4. Summary of findings

The project involved the collection of several thousand aquatic sediment cores by a team of sampling personnel, using a standard sampling protocol, from locations representative of major catchments according to priorities identified by the NPI. For the purpose of the study, samples from a given location were pooled. Samples were collected in freshwater, estuarine and marine locations. Where practical, samples were collected from locations within the same catchment from the non-impacted upper catchment through estuary to marine environment. The sampling strategy was deliberately designed to represent environments not impacted by obvious proximate point sources of dioxin-like chemicals.

In addition to the sediment samples, bivalve samples were collected when available. Furthermore, fish samples were obtained through local commercial fishing industries and government agencies with an emphasis on local catch of consumer species.

Chemical analysis of sediment and biota samples was conducted by AGAL, and a series of quality assurance/quality control (QA/QC) procedures were incorporated into the study including replicate sampling, replicate analysis and an interlaboratory comparison where selected samples were reanalysed at an overseas laboratory. The QA/QC procedures suggested that the analytical reproducibility was high, whereas sampling reproducibility is likely to have contributed the greatest uncertainty to the results. This is particularly relevant in locations that are influenced by potent local point sources.

In terms of the actual data, dioxin-like chemicals were found in all sediment samples with concentrations ranging from 0.002 to 520 pg TEQ g^{-1} dm. Highest concentrations were found in the sediments sampled from the Lower Parramatta River (100 and 520 pg TEQ g^{-1} dm) and the western section of Port Jackson (78 and 130 pg TEQ g^{-1} dm), in close proximity to historical manufacturing point sources around Homebush Bay. The contaminated sediments of Homebush Bay represent a major source of dioxin contamination in Sydney and have been scheduled for remediation in the immediate future. With the exception of this specific hot-spot (relatively contaminated area), consistently elevated concentrations of dioxin-like chemicals were also found in other estuarine waters of Sydney (Botany Bay) as well as the estuaries in and near Brisbane, Melbourne, Hobart, Perth and Wollongong. Considering all sediment samples, the median concentrations were 0.2, 2.3 and 0.12 pg TEQ g^{-1} dm in sediments from freshwater, estuarine and marine locations, respectively.

A statistical analysis of the data (two-way ANOVA) followed by a Tukey (HSD) test showed that significant differences exist between levels of TEQ values of dioxin-like chemicals across sampling locations with different catchment associated land-uses, with urban/industrial sites having significantly higher TEQ levels than samples collected adjacent to remote or agricultural regions. However, the statistical analysis showed no significant differences in concentrations of dioxin-like chemicals between sediments from freshwater, estuarine and marine locations. Nevertheless, there were a greater number of high value outliers among the results from estuarine locations. This reflects the situation that in Australia most urban/industrial land-use is located adjacent to estuaries, making it

impractical for a study such as this to assign urban/industrial land-use sampling sites other than at locations adjacent to estuaries.

Homologue and congener profiles for the PCDD/PCDF were strongly dominated by OCDD. Similarly, the tetra to heptachlorinated 2,3,7,8 chlorine substituted profiles were dominated by the highest chlorinated PCDD, 1,2,3,4,6,7,8-heptachloro dibenzodioxin. For most sediment samples, PCDD/PCDF dominated with more than 80% to the total TEQ. However, a range of samples such as from the Brisbane River, the Torrens River or from WA showed contributions of PCB to up to more than 50%, which indicates that PCB and PCDD in particular have different sources and that the profile is influenced by local sources of selected compounds.

In addition to the sediment samples, 18 bivalve samples were collected and the levels of dioxin-like chemicals in the bivalves ranged from about 0.0043 to 1.2 pg TEQ g^{-1} fm (½ LOD) if the data are expressed using the toxicity equivalency factors for fish; and from 0.0068 to 3.4 pg TEQ g^{-1} fm if the data are presented using the TEF for humans. The data shows a trend of increased concentrations in bivalves with increasing concentrations in the sediments. Overall, levels of dioxin-like chemicals in bivalves were well below the benchmark value of 25 pg TEQ g^{-1} fm for dioxins in fish set by the US FDA, which was identified as a level with no serious health effects and, thus, also much below the 50 pg TEQ g^{-1} fm action level set by the US FDA (US EPA, 1985 quoted in Wenning et al. 2003). However, it should be noted that three of the 18 bivalve samples exceeded 1 pg TEQ g^{-1} fm (based on TEQ_{HUMANS}), a level that according to information obtained by Wenning et al. (2003) from the US FDA warrants further investigation.

Relatively high concentrations of dioxin-like chemicals were measured in a sample of oysters from Coffin Bay, South Australia. However, this location had very low concentrations of dioxin-like chemicals in the sediments. To check the veracity of this outcome, bivalves from the Coffin Bay location were resampled, taking bivalves from the same sites used for the original sampling. The analysis results from the resampled bivalves found concentrations of dioxin-like chemicals order of magnitude less than those measured in the analysis of the original sample from this location. The new results for Coffin Bay bivalves were consistent with concentrations of dioxin-like chemicals at other marine locations sampled in this project, and were consistent with the negligible concentration in the sediments at this location. The reason for the original anomalous high result for the Coffin Bay bivalves is unknown, but it has been included with the resampling results in the data analysis, related tables, and figures.

Dioxin-like chemicals were also analysed in 23 fish flesh samples from around the country and concentrations ranged from 0.0053 to 0.49 pg TEQ g^{-1} fm. Again, the concentration of dioxin-like chemicals was highest in a fish sample obtained from the Sydney/Port Jackson area. None of the fish samples analysed exceeded the 1 pg TEQ g^{-1} fm level that is considered to become a threshold for potential further investigations by the US FDA (see Wenning et al. 2003).

Overall, the results from this study found that the concentrations of dioxin-like chemicals in the majority of samples obtained from aquatic environments throughout Australia are low

when compared to results from many other industrialised countries although they are mostly not as low as those observed in the New Zealand studies. Furthermore, the concentrations of dioxin-like chemicals in sediments and bivalves from certain areas and particularly in the estuarine section of the Parramatta River and the western part of Port Jackson are substantially elevated and similar to those found in comparable international industrialised estuaries. Bivalve results, similar to the sediment results, indicated the existence of areas with elevated levels but overall the limited results from this study did not find an impact on commercial seafood. Notably only very few fish samples originated from areas with elevated levels of dioxin-like chemicals in sediments and hence it is beyond the scope of this study to evaluate whether seafood caught in these areas is suitable for consumption.

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6. Appendices

Appendix A Details of sampling program

This Appendix provides details of the sampling program. It includes:

- Table A1 - Sampling locations for analysed sediment samples including region, state and catchment and analysed bivalve samples.
- Sampling form - to be completed for each sampling location
- Description of the sediment coring device.

Table A1 Sampling locations.

