of the emergency are confined to a section of the plant.
Site Emergency	Radiological consequences of the emergency are confined to the site.
Off-Site Emergency	Radiological consequences of the emergency extend beyond the site boundary.

9. At that time, notification timeframe was initially only specified for the two more serious categories of emergencies, viz. “Off-Site Emergency” and “Site Emergency” in the agreement. Under the agreement, when DBNPS declares an “Off-Site Emergency”, PEACO/GD will immediately inform the HKSAR Government via the Hong Kong Observatory (HKO), which will commence the assessment process after acknowledging receipt of information. The Security Bureau (SB) will determine on the appropriate level of activation of the Daya Bay Contingency Plan in the light of the

severity of the incident. It will also direct and coordinate the HKSAR Government's response to the nuclear incident. PEACO/GD will subsequently provide an updated situation report at an interval of no more than six hours. If there is any significant change in the situation, the Hong Kong authorities will also be notified. As for "Site Emergency", after receiving the notification report of the relevant nuclear incident from DBNPS, PEACO/GD will notify the Hong Kong authorities as soon as possible, based on the circumstances at the time or at the latest two hours from the time of notification. Thereafter, PEACO/GD will provide updated situation report once every six hours, and notify Hong Kong as soon as possible if there is any significant change in the situation. When a nuclear incident occurs at DBNPS with a "Plant Emergency" or an "Emergency Standby" status, the Guangdong authorities will notify the Hong Kong authorities at the same time when the China Atomic Energy Authority notifies the IAEA.

10. To enhance the notification mechanism for nuclear incidents, the HKSAR Government and the Mainland authorities have conducted multiple discussions. PEACO/GD agreed to further improve the notification mechanism for DBNPS in respect of incidents of "Plant Emergency" or below. According to the latest arrangements, when an emergency operational event classified as "Plant Emergency" or "Emergency Standby" occurs at DBNPS, PEACO/GD will notify Hong Kong within 24 hours of its occurrence. For non-emergency operational events¹ or matters that do not come under the classification of operational events² at DBNPS, PEACO/GD will notify Hong Kong within two working days or latest in 72 hours after the occurrence of such events.

11. Over the years, the above notification mechanism for DBNPS incidents has been effective. In view of the development of nuclear facilities in the Guangdong Province in recent years, the HKSAR Government and PEACO/GD have drawn up an incident notification mechanism for new nuclear power stations in the province. The new mechanism, which is based on that for DBNPS, covers different levels of incidents at all newly constructed nuclear power stations in Guangdong, enhancing further the channels for information exchange and contingency notification between Hong Kong and Guangdong for the purpose of strengthening mutual communication of information on nuclear incidents.

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¹ That is, Licensing Operational Events (LOE) that are classified at Level 0 or above on the International Nuclear and Radiological Event Scale (INES), but their emergency situation do not registered at emergency standby or above. These LOEs bear no implication for nuclear safety, public health and environment are not required to be reported to the International Atomic Energy Agency (IAEA).

² Such events include minor earthquake, typhoon, fire outbreak and staff casualties that affect or occur within nuclear power sites with possible impact on nuclear safety.

Daya Bay Contingency Plan

12. To prepare for the unexpected, the HKSAR Government has put in place a comprehensive contingency plan – the Daya Bay Contingency Plan. In case of an incident at a nuclear power station near Hong Kong that leads to a release of radioactive materials, emergency response actions can be promptly taken to minimise the impact of the accident on Hong Kong public.

13. The Daya Bay Contingency Plan has set out appropriate contingency measures to be adopted for public health and safety in case of a release of radioactive materials at the GNPS, the LNPS as well as other nuclear power stations beyond Daya Bay. The main components of the Daya Bay Contingency Plan include:

- (a) **Enhanced radiation monitoring** – to enhance monitoring of radiation level in the territory of Hong Kong and carry out enhanced monitoring activities in respect of air, marine water, drinking water, food, live food animals, etc.;
- (b) **Immediate assessment on the situation** – upon receiving the notification of a nuclear incident at a nuclear power station, relevant government departments will conduct immediate assessments on the incident, such as the condition of the nuclear power plant concerned, for making recommendation to the SB. If the incident develops into an “Off-site Emergency” situation, HKO will use its Accident Consequence Assessment System to project the possible radiation dose in various parts of the Hong Kong territory;
- (c) **Principal countermeasures** – in the event of a serious nuclear accident at DBNPS, full-scale countermeasures will be taken in areas in Hong Kong which are within a range of 20 km from the Station. Such measures include evacuation and sheltering; distribution of thyroid blocking agents for use by specific groups of the public and providing usage instructions; monitoring of persons who have been in the areas; implementation of ingestion pathway countermeasures throughout the territory; monitoring of incoming goods; notifying the public of the incident and the corresponding response actions;
- (d) **Emergency response structure** – to expeditiously mobilise personnel of the HKSAR Government to assess the prevailing situation, give advice to decision-making authorities and recommend countermeasures to be taken, properly implement all necessary countermeasures and notify the public in a timely manner;

- (e) **Response to a nuclear emergency beyond Daya Bay** – to apply measures under different parts of the Contingency Plan with appropriate adaptations when handling a nuclear emergency that occurs at a nuclear power station beyond Daya Bay. The departments concerned shall monitor the situation, assess the possible impacts and implement necessary measures, and pay close attention to any possible radioactive contamination of incoming food, goods and visitors.

