CHAPTER 9

INGESTION COUNTERMEASURES:
FOOD, LIVE FOOD ANIMALS AND WATER

Introduction

9.1 In the event of an off-site emergency at the GNPS/LNPS, food and water may become radiologically contaminated during and following the passage of the plume. While plants and animals could become surface contaminated, tissue contamination could occur after inhalation, or after ingestion of radiologically contaminated nutrients (animals eating a large quantity of contaminated items can concentrate radioactivity in their tissues). This tissue contamination could continue, reducing over time, for some years. Surface contamination can be largely removed by washing but tissue contamination cannot be so removed.

9.2 To prevent and mitigate the possible impact on public health, ingestion countermeasures are to be implemented throughout Hong Kong, - the whole territory of which falls within the 85 km Emergency Planning Zone 2 (EPZ2) (Chapter 1), if the DBCP is at FULL ACTIVATION level (i.e. there is an off-site emergency at the GNPS/LNPS). Preparations will be required at the PARTIAL ACTIVATION level. In some circumstances, e.g. that of a small-scale limited release at the GNPS/LNPS, sample food monitoring may commence at this activation level of the DBCP. Similar measures would also be taken in Guangdong. In Guangdong, the Ingestion Emergency Planning Zone (EPZ) extends to 50 km from the GNPS/LNPS.

9.3 The prevailing Codex Alimentarius Commission (CAC) Guideline Levels1 should be adopted in the monitoring and control of all food items (both locally produced and imported)2. The radioactivity of the four common radionuclides (iodine-131 (I-131), caesium-134 (Cs-134), caesium-137 (Cs-137) and strontium-90 (Sr-90)) will be monitored. I-131, Cs-134 and Cs-137 are the main radionuclides representing health concern and most relevant in the acute phase of nuclear emergencies. Centre for Food Safety (CFS) will keep in view the discussion and recommendation of other relevant international authorities such as IAEA and WHO when considering whether other radionuclides should be monitored.

1 Codex Guideline Levels for Radionuclides in Foods Following Accidental Nuclear Contamination for Use in International Trade (www.codexalimentarius.org/). In January 2012, the prevailing CAC Guidelines Levels for the group of radionuclides including I-131 and Sr-90 in food are 100Bq/kg while that for the group of radionuclides including Cs-134 and Cs-137 in food is 1000 Bq/kg.

2 According to RPAG advice as accepted by the D of Health.
9.4 The decision to implement ingestion countermeasures will be made by the CESG or the S for S’ ITF after considering advice from HKOMAC and the Controller, CFS of FEHD (Chapter 2). The decision will be advised through EMSC using the alerting procedures at Annex 9.1.

9.5 In the early and intermediate phases of the emergency, the monitoring of food will concentrate on fresh produce (milk, fresh vegetables and fruits, fresh water fish and marine fish) which are more prone to radiation contamination immediately after a nuclear incident. In the longer term, meat and grains will also be targeted. Details of the likely affected area and the predicted plume exposure pathway if any will be provided before commencement of food monitoring and updated as appropriate by HKO.

9.6 The division of responsibilities for the monitoring of food and live food animals is set out below –

<table>
<thead>
<tr>
<th>Imported (at points of entry)</th>
<th>Local</th>
<th>Wholesale Market</th>
<th>Retail Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live cattle, pigs and goats</td>
<td>FEHD</td>
<td>AFCD</td>
<td>FEHD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FEHD at slaughterhouse</td>
<td>-</td>
</tr>
<tr>
<td>Poultry and birds</td>
<td>FEHD</td>
<td>AFCD</td>
<td>AFCD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FEHD</td>
</tr>
<tr>
<td>Fruit and vegetables</td>
<td>FEHD</td>
<td>AFCD at farms</td>
<td>AFCD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(including Yau Ma Tei Fruit Market &amp; Yuen Long Tin Kwong Hui Vegetable Wholesale Market)</td>
<td>FEHD</td>
</tr>
<tr>
<td>Milk</td>
<td>FEHD</td>
<td>AFCD at dairies(raw milk)</td>
<td>FEHD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FEHD at factories</td>
<td></td>
</tr>
<tr>
<td>Meat and other kinds of food</td>
<td>FEHD</td>
<td>FEHD</td>
<td>FEHD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish, shellfish</td>
<td>FEHD</td>
<td>AFCD at farms and culture zones</td>
<td>AFCD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(including Yuen Long Freshwater Fish Market)</td>
<td>FEHD</td>
</tr>
</tbody>
</table>