Region	State	Catchment	Sampling location	Bivalves analysed
Northern Australia	NT	Arafura Sea	Arafura Sea (MA1A)	
		Port of Darwin	Darwin - Port of Darwin (ES1A)	YES
		East Alligator River	Kakadu NP - East Alligator River (FW1A)	
	QLD	Endeavour River	Endeavour R.(ES1A)	
		Johnstone River	Upper Johnstone R. (FW1A)	
			Innisfail - Lower Johnstone R. (ES1A)	YES
			Innisfail - Johnstone R. (ES1A)	
		Dawson River	Banana Region - Upper Dawson R. (FW1A)	
		Heron Island	Heron Island (MA1A)	YES
		Brisbane River	Brisbane - Lower Brisbane R. (ES1A)	
			Upper Brisbane R. (FW1A)	YES
			Brisbane - Port of Brisbane (ES1A & ES1B)	YES
			Moreton Bay (MA1A)	YES (ES1A & ES1B)
South-Eastern Australia	NSW	Namoi River	Narrabri Region - Namoi R. (FW1A)	
		Hunter River	Muswellbrook Region - Upper Hunter R. (FW1A)	
			Singleton Region - Lower Hunter R. (FW1A)	
			Newcastle - Hunter River (ES1A)	
			Newcastle - Port Hunter (MA1A)	
		Blue Mountains	Blue Mountains (FW1A and FW1B)	
		Parramatta River/ Sydney Harbour	Sydney - Parramatta R. (FW1A)	
			Sydney - Parramatta R. (ES1A & ES1B)	
			Sydney - Port Jackson East (ES1A)	
			Sydney - Port Jackson West (ES2A & ES2B)	YES
		Botany Bay	Sydney - Botany Bay (ES1A & ES1B)	
		Lake Illawarra	Wollongong - Lake Illawarra (ES1A & ES1B)	
	ACT	Lake Burley Griffin	Canberra - Lake Burley Griffin (FW1A)	
	VIC	Latrobe Valley	Latrobe Valley - Latrobe R. (FW1A)	
			Latrobe Valley - Latrobe R. (ES1A)	
			Gippsland Lakes (ES1A)	YES
		Yarra River/ Port Jackson	Upper Yarra R. (FW1A)	
			Melbourne - Lower Yarra (ES1A & ES1B)	YES (ES1A)
			Melbourne - Hobsons Bay (ES1A)	YES
			Melbourne - Port Phillip Bay East (ES1A)	YES
			Melbourne - PPB Central (MA1A & MA1B)	
		Werribee River	Moorabool Region - Upper Werribee R. (FW1A)	
			Melton Region - Lower Werribee R. (FW1A & FW1B)	
	TAS	Cape Grim	Cape Grim (MA1A)	
		Launceston Region	Launceston Region - Cyrries River Dam (FW1A)	
			Launceston Region - Lower Tamar R. (ES1A)	YES
		Lake St. Clair	Lake St. Clair (FW1A)	
		Derwent River	Upper Derwent R. (FW1A)	
			Derwent R. - Meadowbank Lake (FW1A & FW1B)	
			Hobart - Derwent R. (ES1A)	
			Hobart - Lower Derwent R. (ES1A)	YES
	SA	Murray River	Renmark Region - Murray R. (FW1A)	
		Torrens River	Upper Torrens R. (FW1A)	
			Adelaide - Torrens R. (FW1A & FW1B)	
			Adelaide - Lower Torrens (FW1A)	YES
			Adelaide - Torrens R. (ES1A)	
		Port Pirie	Port Pirie (ES1A)	
		Franklin Harbour	Spencer Gulf West - Franklin Harbour (MA1A)	
		Coffin Bay	Coffin Bay (MA1A)	YES (MA1A & resample)
South-Western Australia	WA	Serpentine River	Wandering Region - Upper Serpentine R. (FW1A)	
			Serpentine Region - Lower Serpentine R. (FW1A)	
		Leschenault Inlet	Leschenault Inlet (ES1A)	
		Avon River	Northam Region - Middle Avon R. (FW1A)	
			Beverley Region - Upper Avon R. (FW1A)	
		Swan River	Perth - Lower Swan R. (ES1A & ES1B)	
			Perth - Upper Swan R. (FW1A)	
		Canning River	Perth - Canning R. (FW1A & FW1B)	
		Kwinana Beach	Perth - Kwinana Beach (MA1A)	YES
		Rottnest Island	Rottnest Island (MA1A)	

Sampling form - to be completed for each sampling location

E.A. DIOXIN STUDY – SAMPLING FORM (SEDIMENT)

Please note: when filling out this form please provide only information which you know to be correct. If you are unsure of details requested please leave blank (or fill in what you believe to be true and mark '?').

Sampling Date/Time _____

Sampling Area **Site:** _____

State: _____

For office use only
Sample Codes_____

Sample Received (NRCET)

Date……

Person received

Int.No:……

Storage Location

Catchment Land Use (list all)

a.) Industrial
b.) Urban
c.) Agriculture
d.) Remote

Further describe the catchment.
Please indicate all land uses within the catchment.

a) If **Industrial** – what are the key industries in the area?
Please list known potential dioxin sources. If unknown, you may wish to consult the National Pollution Inventory website (http://www.npi.gov.au/cgi-bin/npidownload.pl) to obtain further information. Air and water source data are relevant when obtained from this site.

INDUSTRY	INTENSITY			PROXIMITY TO SITE (APPROX KM)
Sewerage Treatment	High Capacity		Low Capacity	_____
Mining	Heavy	Moderate	Sparse	_____
Waste disposal	Heavy	Moderate	Sparse	_____
Manufacturing	Heavy	Moderate	Sparse	_____
Smelting/Refining	Heavy	Moderate	Sparse	_____
Chemical	Heavy	Moderate	Sparse	_____
Power/Energy Generation	Heavy	Moderate	Sparse	_____
Other	Heavy	Moderate	Sparse	_____

If Other please specify_____

b) If **Agriculture** – Include all types

LAND USE	INTENSITY		PROXIMITY TO SITE (APPROX KM)
Livestock	Intensive	Extensive	_____
Horticulture	Intensive	Extensive	_____
Cropping	Intensive	Extensive	_____
Other	Intensive	Extensive	_____

If Other please specify_____

Approximate area of agricultural activities (ha) _____

Where there are crops in the catchment:
Name main crops _____
Pesticide use (Types/amount p.a.) _____

b) If **Urban** – describe density

DENSITY	PROXIMITY TO SITE (APPROX KM)
High (> 500 000)	_____
Medium (30 000 – 500 000)	_____
Low (< 30 000)	_____

Is burning a regular land management practice in the catchment?

Yes
No

Hydrodynamic regime and depositional environment.

Is the site:

Tidal	Yes	No
Subject to regular flooding	Yes	No

If the site is subject to regular flooding, when was the last flood? _____

Flow Velocity High Medium Low No Flow

What is the width of the water body (m)? _____

Please provide any further information which may be relevant to the sites hydrodynamic regime or deposition environment _____
_____
_____
_____

Other Information
Date of the last rainfall event? _____Amount (in mm) _____
Date of the last heavy (> 25 mm) rainfall event? _____Amount (mm)_____

The Bureau of Meteorology will provide this information if you email a request to your local area. Contact details can be found on their website at: http://www.bom.gov.au

Please provide any additional information on site or sampling which may be relevant.

