Executive Summary

Dietary Exposure to Dioxins of Secondary School Students

Purpose

The risks posed by dioxins to the local population was assessed through a dietary exposure study of secondary school students. This paper describes the methods and findings of the study. The implications of these findings and possible risk management options are also discussed.

Dioxins and Dietary Exposure

2. Dioxins, a group of chemicals consisting of polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), have raised public health concerns because of their possible health implication and potential cancer-causing effects. One of the

dioxin congeners, 2,3,7,8-tetrachlorodibenzo-para-dioxin (TCDD), has been identified as a human carcinogen (International Agency for Research on Cancer classified TCDD as Group 1 carcinogen). Ongoing studies are undertaken to study whether other dioxin congeners are also cancer causing.

3. There is no industrial use of dioxins. These chemical contaminants were generated because of incomplete combustion in incinerators, automobile emissions, bleaching of paper pulp, manufacture or use of defoliants and pesticides, as well as other natural phenomena such as volcano eruptions and forest fires. Dioxins could enter the food chain through deposition in soils and plants and accumulated in animals. Though other routes of exposure exist, dietary exposure has been regarded as the major route of dioxin exposure in the general population.

4. In the past years, there have been global efforts in controlling dioxin accumulation in humans. Generally two approaches are undertaken. One is to reduce the source of dioxin emissions and the other is to establish a tolerable daily intake for dioxins. To date, the

most commonly described tolerable intake level was recommended by World Health Organisation (WHO) in 1998. The WHO recommended that the dietary exposure to dioxins and related compounds should not be higher than 1 - 4 pg toxic equivalent (TEQ) per kg body weight (bw) per day.

Scope and Method

5. This dietary exposure assessment used two sets of data, data on food consumption pattern and dioxin concentrations in relevant food groups.

6. In Hong Kong, data on food consumption pattern are limited. In late 2000, a Food Consumption Survey using food frequency questionnaire and food measurement aids were conducted among secondary school students. The survey collected food consumption pattern for high risk food items.

7. Under the food surveillance programme of the Food and

Environmental Hygiene Department, a wide variety of food samples are taken regularly at every stage of the supply chain: from import and manufacture to the wholesale and retail stages for microbiological, chemical and radiological testing, including testing for dioxins, which commenced in 1999. The laboratory testing of dioxins consisted of two stages, fat extraction process followed by gas chromatography – high resolution mass spectrometry. To study dioxin concentrations in food products, we used the data on dioxins extracted from the food surveillance programme. The results of 88 products belonging to the target food groups collected from January 2000 to April 2001 were used to estimate the dioxin concentrations.

8. In this study, we adopted the "selective studies of individual foods" approach for the estimation of dietary exposure to dioxins. This is a more flexible approach and is one of the approaches recommended by the WHO. The dietary exposure to dioxins could be estimated using the available data from the food surveillance programme and the food consumption data on relevant food groups collected from the Food Consumption Survey.

Dioxin Exposure of Secondary School Students

9. Since dioxins are commonly found in food items of high fat content, consumption data on food items under five food groups of interest were extracted from the Food Consumption Survey for the dietary exposure study. They were meat and meat products, poultry and poultry products, seafood, milk and milk products, as well as eggs and egg products.

10. The laboratory reports provided the concentration of all the 17 dioxin congeners in a food sample. Total dioxin concentration in the food sample, the toxic equivalent (TEQ) concentration, was then computed using the relevant Toxic Equivalency Factors (TEFs) with reference to the WHO–TEF scheme developed in 1997. TEF refers to the equivalent toxic effect of the concerned dioxin congener comparing with its most toxic counterpart – TCDD. The total dioxin concentration for each food sample was computed. Taking into account the skewed distribution of the dioxin concentrations, dioxin concentration for each food group was represented by its median.

11. Using the above two sets of data, dietary exposure to dioxins was determined. **For an average secondary school student in Hong Kong, the dioxin exposure was 0.85 pg WHO-TEQ (PCDD/F) per kg bw per day.** This level was within the range of tolerable daily intake recommended by WHO in 1998.

12. To estimate the dioxin exposure of high consumers, those above 95th percentile exposure level were studied. **The dioxin exposure of these high consumers could be up to 2.07 pg WHO-TEQ (PCDD/F) per kg bw per day.** This level was about 2.5 times that of average eaters.

13. The pattern of dietary exposure showed that seafood, meat as well as poultry and their products were the major dietary sources of dioxins. Dioxin concentration in milk was not high but the consumed amount made it an important source. On the other hand, dioxin concentrations in eggs were high but the consumption level was relatively low.

Implications and Limitations of the Findings

14. Comparing the results of this study with similar studies conducted overseas were difficult principally because different methodologies were adopted. From our study, it could be concluded that an average secondary school student would not experience major toxicological effects of dioxins.

15. Limitations of the study were identified. Firstly, only selected groups of food were chosen for the study and hence might not represent the full range of dioxin exposure. Secondly, dioxin concentrations expressed on fat basis were converted to product basis before the determination of dioxin exposure, based on the assumption that dioxins would be present in the fat portion only. Thirdly, number of samples for establishing the dioxin contamination data was small. Finally, the study was limited to dioxins and toxic effects of dioxin-like PCBs were not accounted for.

Control of Dioxin Exposure

16. Dietary intake is the major route of dioxin exposure. Since dioxins were products of environmental pollution, the ultimate goals of decreasing dioxin exposure are to reduce the dioxin emissions as well as interrupting their pathways into food and these rely on global effort in the international community.

17. International agreed regulatory standard and tolerable intake level for dioxins are still evolving. The Department will continue to monitor international development on regulations of dioxins and foods available in Hong Kong, especially on food items that may contain high levels of dioxins.

18. To minimize dietary exposure to dioxins, the public is advised to consume low-fat products, trim fat from meat and meat products and to use simple cooking methods. Moreover, a balanced diet is recommended to maintain health and to avoid excessive exposure to contaminants from a small range of food items.