FEHD will provide necessary logistical support. GL will provide facilities for detailed analysis of radiation-contaminated samples.
Control of Food

9.7 In case of nuclear emergency at GNPS/LNPS, our primary objective is to ensure a stable supply of safe food items for the consumption of the general public.

9.8 Over 90 percent of Hong Kong’s food supply is imported. The Mainland is our most important source of food supply, especially on fresh food items (Annex 9.2). With the support of the Central People’s Government, supply of fresh food produce from the Mainland has always been steady. At the onset of an emergency at GNPS/LNPS, FHB and FEHD will closely monitor the food supply from the Mainland and will liaise with major food importers and distributors in Hong Kong to conduct scenario planning for the emergency involving sourcing of alternative food supplies and adjustment of stock levels etc.

(a) Imported food from Mainland

9.9 Since the Mainland is an important food source of Hong Kong, the Central People’s Government has always placed much emphasis on maintaining the stability, quality and safety of agricultural products supplied to Hong Kong. Other than vegetables, the area within the 50km Ingestion EPZ of the Mainland accounts a small portion of fresh food supply to Hong Kong. Despite that, to ensure the stable supply of fresh agricultural food products to Hong Kong, the Mainland authorities have established an emergency working mechanism whereby supply could be adjusted to respond to unforeseen circumstances. Moreover, cooperation arrangements have been made for the Mainland authorities to monitor food produced within 50 km of the nuclear power stations at Daya Bay to stop contaminated food from exporting to Hong Kong.

(i) Arrangements on the Guangdong side

9.10 Guangdong authorities have agreed that the radiation control standards for food exported to Hong Kong will be those laid down in the CAC Guideline Levels. Food produced within the 50 km Ingestion EPZ in the areas covered by the plume will be monitored by the Guangdong Entry-Exit Inspection and Quarantine Bureau (GDCIQ) and food exceeding the CAC Guideline Levels will not be exported to Hong Kong. Food with radiation contamination below the Guideline Levels will be certified and will be allowed entry into Hong Kong.

9.11 GDCIQ will monitor food exports to Hong Kong at the Shenzhen side of Man Kam To Control Point (to which all food exports (except those by sea) will be directed), Aotou in Hui Yang County and Gangkou in Hui Dong County. As agreed between the Mainland and Hong Kong, GDCIQ will also monitor food for the four indicator radionuclides (Sr-90, I-131, Cs-134 and Cs-
Monitoring results will be exchanged with Hong Kong after the first 24 hours of the off-site emergency. Sr-90 results will follow some days later because of the time required for the analysis. In the event of an off-site emergency at GNPS/LNPS, the Guangdong authorities can issue certificates of origin for food originating from areas outside the 50 km Ingestion EPZ of the Mainland if necessary.

(ii) Arrangements on the Hong Kong side (also see Chapter 7)

9.12 Food imports by road will be diverted by the Guangdong side to the Man Kam To Control Point as described in paragraph 9.11 above. C&ED has overall responsibility for monitoring goods at points of entry. However, this responsibility is delegated to FEHD for fresh produce and live food animals. AFCD will also monitor all fresh produce arriving at wholesale markets. Details are in the relevant departmental plans. In outline, FEHD will check the certification of fresh produce, and according to a pre-determined sampling pattern, monitor the food using hand-held survey meters for bulk screening and use the NaI Contamination Monitoring Systems for sample screening. Samples with radiation level above the CAC Guideline Levels will be sent to the GL for detailed analysis of Sr-90, I-131, Cs-134 and Cs-137 levels. Resources will be concentrated on monitoring food from areas under the plume within the 50 km Ingestion EPZ of the Mainland. Random screening may also be applied to food from other areas.