_____
_____
_____

REPLICATE DETAILS

REPLICATE 1

Having arrived at your first selected sampling site, please check it conforms with the following criteria:

The site is not within 200 m proximity of any specific major industrial plant, chemical factory or major port infrastructure.

The site is not within 100 m proximity of any jetties or moorings.

The site is not within 50 m proximity of any wooden structures including buildings, fences, poles or similar artifact or structure.

The site is not within 50 m proximity of any stormwater drain (unless the drain is natural – remote areas – or drains agricultural land free of buildings or paved areas).

If estuarine, the site is not within 1 km proximity of a sewerage discharge point which services >1000 equivalent persons and/or is treating trade waste.

If in a flowing freshwater stream, the site is not within 100 m proximity upstream of a sewerage discharge point which services >1000 equivalent persons and/or treats trade waste (unless local factors such as a potential for significant upstream influence from the discharge plume (eg wind driven currents or eddies) indicate that a larger safety margin should be allowed.)

2. GPS Reading **Longitude** _____

Latitude _____

Sediment Characteristics

Type – if known_____

Ground Coverage (eg. seagrass)_____

Sample Depth:

Sub-sample #	Depth (m)	Sub-sample #	Depth (m)
1		6	
2		7	
3		8	
4		9	
5		10	

Briefly describe the sampling area (eg. Bay area, estuarine, oceanic influences, sandbar, etc).

_____

_____

Are bivalves present and able to be collected at or near the site?

Yes

No

If bivalves (or oysters) are present and able to be collected at or near the site, please collect a minimum of approximately 200g (flesh weight) or 30 individuals.

If the bivalves were collected in an area adjacent to the sampling site, at what distance from the sampling site were they collected? _____

Provide details (and a diagram if necessary) of sampling technique if it differed from the suggested configuration (due to spatial constraints).

_____

_____

_____

_____

REPLICATE 2

Having arrived at your second selected sampling site, please check it conforms with the following criteria:

The site is not within 200 m proximity of any specific major industrial plant, chemical factory or major port infrastructure.

The site is not within 100 m proximity of any jetties or moorings.

The site is not within 50 m proximity of any wooden structures including buildings, fences, poles or similar artifact or structure.

The site is not within 50 m proximity of any stormwater drain (unless the drain is natural – remote areas – or drains agricultural land free of buildings or paved areas).

If estuarine, the site is not within 1 km proximity of a sewerage discharge point which services >1000 equivalent persons and/or is treating trade waste.

If in a flowing freshwater stream, the site is not within 100 m proximity upstream of a sewerage discharge point which services >1000 equivalent persons and/or treats trade waste (unless local factors such as a potential for significant upstream influence from the discharge plume (eg wind driven currents or eddies) indicate that a larger safety margin should be allowed.)

GPS Reading Longitude _____

Latitude _____

Approximate proximity to Replicate 1 (m) _____

Sediment Characteristics

Type – if known_____

Ground Coverage (eg. seagrass)_____

Sample Depth:

Sub-sample #	Depth (m)	Sub-sample #	Depth (m)
1		6	
2		7	
3		8	
4		9	
5		10	

Briefly describe the sampling area (eg. Bay area, estuarine, oceanic influences, sandbar, etc).

_____

_____

Are bivalves present and able to be collected at or near the site?

Yes
No

If bivalves (or oysters) are present and able to be collected at or near the site, please collect a minimum of approximately 200g (flesh weight).

If the bivalves were collected in an area adjacent to the sampling site, at what distance from the sampling site were they collected? _____

Provide details (and a diagram if necessary of sampling technique if it differed from the suggested configuration (due to spatial constraints).

_____

_____

_____

DETAILS OF FIELD OFFICER

Name: _____

Organisation: _____

Ph.: (_____) _____

Signature of field officer: _____

Description of the sediment coring device

The picture below shows four parts. From bottom to top they have the following function:

1. The coring device is a 15 cm aluminium tube (2.8 cm internal diameter) that holds the sediment sample together. The tube also acts as a storage container for the individual sub-samples
2. The plastic joint holds the coring tube (only by friction) and screws into the valve
3. The one-way valve (brass) lets the air out of the tube after inserting it into the sediment - creating the vacuum to remove the sediment sample
4. The plastic joint screws into the top of the valve and is manufactured to fit directly into a swimming pool cleaning rod.

Appendix B Analytical methodology

This appendix provides details of the analytical methodology. It includes:

- PCDD/PCDF and dioxin-like PCB analyses
- Sample preparation
- High-Resoultion Gas Chromatography High-Resolution Mass Spectrometric (HRGC-HRMS) Analysis
- Table B1 - The MID Windows for PCDD/PCDF and list of analytes
- Table B2 - Theoretical ion abundance ratios and QC limits
- Table B3 - The MID Windows for non-ortho and mono-ortho PBC and list of analytes
- Table B4 - Theoretical ion abundance ratios and QC limits
- Analyte identification and quantification criteria
- Quantification using the isotope dilution technique
- Total Organic Carbon (TOC) protocol.

PCDD/PCDF and 'dioxin-like' PCBs

A list of analytes is provided in Table B1 and B3.

The method for determination of tetra- through octa-chlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF) and polychlorinated biphenyl congeners (PCB) in soil and sediment matrices is high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS).

This method provides data on all toxic 2,3,7,8-chlorinated PCDD (seven) and PCDF (ten) isomers, plus the 12 'dioxin-like' PCB congeners designated as toxic by the World Health Organisation (WHO). The PCDD/PCDF and PCB are determined by the isotope dilution quantitation technique. This technique allows determination of the dioxin toxicity equivalent (TEQ_{DF}) as well as the PCB toxicity equivalent (TEQ_{PCB}) for the 'dioxin-like' PCB in a sample using WHO_{98} toxicity equivalency factors (TEFs). The total toxic equivalents (TEQ_{DF+PCB}) are calculated as the sum of TEQ_{DF} + TEQ_{PCB}.

The detection limits and quantification levels in this method are usually dependent on the level of interferences rather than instrumental limitations. The method is 'performance based'.

PCDD/PCDF and dioxin-like PCB analyses

The following standards were all purchased from Wellington Laboratories (Ontario, Canada) and were used for calibration, quantification and determination of recovery of PCDD/PCDF and dioxin-like PCB.

PCDD/PCDF

- EPA-1613-CVS calibration and verification solutions (CS-1 to CS-5)
- EPA-1613-LCS labelled compound surrogate solution
- EPA-1613-ISS-ST internal standard solution

Dioxin-like PCB

- WP-CVS calibration and verification solutions (CS-1 to CS-7)
- WP-LCS labelled surrogate spiking solution
- WP-ISS internal standard solution

Acetone, dichloromethane, hexane, and toluene were all OmniSolv® grade sourced from Merck KgaA (Darmstadt, Germany). Anhydrous sodium sulfate (granular) was AR grade sourced from Mallinckrodt (Kentucky, USA). AnalaR® sulfuric acid S.G. was sourced from Merck (Victoria, Australia).