Standing Radiation Monitoring System

14. Apart from the establishment of notification mechanism with PEACO/GD, the Administration has set up its own standing warning system for regular monitoring of possible radiological impacts on Hong Kong to enable the timely adoption of contingency arrangements. The warning system mainly includes:

- a) **Radiation Monitoring Network of HKO**

HKO has implemented its Environmental Radiation Monitoring Programme since 1987. Under this programme, HKO regularly monitors the ambient environmental radiation level in Hong Kong through the real-time Radiation Monitoring Network and by analysing samples collected from different areas in Hong Kong. HKO's Radiation Monitoring Network monitors the ambient gamma radiation level in real time. An alarm at the HKO Headquarters will be triggered once a significant increase in ambient radiation level is detected at any one of the monitoring stations. As an increase in ambient radiation level may be due to natural meteorological variations instead of an accidental release of radioactive materials from a nuclear power plant, HKO will reassess the radiation level. If the rise is not due to meteorological factors and it is not a false alarm, HKO will enquire with relevant authorities about the situation to confirm the cause of the alarm trigger. In view of the new nuclear power stations in Yangjiang and Taishan being located to the west of Hong Kong, HKO has set up two additional real-time radiation monitoring stations, one at Chep Lap Kok in the west and the other at Cape D'Aguilar in the south, increasing the number of radiation monitoring stations in Hong Kong to 12. HKO's radiation monitoring system can promptly confirm whether there is an increase in the ambient radiation level of Hong Kong and the areas affected. Ambient gamma radiation data are available at the HKO website for public consumption.

- b) Water contamination monitoring systems of the Water Supplies Department (WSD)

The WSD has set up two identical On-line Water Contamination Monitoring Systems at Muk Wu Pumping Stations to provide real-time monitoring of the raw water imported from Guangdong. The alarms at HKO and WSD will be triggered if the radioactivity level in the water has exceeded the pre-set level. HKO and WSD will verify the authenticity of the alarm, and arrange to conduct detailed radiological analysis of water samples where necessary. HKO and WSD will alert SB immediately if the alarm is confirmed. Furthermore, WSD will check the radioactivity levels of water samples collected from local catchments, impounding reservoirs, water treatment works and consumer taps.

- (c) Food radiation monitoring by the Food and Environmental Hygiene Department (FEHD)

FEHD collects samples from food, live food animals and poultry imported from the Mainland for radiation monitoring.

Emergency Radiation Monitoring

15. The above-mentioned monitoring work will all be enhanced in the event of a nuclear emergency, including activation of emergency radiation monitoring activities, measuring ambient gamma dose-rate, collecting airborne particulate and gaseous iodine samples, etc. HKO will also flexibly assign land mobile survey routes in coordination with aerial radiation monitoring. In case of an emergency, the Government will enhance the radiation monitoring of marine water (with public beaches and Fish Culture Zones included).

16. According to the Daya Bay Contingency Plan, to avoid public consumption of contaminated food, water or milk, in the event of a serious nuclear accident, ingestion pathway countermeasures for food and water will be implemented in areas falling within 85 km of the nuclear power station concerned for exercising controls over food, live food animals and water imported from areas close to the nuclear power station, be they locally produced or supplied. Such countermeasures include the Agriculture, Fisheries and Conservation Department's monitoring of primary produce including fish, vegetables, livestock and poultry at farm and wholesale market levels; FEHD's contamination checks for imported foodstuffs and live food animals at the points of entry, as well as for foodstuffs and live food animals at slaughterhouses, wholesale markets and retailers. As regards the drinking water supply, WSD monitors the radioactivity of raw water supply from Guangdong through an automated system and collects drinking water samples

from different local areas for radiological analysis. In case of an emergency whereby contamination is detected, WSD will implement necessary countermeasures including rejection of inflow of water from contaminated sources (such as temporarily suspending the supply of raw water from Guangdong Province), using water from non-contaminated or least contaminated sources as far as practicable, and adjustment of the water treatment processes to reduce the content of radioactive substances in treated water supply, etc..

Accident Consequence Assessment

17. HKO has put in place an “Accident Consequence Assessment System” to simulate and assist in assessing the potential consequences of an accidental radiological release. By using the latest meteorological information as well as relevant information on the magnitude of the radiological release as input, this computer system is able to simulate the transportation and dispersion of the radioactive materials and to project the radiation dose in different parts of Hong Kong. When the appropriate information on the accident and source term become available, the assessment work can be completed within one to two hours. The Accident Consequence Assessment System is applicable to nuclear incidents at Daya Bay and other places near Hong Kong.

Advice Sought

18. Members are invited to note the contents of the paper.

**Security Bureau
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