9.13 The radiation control standards for imported food are the prevailing standards laid down in the CAC Guideline Levels. Food with radiation level exceeding the CAC Guideline Levels will be returned to Guangdong according to an agreement reached with GDCIQ. Compensation may be required if subsequent testing and arbitration reveals the radiation level of the food is below the CAC Guideline Levels.

9.14 Contaminated food which cannot be returned to Guangdong will be disposed of according to the Waste Disposal Action Plan (Chapter 10).

(b) Locally produced food

9.15 Under the ingestion countermeasures, AFCD will monitor food at the primary production level and in wholesale markets and FEHD will monitor food at the retail level and meat at the slaughterhouses and retail level, according to the division of responsibilities described in paragraph 9.6. The radiation control standards to be applied are also the prevailing ones laid down in the CAC Guideline Levels as for imported food. It is necessary to ensure the consistent application of the same standards to both imported food and locally produced food to ensure the overall food safety. AFCD will monitor the radiation level of local produce (mainly vegetables and poultry) to ensure that only those below CAC Guideline Levels are allowed into the market.
9.16 Samples with radiation level detected above the CAC Guideline Levels will be further analysed by GL as imported food in paragraph 9.12. Food confirmed with radiation above the CAC Guideline Levels will be disposed of according to the Waste Disposal Action Plan (Chapter 10).

(c) **Imported food from places outside the Ingestion EPZ of the Mainland**

9.17 Imported food from places outside the 50km Ingestion EPZ of the Mainland would not be contaminated by an emergency at the GNPS/LNPS and no special measures need to be considered (see Chapter 15). Importers of food at the wholesale level will have to produce documentation of the place of origin of the food. As discussed in paragraph 9.11, the Guangdong authorities can issue certificates of origin for food originated from areas in Guangdong which are outside the 50 km Ingestion EPZ if necessary.

(d) **Exports of food**

9.18 Hong Kong is not a significant exporter (or re-exporter) of food. Nevertheless, it does export some food to serve a demand for oriental food, particularly in overseas Chinese markets. In the event of an off-site release, the prevailing CAC Guideline Levels would apply to such food and certification that the radiation level of the food is below the CAC Guideline Levels would probably be required, together with normal certification, by importing countries. FEHD is the authority for the issue of food export certificates. TID would assist FEHD in liaising with consulates to clarify their particular requirements and how these should be implemented.

**Live Food Animals**

(a) **Imported live food animals**

9.19 FEHD monitors the radiation level of live food animals imported from the Mainland for direct human consumption at Man Kam To Control Point. Livestock Contamination Monitoring Systems (CMS) have been installed for operational use by FEHD to monitor the radiation level of imported livestock (cattle, pigs and goats) at the boundary control points and Sheung Shui Slaughterhouse. CFS will also screen poultry at the boundary control points by using the hand-held Poultry CMS. It has been agreed with the Guangdong authorities that the judgment as to whether live food animals are contaminated will be based on the radiation level in the meat derived from these animals after slaughtering.

9.20 If the Livestock CMS or the Poultry CMS indicates that the live food animal might have been contaminated, the live food animal concerned would be slaughtered and its meat will be sent to the GL to determine whether the radiation level has exceeded the CAC Guideline Levels. In addition, meat
from imported live food animals for direct human consumption will be sampled by FEHD for testing of radiation level, irrespective of whether they come from the 50km Ingestion EPZ. Samples above the CAC Guideline Levels will be sent to the GL for detailed analysis of Sr-90, I-131, Cs-134 and Cs-137 levels. If the results from GL confirm that the radiation contamination is above the CAC Guideline Levels, CFS will then liaise with the relevant Mainland authorities to arrange for the return of the affected live food animals to the original port of export. If the circumstances so require, CFS may arrange for the affected live food animals to be euthanised and disposed of under the Waste Disposal Action Plan (See Chapter 10).