All chromatographic columns were purchased from Fluid Management Systems (Waltham, MA, USA) and were used without any further treatment. They comprised multi-layer (basic/neutral/acidic) silica, basic alumina and PX-21 carbon dispersed on celite which are packed in individual teflon columns and vacuum sealed in aluminium foil packages.

Sample preparation

Accelerated solvent extraction was performed on soil and sediment samples using an ASE 100 (Dionex, Utah, USA) with toluene as the extracting solvent and a temperature and pressure of 150 °C and 1,500 psi, respectively.

Approximately 20g of soil or sediment was accurately weighed and spiked with a known amount of the respective PCDD/PCDF and dioxin-like PCB isotopically labelled $^{13}C_{12}$ surrogate spiking solutions. Extracts were solvent exchanged into hexane from toluene and subsequently cleaned up using multiple extractions with concentrated sulfuric acid until the acid layer remained colourless. The hexane extracts were washed several times with water and dried through cleaned anhydrous sodium sulfate. Sulphur was removed using activated copper or silver nitrated dispersed on silica gel. The extracts were then concentrated prior to clean-up on the Power-Prep™ system. Elution through the different columns is computer controlled and requires applying the hexane extract first onto the multi-layer silica and using hexane at a flow rate of 10 mL/min onto the alumina column. Dichloromethane:hexane (2:98) at 10 mL/min is used initially and then the solvent strength is modified to dichloromethane:hexane (50:50) and transferred to the carbon column which is eluted with ethyl acetate:toluene (50:50) in the forward direction at 10 mL/min. The flow is then reversed and the carbon column is eluted with toluene at 5 mL/min.

Two fractions are collected. The first fraction is collected from the alumina column during elution using dichloromethane:hexane (50:50) and contains the mono-ortho and di-ortho PCB. The second fraction containing PCDD/PCDF and & non-ortho PCB are eluted from the carbon column during the reverse elution with toluene. The two fractions are concentrated separately under vacuum and the respective recovery standards (EPA-1613-ISS-ST & WP-ISS) are added and then further concentrated using clean dry nitrogen to a final volume of 10 µL prior to HRGC/HRMS analysis.

High-resolution gas chromatography high-resolution mass spectrometric (HRGC-HRMS) analysis

All analyses were conducted on a MAT95XL HRMS (ThermoFinnigan MAT GmbH, Bremen, Germany) coupled to an Agilent 6890 GC (Palo Alto, CA, USA) equipped with a CTC A200S autosampler. A DB-5 (J & W Scientific, Folsom, CA, USA) capillary column (60m x 0.25mm i.d., film thickness 0.25µm) was used as the primary analytical column with ultra-high purity helium as the carrier gas. A flow rate of 1.0 mL/min was maintained throughout the chromatographic run. The temperature program was from 100 °C (isothermal for 1 min) then ramp 1 to 200 °C at 40 °C/min, ramp 2 to 235 °C (isothermal for 10 min) at 3 °C/min and then ramp 3 to 310 °C (isothermal 9 min) at 5 °C/min. A 1µL splitless injection with an injector temperature of 290 °C was employed for all standards and sample extracts. The mass spectrometer operating conditions were: ion source and transfer line temperatures, 240 °C and 280 °C, respectively; ionisation energy 45eV, filament current 0.7mA and electron multiplier voltage set to produce a gain of 106. Resolution was maintained at 10,000 (10% valley definition) throughout the sample sequence. Multiple ion detection (MID) experiments were performed in the electron impact mode with monitoring of the exact masses of either M+, [M+2]+ or [M+4]+ ions for native and labelled compounds. Individual congeners are identified using the GC retention time and ion abundance ratios with reference to internal standards. A DB-dioxin column was used for confirmation analysis when required.

Table B1 The MID windows for PCDD/PCDF and list of analytes

MID Window	Accurate Mass	Ion Id	Ion Type*	Analyte (I= internal standard)
1	303.9016	M	R	TCDF
	305.8987	M+2	T	TCDF
	315.9419	M	R	TCDF(I)
	317.9389	M+2	T	TCDF(I)
	319.8965	M	R	TCDD
	321.8936	M+2	T	TCDD
	331.9368	M	R	TCDD(I)
	333.9338	M+2	T	TCDD(I)
2	339.8597	M+2	T	PeCDF
	341.8567	M+4	R	PeCDF
	351.9000	M+2	T	PeCDF(I)
	353.8970	M+4	R	PeCDF(I)
	355.8546	M+2	T	PeCDD
	357.8516	M+4	R	PeCDD
	367.8949	M+2	T	PeCDD(I)
	369.8919	M+4	R	PeCDD(I)
3	373.8208	M+2	T	HxCDF
	375.8178	M+4	R	HxCDF
	383.8639	M	R	HxCDF(I)
	385.8610	M+2	T	HxCDF(I)
	389.8156	M+2	T	HxCDD
	391.8127	M+4	R	HxCDD
	401.8559	M+2	T	HxCDD(I)
	403.8529	M+4	R	HxCDD(I)
4	407.7818	M+2	T	HpCDF
	409.7788	M+4	R	HpCDF
	417.8250	M	R	HpCDF(I)
	419.8220	M+2	T	HpCDF(I)
	423.7767	M+2	T	HpCDD
	425.7737	M+4	R	HpCDD
	435.8169	M+2	T	HpCDD(I)
	437.8140	M+4	R	HpCDD(I)
5	441.7428	M+2	T	OCDF
	443.7399	M+4	R	OCDF
	457.7377	M+2	T	OCDD
	459.7348	M+4	R	OCDD
	469.7780	M+2	T	OCDD(I)
	471.7750	M+4	R	OCDD(I)

❖T = Target Ion or Quantitation Ion; R = Ratio Ion or Qualifier Ion.

TCDD – tetrachlorodibenzo-*p*-dioxin
PeCDD – pentachlorodibenzo-*p*-dioxin
HxCDD – hexachlorodibenzo-*p*-dioxin
HpCDD – heptachlorodibenzo-*p*-dioxin
OCDD – octachlorodibenzo-*p*-dioxin

TCDF – tetrachlorodibenzofuran
PeCDF – pentachlorodibenzofuran
HxCDF – hexachlorodibenzofuran
HpCDF – heptachlorodibenzofuran
OCDF – octachlorodibenzofuran

Table B2 Theoretical ion abundance ratios and QC limits

No. of Chlorine Atoms	m/z's forming the ratio[1]	Theoretical Ratio	QC limits[2]	
			Lower	Upper
4[3]	M/(M+2)	0.77	0.65	0.89
5	(M+4)/(M+2)	0.65	0.56	0.76
6	(M+4)/(M+2)	0.81	0.70	0.95
6[4]	M/(M+2)	0.51	0.43	0.59
7	(M+4)/(M+2)	0.95	0.83	1.14
7[5]	M/(M+2)	0.44	0.37	0.51
8	(M+2)/(M+4)	0.89	0.76	1.02

[1]The ratio is defined as the Qualifier ion area (R) divided by the Quantitation ion area (T).
[2]QC limits represent ±15% windows around the theoretical ion abundance ratios.
[3]Does not apply to $^{37}Cl_4$-2,3,7,8-TCDD (clean-up standard).
[4]Used for $^{13}C_{12}$-HxCDF only.
[5]Used for 13C12-HpCDF only.

