Dietary Exposure to Dioxins from Sydney Harbour Seafood

Wilson, A. & Hambridge, T.

Food Standards Australia New Zealand

Introduction

The term 'dioxins' is used to describe a group of environmentally persistent chemicals, which are not manufactured intentionally but are by-products of combustion. Dioxins accumulate in the body fat of animals and humans, giving rise to concerns for potential adverse human health and environmental effects.

In September 2006, the NSW Food Authority (NSWFA) requested that Food Standards Australia New Zealand (FSANZ) undertake a revised risk assessment for dioxins based on analytical results for a broad range of seafood from the Sydney Harbour area.

The risk assessment included results for the 29 dioxin congeners identified by the World Health Organization (WHO) as having a common mechanism of toxicity, to be persistent and accumulated in the food chain.

Purpose

To determine the risk of dietary exposure to dioxins for consumers of Sydney Harbour seafood, by assessing background dioxin exposure from other foods and dioxin exposure from Sydney Harbour seafood as a percentage of the reference health standard. Additionally, to determine whether consumption advice was necessary and if advice would differ for areas to the east or west of the Harbour Bridge.

Concentration Data

The risk assessment was based on additional sampling of a broader range of seafood than that obtained initially. All samples were collected in the area between Sydney Harbour Entrance and the upper Parramatta River, following the notification of fishing bans and consumption advice given by NSWFA in February 2006.

These further analytical results indicated higher than expected levels of dioxins for the types of fish, molluscs and crustacea sampled. (See Table 1 for a summary of the concentration data).

Table 1. Dioxin concentration data for seafood from Sydney Harbour including based on location in Harbour

Seafood	Whole Harbour		East of Harbour Bridge		West of Harbour Bridge	
	Number of Samples	Mean (pg TEQ*/g)	Number of Samples	Mean (pg TEQ*/g)	Number of Samples	Mean (pg TEQ*/g)
Crustacea	50	11.0	12	5.8	38	12.6
Fish	316	25.1	146	10.7	170	37.4
Molluscs	37	16.6	15	6.4	22	23.5

*TEQ = the intake of dioxins is expressed in units of Toxic Equivalents (TEQ), applying the World Health Organization's Toxic Equivalence Factors, a ranking system for congeners of the dioxin class.

Reference Health Standard

In 2002, the Australian National Health and Medical Research Council (NHMRC) established a Tolerable Monthly Intake (TMI) for dioxins of 70 pg TEQ/kg of body weight from all sources (including food, air and dermal exposure) that indicates the long-term nature of any potential dioxin toxicity. Estimated dietary exposures to dioxins conducted by FSANZ did not include non-food sources.

Dietary Exposure Assessment Details

A revised dietary exposure assessment was conducted by FSANZ in the following ways:

- **Baseline** - a baseline dietary exposure assessment using mean consumption data of foods for all respondents from the 1995 Australian National Nutrition Survey (NNS) and the mean concentrations of dioxins included in the FSANZ 2004 National Dioxins Program exposure assessment;
- **General Population Assessment** - an estimate of the potential dietary exposure for the general population as a result of infrequently eating seafood from Sydney Harbour based on the mean level of consumption of seafood for the population in addition to baseline exposures; and
- **Frequent Consumers Assessment** - an estimate of the potential dietary exposure as a result of eating seafood from Sydney Harbour more frequently and at higher levels of consumption in addition to baseline exposures.

General Population Estimate

Estimated dietary exposures were based on mean consumption for 'eaters' and 'non-eaters' of:

- prawns of 4 g per person/day (120 g/month)
- crab of 0.1 g per person/day (3 g/month)
- fish of 7 g per person/day (210 g/month)
- squid of 0.6 g per person/day (19 g/month).

Results are expressed as a percentage of the TMI (Table 2).