(b) Local live food animals

9.21 AFCD will monitor radiation level of the locally raised live food animals similar to that performed by FEHD on imported ones. If a significant increase in radioactivity level is detected during monitoring, the live food animal concerned would be slaughtered and its meat will be sampled for testing of radiation level according to the CAC Guideline Levels.

Food Control Committee

9.22 In the wake of an off-site emergency at GNPS/LNPS, the Permanent Secretary for Food and Health (Food) will convene the Food Control Committee (FCC) to monitor the food supply, in particular that of fresh produce, to Hong Kong. The FCC membership currently comprises representatives from FHB, FEHD, AFCD, TID and C&ED. Representatives from other departments will be invited to join when necessary.

9.23 In the unlikely event of shortage of certain food items (including milk, milk products and bottled water) as a result of the application of the CAC Guideline Levels, and such shortages cannot be reduced or averted by practicable means, the IAEA standards (which are less stringent than the CAC Guideline Levels) applicable to the particular radionuclide of concern in the affected food item may be adopted for food control on the direction of the CESG which will take into account the advice of FCC and DH. The relevant OIL, based on the Generic Criteria promulgated by IAEA as set out in Annex 1.5, is detailed in Annex 9.4. The IAEA standards will keep the effective dose to any person below 10 mSv per annum, which is unlikely to incur either short-term or long-term health detriments. RPAG has already recommended, and D of Health accepted the general adoption of IAEA standards for ingestion counter-measures, subject to domestic considerations in application (paragraph 1.30 (i) of Chapter 1)

Response plan to address food shortages
9.24 The Central Government attaches great importance to the stable supply of agricultural by-products to Hong Kong as well as the quality and safety of such products. The Mainland has put in place a contingency mechanism to maintain a stable food supply to Hong Kong, which can cope with the normal annual demand as well as that under unforeseen circumstances. To ensure stability in food supply to Hong Kong, FHB has also established a liaison mechanism with the relevant Mainland authorities (the Ministry of Commerce, the State General Administration of Quality Supervision, Inspection and Quarantine, etc.) for exchanging and collating information on matters such as food supply and safety, particularly in relation to food and public health incidents that may cause concern to both places. In the very unlikely event that there is a foreseen shortage of certain fresh food items due to a disruption of supply from Guangdong, FHB will, under the direction of FCC, liaise with relevant Mainland Authorities to identify alternative sources from areas outside Guangdong. FHB will also liaise with the food trade to ensure communication throughout to facilitate early alternative sourcing from overseas if required, or alternative sourcing of chilled and frozen food products to maintain a steady supply of food.

Water

9.25 It is most unlikely that the contamination levels in water - either in the reservoirs in Hong Kong or Shenzhen or in the Dongjiang (East River) - could approach the radiation control standard in any conceivable nuclear accident at GNPS/LNPS. The control value for water as agreed with the Guangdong side\(^3\) is given in Annex 9.3.

9.26 Water from Guangdong supplied to Hong Kong is monitored by the Guangdong side at the inlet of the aqueduct and at Shenzhen Reservoir, and by Hong Kong with water sampling and real-time On-line Water Contamination Monitoring Systems set up at the Muk Wu Pumping Station near Man Kam To. When the DBCP is at the PARTIAL or FULL ACTIVATION level, Hong Kong will increase its frequency of monitoring to four hourly intervals, which correspond to the enhanced sampling times on the Guangdong side plus the time taken for the water to flow from the inlet of the aqueduct supplying water to Hong Kong. Guangdong will monitor water daily, but in the event that contamination exceeds 50% of the control value Guangdong side will increase its monitoring frequency to four hourly.