Table B3 The MID windows for non-ortho and mono-ortho PCB and list of analytes

MID Window	Accurate Mass	Ion Id	Analyte (I= internal standard)
1	289.9224	M	TeCB
	291.9194	M+2	TeCB
	293.9165	M+4	TeCB
	301.9626	M	TeCB (I)
	303.9597	M+2	TeCB (I)
	323.8834	M	PeCB
	325.8804	M+2	PeCB
	327.8775	M+4	PeCB
	337.9207	M+2	PeCB (I)
	339.9178	M+4	PeCB (I)
2	359.8415	M+2	HxCB
	361.8365	M+4	HxCB
	363.8356	M+6	HxCB
	371.8817	M+2	HxCB (I)
	373.8788	M+4	HxCB (I)
	393.8025	M+2	HpCB
	395.7995	M+4	HpCB
	397.7966	M+6	HpCB
	405.8428	M+2	HpCB (I)
	407.8398	M+4	HpCB (I)

TeCB - tetrachlorobiphenyl
PeCB - pentachlorobiphenyl
HxCB - hexachlorobiphenyl
HpCB - heptachlorobiphenyl

Table B4 Theoretical ion abundance ratios and QC limits

No. of Chlorine Atoms	m/z's forming the ratio[1]	Theoretical Ratio	QC limits[2]	
			Lower	Upper
4	M/(M+2)	0.77	0.65	0.89
5	(M+4)/(M+2)	0.66	0.56	0.76
6	(M+4)/(M+2)	0.82	0.70	0.94
7	(M+4)/(M+2)	0.98	0.83	1.13

[1]The ratio is defined as the Qualifier ion area (R) divided by the Quantitation ion area (T).
[2]QC limits represent ±15% windows around the theoretical ion abundance ratios.

Analyte identification and quantification criteria

For positive identification and quantification of PCDD/PCDF and 'dioxin-like' PCB the following criteria must be met:

- The retention time of the analyte must be within 1 second of the retention time of the corresponding $^{13}C_{12}$ surrogate standard
- The ion ratio obtained for the analyte must be ±15% (±20% for PCB) of the theoretical ion ratio
- The signal to noise ratio must be greater than 3:1
- Levels of PCDD and PCDF congeners in a sample must be greater than 3 times any level found in the corresponding laboratory blank analysed
- Surrogate standard recoveries must be in the range 25-150%.

Quantification using the Isotope Dilution Technique

The naturally occurring (native) compound is determined by reference to the same compound in which one or more atoms have been isotopically enriched. In this method, all carbon atoms for selected PCDD/PCDF and PCB molecules have been substituted with carbon-13 to produce $^{13}C_{12}$-labelled analogs of the chlorinated dibenzo-*p*-dioxins, dibenzofurans and biphenyls, respectively. The $^{13}C_{12}$-labelled PCDD/PCDF and PCB are spiked into each sample and allow identification and correction of the concentration of the native compounds in the analytical process. Homologue totals for the tetra - octachloro dibenzo-*p*-dioxins and dibenzofurans are calculated by summing the total areas for each positively identified congener within each group and quantifying these totals using the mean relative response factor (RRF) of the determined RRFs for a homologue series.

The proprietary chromatographic integration package supplied with the Thermo Finnigan instrument, (Xcalibur®), was used to target all monitored compounds and create a text file that was further manipulated in Excel to produce the final certificate of analysis.

Total organic carbon protocol

Total organic carbon (TOC) was determined by the Queensland Health Scientific Services (QHSS) laboratory according to a standardised procedure (QHSS, 1996). Inorganic carbonates were removed using acid-catalysed digestion (10% HCl, 1% $FeCl_2$ at 70 °C). The remaining material was dried and combusted in the LECO induction furnace with subsequent detection of CO_2. (LECO WR12 CO_2 detector.)

Appendix C Quality control

This appendix reports the reports the quality control measures undertaken for this study:

- Sample handling and quality assurance
- Laboratory quality control
- Data quality and reporting of analysis of dioxin and dioxin-like compounds
- Table C1 - Reporting basis for contaminant concentrations in soils
- Table C2 - Reporting basis for quality control samples
- Sampling reproducibility
- Table C3 - Comparison of the analytical results for 13 sediment samples where both 'A' and 'B' samples were analysed
- Table C4 - Summary of the interlaboratory evaluation of the analytical results for eight sediment samples.

Sample handling and quality assurance

A number of procedures were implemented to avoid sample contamination. Contact between samples and contact with plastics was avoided at all stages.

Direct contact with the sediment by sampling personnel was avoided by use of the coring tubes. Coring tubes were thoroughly cleaned with acetone and toluene at ENTOX and sealed with aluminium foil prior to distribution to sampling personnel. Sediment-filled coring tubes were resealed in aluminium foil at the point of collection, and returned as quickly as practical to ENTOX in the original packaging. Following receipt by ENTOX, tube contents were removed promptly under clean laboratory conditions. All items of equipment involved in sediment core handling were rinsed clean in a detergent solution and solvent rinsed (acetone) between samples. Once removed from coring tubes, samples were stored in foil packets prior to homogenisation and freeze-drying. They were then transferred to solvent washed glass jars for transport to AGAL for analysis.

Bivalve molluscs were collected whole and unopened by sampling personnel. They were placed immediately on ice and sent frozen to ENTOX. On arrival at the ENTOX laboratory they were removed from shells using a solvent-washed shucking knife and placed in solvent washed jars and refrozen for transport to AGAL.

Fish were obtained whole and frozen from local fishermen. On receipt by ENTOX they were filleted with a solvent-washed knife and fillets refrozen in solvent washed jars for transport to AGAL.

Laboratory quality control

Laboratory quality control was achieved through implementation of the following procedures:

- A laboratory blank was analysed with each batch of samples
- A suitable soil laboratory control sample (LCS) was analysed with each batch of samples as a replicate to assess method precision
- The GCMS resolution, performance and sensitivity was established for each MS run
- The recoveries of all isotopically-labelled surrogate standards was calculated and reported
- Ten percent of all samples were analysed by an independent crosscheck QC laboratory (Ministry of the Environment, Laboratory Services Branch, Toronto, Ontario, Canada).