Table 2. Estimated mean monthly dietary exposure to total dioxins for the general population as a percentage of the TMI

Scenario	%TMI (Lower Bound – Upper Bound)*
Baseline	5 - 20
Sydney Harbour crustacea + Baseline	30 - 50
Sydney Harbour fish + Baseline	120 - 135
Sydney Harbour molluscs + Baseline	20 – 35
Sydney Harbour crustacea, fish and molluscs + Baseline	150 - 170

* Lower bound mean concentrations were calculated assuming that for 'not detected' results, the dioxin concentration was zero. The upper bound mean concentrations were calculated assuming that for 'not detected' results, the dioxin concentration was equal to the Limit of Reporting (LOR) for the analytical method.

Frequent Consumers Assessment

The estimated dietary exposures for 'eaters only' as a percentage of the TMI are presented in Table 3 and were based on:

- a mean crustacea dioxin concentration of 11 pg TEQ/g assuming that crustacea were either consumed in mean (75 g) or large (250 g) serve sizes
- a mean fish dioxin concentration of 25 pg TEQ/g assuming that fish were either consumed in mean (115 g) or large (305 g) serve sizes
- a mean concentration mollusc dioxin concentration of 17 pg TEQ/g assuming that molluscs were either consumed in mean (80 g) or large (240 g) serve sizes.

Table 3. Estimated monthly dietary exposure to dioxins for frequent consumers of Sydney Harbour seafood as a percentage of the TMI

	% TMI (Lower Bound – Upper Bound)		
Number of Serves	Crustacea	Fish	Molluscs
1 mean serve per month	20 – 40	65 – 80	35 – 50
1 large serve per month	65 – 80	170 – 180	90 – 110
1 mean serve per week (4/month)	75 – 90	250 – 270	120 – 140
1 large serve per week (4/month)	240 – 260	660 – 670	350 – 370
3 mean serves per week (12/month)	220 – 230	740 – 760	350 – 370
3 large serves per week (12/month)	710 – 720	1960 - 1970	1050 – 1060

Risk Assessment Conclusions

The public health and safety risk for the majority of the population from dioxin exposure following the consumption of seafood from Sydney Harbour is considered to be very low, given the infrequent and low level of Sydney Harbour seafood consumed by the general population.

For a relatively small sub-population group, namely, recreational fishers who frequently consume their catch from Sydney Harbour, and do so over a long period, the assessment indicated that under some scenarios, it was possible for the TMI to be exceeded.

To find out further information on the risk assessment conducted by FSANZ, visit our website http://www.foodstandards.gov.au/foodmatters/dioxinsinfood.cfm

Risk Management

Based on the FSANZ risk assessment and advice from an Expert Panel, the NSWFA issued advice for the consumption of seafood from Sydney Harbour, which can be found on their website along with further information at http://www.foodauthority.nsw.gov.au/consumer/c-dioxins.htm.

General consumption advice:

- For recreational fishing, eating of Harbour fish caught east of the Sydney Harbour Bridge should be limited to no more than 150 grams per month.
- No seafood caught west of the Sydney Harbour Bridge should be eaten.
- All commercial fishing in Sydney Harbour has been halted since 2006 due to elevated levels of dioxins detected in some fish and seafood.

For recommended consumption of specific species caught east of the Harbour Bridge, please refer to Table 4.

Table 4. Recommended seafood consumption based on eating a single species caught east of the Sydney Harbour Bridge

Species	Number of 150 gram serves per month	Amount per month (grams)
Prawns	4	600
Crabs	5	750
Bream	1	150
Flounder	12	1800
Kingfish	12	1800
Luderick	12	1800
Sand Whiting	8	1200
Sea Mullet	1 every 3 months	50
Silver Biddie	1	150
Silver Trevally	5	750
Tailor	1	150
Trumpeter Whiting	12	1800
Yellowtail Scad	8	1200
Squid	4	600

Australia
New Zealand

PO Box 7186 Canberra BC ACT 2610
PO Box 10559 The Terrace Wellington 6036

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