9.27 Should the contamination level exceed the control standard, the water supply from Guangdong to Hong Kong will be temporary suspended until such time as the control standard is no longer exceeded. If this were to

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\(^3\) These bilateral standards, being more stringent than the corresponding IAEA OILs in Annex 9.4 are given precedence, according to RPAG advice. In the event of shortage of water as a result of the application of the more stringent bilateral standards, and such shortages cannot be alleviated by practicable means, OIL6 for water may be adopted instead on direction of the CESG taking into account of the advice of DH.
cause an acute water shortage, Hong Kong could request Guangdong to resume supply earlier. If WSD were to contemplate making such a request, consultation should be initiated immediately with EMSC and ITF through the WSD Liaison Officer. WSD would then take measures so far as is practicable to mitigate the radiation level in water by way of water treatment or dilution with non-contaminated or less contaminated water.

9.28 At the PARTIAL and FULL ACTIVATION levels, WSD will arrange sampling at reservoirs in Hong Kong, the inlets and outlets of water treatment works, water catchment areas and consumer taps. Results will be shared with HKOMAC and DH and an analytical summary given to EMSC. If contamination is found, WSD will consider the application of counter-measures, such as -

(a) rejection of inflow affected by radioactive plume;
(b) arranging for water to be drawn off preferentially from non-contaminated or least contaminated sources;
(c) adjustment of treatment processes to reduce radioactivity in treated water; and
(d) water rationing.

9.29 Contaminated water treatment sludge will be disposed of according to the Waste Disposal Action Plan (See Chapter 10).

Public Information

9.30 ISD will coordinate publicity in Hong Kong, as set out in Chapter 5, on the ingestion counter-measures. This publicity will stress the precautionary nature of the arrangements, the efforts made by the Guangdong and Hong Kong authorities to prevent the import and sale of contaminated items and the stringency of the control measures, such that there should be no ill-health effects for eating any produce in Hong Kong. EMSC will inform PEACO of the implementation of ingestion countermeasures at the points of entry. AFCD, FEHD and WSD will publish and update the relevant surveillance information on their as well as the DBCP’s websites.

9.31 C&ED, TID, FEHD and AFCD may need to make arrangements to answer queries from food importers on the documentation requirements of the Emergency (Radiological Contamination) Regulation, if this is invoked. Similarly, they may need to make arrangements to keep food exporters informed of overseas restrictions on HK imports. AFCD may need to make arrangements to provide information to farmers (including fish farmers) regarding harvesting of products and future planting or rearing.
INFORMATION COUNTERMEASURES: ALERTING CHART

SB/EMSC

ISD

Issue press release to the public and all government departments

SB/EMSC

FHB (Food Branch)

CP

ACP/OPS

FEHD

Monitoring overall food supply

DDC

BORDIST

AFCD

Monitoring food and live food animals and hosing down of empty contaminated vehicles.

FEHD

Monitoring fresh food and live food animals at farms and wholesale markets

C&ED

Command of monitoring goods, lorries and lorry drivers

WSD

Monitoring raw and treated water supply

EPD

Advice on disposal of contaminated waste

GL

Laboratory facilities

DH f.i.

HKO f.i.
## Annex 9.2

### Sources of supply of fresh food and live food animals (2010)

<table>
<thead>
<tr>
<th>Type of fresh food and live food animals</th>
<th>Produced locally</th>
<th>Imported from the Mainland (from an area within 50 km from the nuclear power stations in Daya Bay)</th>
<th>Imported from the Mainland (other areas)</th>
<th>Imported from overseas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables (tonnes)</td>
<td>2.5%</td>
<td>18.9%&lt;sup&gt;4&lt;/sup&gt;</td>
<td>71.6%&lt;sup&gt;4&lt;/sup&gt;</td>
<td>7%</td>
</tr>
<tr>
<td>Live pigs (heads)</td>
<td>5.2%</td>
<td>4.3%</td>
<td>90.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Live cattle (heads)</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Live goats (heads)</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Live chicken (heads)</td>
<td>61.4%</td>
<td>5.3%</td>
<td>33.3%</td>
<td>0%</td>
</tr>
<tr>
<td>Live freshwater fish (tonnes)</td>
<td>3.8%</td>
<td>0%&lt;sup&gt;4&lt;/sup&gt;</td>
<td>89.8%&lt;sup&gt;4&lt;/sup&gt;</td>
<td>6.4%</td>
</tr>
<tr>
<td>Live marine fish (tonnes)</td>
<td>23.4%</td>
<td>11.5%</td>
<td></td>
<td>65.1%</td>
</tr>
<tr>
<td>Milk, milk products and frozen confections (tonnes)</td>
<td>27%</td>
<td>12.5%</td>
<td></td>
<td>60.5%</td>
</tr>
</tbody>
</table>