For positive analyte identification and quantification, the following criteria were met:

- The retention time of the analyte was within 1 second of the retention time of the corresponding $^{13}C_{12}$ surrogate standard
- The ion ratio obtained for the analyte was 10% (20% for PCB) of the theoretical ion ratio
- The signal to noise ratio was greater than 3:1

- Levels of PCDD and PCDF congeners in a sample were greater than 5 times any level found in the corresponding laboratory blank analysed (3 times the level in the blank for OCDD)
- Surrogate standard recoveries were in the range 25-150%.

Data quality and reporting of analysis of dioxin and dioxin-like compounds

PCDD/PCDF and 'dioxin-like' PCB data were corrected for recovery of $^{13}C_{12}$ surrogate standards.

The basis of reporting for primary and quality control samples are given in Tables C1 and C2, respectively.

Table C1 Reporting basis for chemical concentrations in sediments

Chemical class	Reporting basis
PCDD/PCDF	pg/g on a dry mass basis. Total toxic equivalents for PCDD/PCDF (WHO_{98}-TEQ_{DF}) will be calculated using the WHO Toxic Equivalents Factors (TEFs).
'dioxin-like' PCB	pg/g on a dry mass basis. Total toxic equivalents for 'dioxin-like' PCB (WHO_{98}-TEQ_{PCB}) will be calculated using the WHO Toxic Equivalents Factors (TEFs).
PCDD/PCDF and 'dioxin-like' PCB	Total toxic equivalents for PCDD/PCDF and 'dioxin-like' PCB (WHO_{98}-TEQ_{DF+PCB}) will be calculated from the addition of the respective WHO_{98}-TEQ_{DF} and WHO_{98}-TEQ_{PCB} values

Table C2 Reporting basis for quality control samples

QC Sample	Reporting Basis
Laboratory blanks	Calculated using the average dry mass of all samples analysed in the batch. Reported on a mass per mass basis.
Field blanks	Calculated using the dry mass of sediment collected in a single jar for the corresponding field sample. Reported on a mass per mass basis.
Rinsate blanks	Calculated using the volume of rinsate analysed. Reported on a mass per volume basis.

Sampling reproducibility

Table C3 Comparison of analytical results for 13 sediment samples where both 'A' and 'B' samples were analysed

Sample	Salinity	TOC (%)	Conc. in $TEQ_{(DF+PCB)}$ [1]	∑PCDD/ PCDF[1]	∑PCB[1]	No. of detectables	Mean normalised difference[2]
Brisbane – Port of Brisbane (ES1)	Estuarine	0.28	0.13	170	4.8	19	127%
		3.0	0.29	890	ND	10	
Sydney – Lower Parramatta R. (ES1)	Estuarine	2.6	100	54000	6100	39	104%
		3.2	520	110000	28000	37	
Sydney – Port Jackson West (ES2)	Estuarine	1.9	78	48000	5500	40	83%
		5.3	130	89000	22000	36	
Sydney – Botany Bay (ES1)	Estuarine	2.5	35	31000	8700	36	57%
		1.5	22	18000	4500	37	
Blue Mountains Rivers (FW1)	Freshwater	0.46	0.43	1400	1.8	18	35%
		0.90	0.38	1900	4.6	11	
Wollongong – Lake Illawarra (ES1)	Estuarine	2.5	5.9	5500	480	38	17%
		2.8	6.1	6600	400	35	
Adelaide – Torrens R. (FW1)	Freshwater	1.4	1.2	3500	8.3	26	32%
		1.4	1.2	3200	6.3	22	
Derwent R. – Meadowbank Lake (FW1)	Freshwater	2.6	0.017	21	40	17	67%
		1.4	0.012	46	ND	8	
Melbourne – Lower Yarra R. (ES1)	Estuarine	4.1	17	16000	9400	38	167%
		0.46	1.0	710	660	34	
Melbourne – Port Phillip Bay Central (MA1)	Marine	1.2	3.9	2400	440	32	29%
		1.4	2.1	2500	340	32	
Melton Region – Lower Werribee R. (FW1)	Freshwater	0.41	0.055	53	ND	10	66%
		0.29	0.019	34	ND	12	
Perth – Lower Swan R. (ES1)	Estuarine	3.1	5.4	1600	1400	36	58%
		2.7	3.5	600	760	36	
Perth – Canning R. (FW1)	Freshwater	1.7	2.2	310	1100	35	25%
		4.4	2.9	340	670	34	

[1] Excluding half LOD values

[2] Mean normalised difference calculated for all congeners detected in both samples

Analytical reproducibility

Table C4 Summary of interlaboratory evaluation of analytical results of eight sediment samples

Sample	Laboratories	$TEQ_{(DF+PCB)}$[1]	∑PCDD/ PCDF[1]	∑PCB[1]	No. of detectables	Mean normalised difference[2]
Darwin – Port of Darwin (ES1A)	AGAL	0.81	250	0.44	12	62%
	MoE C	0.25	170	8.6	10	
Newcastle – Hunter River (ES1A)	AGAL	0.94	1400	240	31	24%
	MoE C	1.1	1700	330	25	
Sydney – Parramatta R. (EW1A)	AGAL	1.1	1700	870	28	38%
	MoE C	1.4	2500	1300	26	
Sydney – Lower Parramatta R. (ES1A)	AGAL	103	54000	6100	36	28%
	MoE C	125	66000	8400	36	
Sydney – Port Jackson West (ES2A)	AGAL	78	48000	5500	37	24%
	MoE C	63	55000	7300	36	
Sydney – Port Jackson East (ES1A)	AGAL	0.76	800	57	29	43%
	MoE C	0.90	1200	88	21	
Sydney – Botany Bay (ES1A)	AGAL	35	31000	8700	33	12%
	MoE C	38	37000	9000	36	
Wollongong – Lake Illawarra (ES1A)	AGAL	5.9	5500	480	35	34%
	MoE C	9.3	8800	580	34	

[1] Excluding half LOD values.
[2] Mean normalised difference is calculated for all congeners detected by both laboratories.

Appendix D Concentrations of PCDD/PCDF and PCB in Australian sediments

This appendix reports the concentrations of PCDD/PCDF and PCB in Australian sediments.

For PCDD/PCDF, the tables report the results for each of the 2,3,7,8-dioxin substituted congeners, the concentration of the sum of all congeners in a homologue group and the calculated sum of all the tetra- to octa-chlorinated PCDD/PCDF (a).

For PCB, the tables report the results for each of the dioxin-like PCB congeners and the calculated sum for each sample (b).

TEQ_{DF} (a), TEQ_{PCB} (b), and TEQ_{DF+PCB} (c) were calculated, both including half LOD values and excluding LOD values, using the WHO_{98} scheme (van den Berg et al. 1998).

TOC (Total Organic Carbon) is reported for each sample (d).

Table D1a Concentrations of PCDD/PCDF in Australian freshwater sediments (pg g^{-1} dm)

	N	N	N	N	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Congener	Kakadu NP East Alligator River (FW1A)	Upper Johnstone R. (FW1A)	Banana Region Upper Dawson R. (FW1A)	Upper Brisbane R. (FW1A)	Narrabri Region Namoi R. (FW1A)	Muswellbrook Region Upper Hunter R. (FW1A)	Singleton Region Lower Hunter R. (FW1A)	Blue Mountains (FW1A)	Blue Mountains (FW1B)	Sydney Parramatta R. (FW1A)	Canberra Lake Burley Griffin (FW1A)	Latrobe Valley Latrobe R. (FW1A)	Upper Yarra R. (FW1A)	Moorabool Region Upper Werribee R. (FW1A)	Melton Region Lower Werribee R. (FW1A)	Melton Region Lower Werribee R. (FW1B)	Launceston Region Cyrries River Dam (FW1A)	Upper Derwent R. (FW1A)	Derwent R. Meadowbank Lake (FW1A)
2,3,7,8-TCDD	<0.01	<0.03	<0.05	<0.04	<0.02	<0.04	<0.04	<0.03	<0.07	<0.1	<0.1	<0.2	<0.03	<0.07	<0.04	<0.03	<0.07	<0.06	<0.06
Total TCDD isomers	1	<0.3	<0.3	0.21	<0.3	0.25	0.25	4.1	4.5	1.4	0.35	<1	2.6	<0.5	<0.3	<0.2	0.72	1.9	5
1,2,3,7,8-PeCDD	<0.05	<0.03	<0.2	<0.1	0.04	<0.07	<0.04	0.098	<0.08	0.24	<0.04	<0.2	<0.09	<0.1	<0.05	<0.04	<0.1	<0.3	<0.08
Total PeCDD isomers	<0.4	<0.2	<1	<0.6	<0.2	<0.4	<0.2	0.92	<0.5	0.79	0.25	<1	0.93	<0.6	<0.6	<0.2	<0.6	0.72	0.53
1,2,3,4,7,8-HxCDD	<0.09	<0.03	0.12	<0.2	<0.08	<0.03	<0.04	0.19	<0.1	<0.5	<0.1	<0.05	<0.1	<0.07	<0.04	0.018	0.061	<0.05	<0.03
1,2,3,6,7,8-HxCDD	<0.1	<0.03	0.29	<0.06	<0.1	<0.04	<0.04	0.28	0.44	0.91	<0.4	0.07	<0.2	<0.1	<0.09	<0.05	0.092	0.53	<0.04
1,2,3,7,8,9-HxCDD	<0.3	<0.03	<0.2	0.11	<0.08	<0.04	<0.05	0.22	<0.4	<0.5	0.23	<0.1	<0.4	<0.1	<0.07	0.045	<0.04	0.19	<0.1
Total HxCDD isomers	1.4	<0.2	4.8	0.56	0.63	0.44	<0.2	5.4	4.9	8.8	3.4	1.9	3	0.61	1.1	0.12	2	4.9	1.2
1,2,3,4,6,7,8-HpCDD	2.5	0.16	8.6	2.3	1.6	0.8	<0.3	12	15	23	7.4	3.1	3.1	0.63	<0.6	0.55	3.3	19	0.82
Total HpCDD isomers	7	<0.2	26	5.7	4.6	1.8	0.52	29	38	51	16	8	7.3	1.7	1.7	1.6	9	34	<1
OCDD	210	<8	710	120	140	13	5.4	1400	1810	1600	150	140	140	44	50	32	230	250	11
2,3,7,8-TCDF	<0.03	<0.02	<0.03	<0.05	<0.02	<0.02	<0.01	<0.02	<0.06	0.17	0.25	<0.04	0.13	<0.1	<0.02	0.02	<0.05	<0.05	<0.05
Total TCDF isomers	0.24	<0.2	<0.2	<0.4	<0.3	0.46	<0.08	<0.3	<0.5	1.9	1.7	<0.3	1.2	<0.8	0.23	<0.2	1.6	1.7	2.1
1,2,3,7,8-PeCDF	<0.02	<0.01	<0.07	<0.02	<0.01	<0.02	<0.02	<0.02	<0.1	<0.08	<0.2	<0.05	<0.06	0.02	<0.04	<0.01	<0.03	<0.09	<0.05
2,3,4,7,8-PeCDF	<0.01	<0.05	<0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	<0.2	<0.05	<0.06	<0.03	<0.03	<0.01	<0.02	0.12	<0.06
Total PeCDF isomers	0.2	<0.6	<0.5	<0.3	<0.3	<0.1	<0.1	<0.3	<0.8	1.1	0.61	<0.7	<0.4	<0.3	<0.6	<0.1	<0.1	<1	<0.4
1,2,3,4,7,8-HxCDF	<0.01	<0.03	<0.03	<0.04	<0.05	<0.01	<0.03	<0.02	<0.03	<0.2	<0.07	<0.08	<0.1	<0.08	<0.04	<0.01	<0.02	<0.2	<0.01
1,2,3,6,7,8-HxCDF	<0.02	<0.02	<0.06	<0.04	<0.06	<0.02	<0.03	<0.02	<0.02	0.29	0.19	<0.05	<0.08	<0.06	<0.07	0.021	<0.02	<0.06	<0.01
2,3,4,6,7,8-HxCDF	<0.01	<0.02	<0.08	<0.04	<0.05	<0.01	<0.02	0.018	0.036	0.22	0.1	<0.06	<0.07	<0.09	<0.08	<0.006	<0.005	<0.07	<0.02
1,2,3,7,8,9-HxCDF	<0.05	<0.02	<0.03	<0.04	<0.04	<0.04	<0.02	<0.01	<0.03	<0.04	<0.1	<0.04	0.29	<0.05	<0.03	<0.01	<0.008	<0.06	<0.03
Total HxCDF isomers	0.06	<0.2	<0.5	<0.5	<0.6	<0.2	<0.2	<0.2	<0.2	1.6	1.5	<0.7	0.6	<0.7	<0.8	<0.1	0.1	1.8	0.19
1,2,3,4,6,7,8-HpCDF	<0.05	<0.03	<0.1	<0.1	<0.04	0.23	<0.05	<0.06	<0.1	1.9	1.6	<0.1	<0.4	<0.4	<0.08	<0.1	0.058	2.9	0.24
1,2,3,4,7,8,9-HpCDF	<0.02	<0.04	<0.1	<0.06	<0.1	<0.02	<0.02	<0.02	<0.04	0.19	<0.08	<0.06	<0.07	<0.08	<0.1	<0.008	0.031	0.26	<0.02
Total HpCDF isomers	<0.1	<0.1	<0.4	<0.2	<0.3	0.38	<0.08	<0.2	<0.3	4	4.3	<0.3	<1	<0.8	<0.4	<0.2	0.089	6.1	0.3
OCDF	<0.07	<0.1	<0.1	<0.08	<0.2	1.2	<0.1	<0.1	<0.1	5.7	4.2	<0.06	<0.5	<0.1	<0.3	0.08	<0.09	24	<0.1
Sum of PCDD/-F (exc)[1]	**220**	**0**	**740**	**130**	**150**	**18**	**6.2**	**1400**	**1900**	**1700**	**180**	**150**	**160**	**46**	**53**	**34**	**240**	**330**	**21**
WHO_{98}-TEQ_{DF} (inc)[2]	**0.11**	**0.055**	**0.36**	**0.15**	**0.11**	**0.083**	**0.060**	**0.45**	**0.49**	**0.95**	**0.34**	**0.29**	**0.21**	**0.14**	**0.084**	**0.061**	**0.17**	**0.59**	**0.11**
WHO_{98}-TEQ_{DF} (exc)[1]	**0.046**	**0.0016**	**0.20**	**0.046**	**0.07**	**0.012**	**0.00054**	**0.43**	**0.38**	**0.81**	**0.18**	**0.052**	**0.087**	**0.012**	**0.005**	**0.019**	**0.072**	**0.38**	**0.012**