<sup>4</sup> Estimation based on the distribution of sources as indicated in the accompanying documents of food consignments inspected at import level by the Centre for Food Safety.
### Annex 9.3

**Control Value for Water**

<table>
<thead>
<tr>
<th>Radionuclide (x)</th>
<th>Derived Intervention Level for drinking water (DIL&lt;sub&gt;x&lt;/sub&gt;) (Bq/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr-90</td>
<td>100</td>
</tr>
<tr>
<td>I-131</td>
<td>1000</td>
</tr>
<tr>
<td>Cs-134</td>
<td>500</td>
</tr>
<tr>
<td>Cs-137</td>
<td>600</td>
</tr>
</tbody>
</table>

Raw water from Guangdong or from reservoirs in Hong Kong is treated for potable supply. This treatment process may remove a proportion of the radionuclides present, depending on their form and state in water. The control value C<sub>x</sub> for raw untreated water for a particular radionuclide x is given by the formula:

\[
C_x = \frac{\text{DIL}_x}{1 - e_x}
\]

where e<sub>x</sub> is the removal efficiency for the radionuclide x in the treatment process used in Hong Kong. 0 < e<sub>x</sub> < 1.

In addition, the sum of ratios of measured activity of radionuclides to their respective control values for raw water should not exceed unity.

Because of the length of time required to test for Sr 90, it has been agreed with Guangdong that initial control will rest with the control values of the other three indicator radionuclides.
Default Screening Operational Intervention Levels (OILs) for Food, Milk and Water Concentrations from Laboratory Analysis

<table>
<thead>
<tr>
<th>OIL</th>
<th>Value</th>
<th>Response action (as appropriate) if the value is exceeded</th>
</tr>
</thead>
<tbody>
<tr>
<td>OIL5</td>
<td>• 100 Bq/kg gross beta ($\beta$) or&lt;br&gt;• 5 Bq/kg gross alpha ($\alpha$)</td>
<td>• Above OIL5: Assess using OIL6&lt;br&gt;• Below OIL5: Safe for consumption during the emergency phase</td>
</tr>
<tr>
<td>OIL6</td>
<td>• As listed in Table 10 of GSG-2*&lt;br&gt;• OIL6 is exceeded if&lt;br&gt;$$\sum_{i} C_{f,i} \frac{OIL6_i}{OIL6_i} &gt; 1$$&lt;br&gt;where&lt;br&gt;$C_{f,i}$ is the concentration of radionuclide i in the food, milk or water (Bq/kg);&lt;br&gt;$OIL6_i$ is the concentration of radionuclide i from Table 10 of GSG-2* (Bq/kg).</td>
<td>• Stop consumption of non-essential food, milk or water and conduct an assessment on the basis of realistic consumption rates. Replace essential food, milk and water promptly, or relocate people if replacement of essential food, milk and water is not possible.&lt;br&gt;• For fission products (e.g. containing iodine) and iodine contamination, consider providing iodine thyroid blocking if replacement of essential food, milk or water is not immediately possible.&lt;br&gt;• Estimate the dose to those who may have consumed food, milk or rainwater from the area where restrictions were implemented to determine if medical screening is warranted.</td>
</tr>
</tbody>
</table>


Note: The OILs should be revised as soon as it is known which radionuclides are actually involved. The OILs should also be revised, if necessary, as part of the preparedness process, to be more consistent with the instruments to be used during the response. However, the default OILs in this table can be used without revision to make a conservative assessment immediately.