1 = excluding LOD values
2 = including half LOD values

Table D1b Concentrations of PCB in Australian freshwater sediments (pg g^{-1} dm)

	N	N	N	N	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Congener	Kakadu NP East Alligator River (FW1A)	Upper Johnstone R. (FW1A)	Banana Region Upper Dawson R. (FW1A)	Upper Brisbane R. (FW1A)	Narrabri Region Namoi R. (FW1A)	Muswellbrook Region Upper Hunter R. (FW1A)	Singleton Region Lower Hunter R. (FW1A)	Blue Mountains (FW1A)	Blue Mountains (FW1B)	Sydney Parramatta R. (FW1A)	Canberra Lake Burley Griffin (FW1A)	Latrobe Valley Latrobe R. (FW1A)	Upper Yarra R. (FW1A)	Moorabool Region Upper Werribee (FW1A)	Melton Region Lower Werribee (FW1A)	Melton Region Lower Werribee (FW1B)	Launceston Region Cyrries River Dam (FW1A)	Upper Derwent R. (FW1A)	Derwent R. Meadowbank Lake (FW1A)
PCB 77	<0.4	<0.3	1.3	<0.8	<0.3	<1	<0.6	0.72	<1	13	28	<0.8	1.1	0.68	1	<0.4	<0.6	6.7	1.1
PCB 81	<0.03	<0.08	0.18	0.054	<0.02	<0.06	0.062	0.017	<0.2	0.39	0.88	<0.1	<0.05	<0.2	<0.03	<0.04	<0.07	<0.2	0.12
PCB 126	<0.03	<0.09	<0.08	<0.3	<0.02	<0.05	<0.07	<0.06	<0.2	2	4.2	<0.3	0.085	<0.1	<0.06	<0.02	<0.04	<1	<0.3
PCB 169	<0.006	<0.03	<0.09	<0.06	<0.01	0.058	<0.04	<0.03	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.3	<0.2	<0.5
PCB 105	<40	<2	<1	<0.9	<0.8	<2	20	<3	<5	190	270	<3	5.2	9.2	<3	<1	<2	48	7.9
PCB 114	<1	<0.2	<0.4	<0.5	<0.1	<0.2	1	<0.2	<0.9	8.2	13	<0.5	<0.07	<0.3	<0.1	<0.1	<0.4	2.1	<0.8
PCB 118	<70	<6	<5	<4	<3	6.1	48	<10	<20	570	810	<10	<10	28	<6	<5	<5	120	28
PCB 123	<2	<0.9	<0.5	<0.3	<0.1	<0.2	1.4	<0.2	<2	20	24	<1	<0.4	0.85	0.18	<0.4	<0.8	5.3	<0.2
PCB 156	<10	0.74	<0.6	<0.6	<0.2	<0.5	4.5	0.96	4.6	53	110	<0.4	<1	<1	0.82	<0.8	<0.2	17	2.4
PCB 157	<2	<0.5	<0.03	<1	<0.09	<0.2	1.4	0.15	<0.9	16	25	<2	<0.7	<0.1	<0.1	<0.2	<0.8	5.7	<0.5
PCB 167	<5	<0.09	<1	<0.8	<0.1	<0.5	<2	<0.4	<0.6	<20	<70	<0.9	1.7	<4	<0.5	<0.2	<0.7	<5	<2
PCB 189	<0.2	<0.2	<0.4	<0.3	<0.02	<0.2	<0.1	<0.09	<1	2	5.6	<0.6	<1	<0.2	<0.04	<0.06	<0.4	1.2	<0.4
Sum of PCB (exc)[1]	**0**	**0.74**	**1.5**	**0.054**	**0**	**6.2**	**76**	**1.8**	**4.6**	**870**	**1300**	**0**	**8.1**	**39**	**0**	**0**	**0**	**210**	**40**
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.010**	**0.0057**	**0.0052**	**0.016**	**0.0014**	**0.0041**	**0.014**	**0.0045**	**0.015**	**0.32**	**0.61**	**0.017**	**0.011**	**0.0098**	**0.0041**	**0.0017**	**0.0043**	**0.082**	**0.023**
WHO_{98}-TEQ_{PCB} (exc)[1]	**0**	**0.00037**	**0.00015**	**0.0000054**	**0**	**0.0012**	**0.010**	**0.00063**	**0.0023**	**0.32**	**0.61**	**0**	**0.0091**	**0.0039**	**0.00053**	**0**	**0**	**0.031**	**0.0049**

1 = excluding LOD values
2 = including half LOD values

Table D1c TEQ_{DF+PCB} in Australian freshwater sediments (pg TEQ g^{-1} dm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.12**	**0.061**	**0.37**	**0.16**	**0.11**	**0.087**	**0.074**	**0.46**	**0.51**	**1.3**	**0.95**	**0.31**	**0.22**	**0.15**	**0.089**	**0.063**	**0.17**	**0.67**	**0.14**
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	**0.050**	**0.0020**	**0.20**	**0.046**	**0.070**	**0.013**	**0.011**	**0.43**	**0.38**	**1.1**	**0.79**	**0.052**	**0.096**	**0.015**	**0.0055**	**0.019**	**0.072**	**0.41**	**0.017**

Table D1d Total Organic Carbon (TOC) in Australian freshwater sediments (%)

Total Organic Carbon %	**0.30**	**0.093**	**0.77**	**0.43**	**0.098**	**5.9**	**0.66**	**0.46**	**0.90**	**0.70**	**0.63**	**0.46**	**3.2**	**0.30**	**0.41**	**0.29**	**1.0**	**3.0**	**2.6**

Table D1a cont'd Concentrations of PCDD/PCDF in Australian freshwater sediments (pg g^{-1} dm)

Congener	SE Derwent R. Meadowbank Lake (FW1B)	SE Lake St. Clair (FW1A)	SE Renmark Region Murray R. (FW1A)	SE Upper Torrens R. (FW1A)	SE Adelaide Torrens R. (FW1A)	SE Adelaide Torrens R. (FW1B)	SE Adelaide Lower Torrens R. (FW1A)	SW Wandering Region Upper Serpentine R. (FW1A)	SW Serpentine Region Lower Serpentine R. (FW1A)	SW Perth Upper Swan R. (FW1A)	SW Perth Canning R. (FW1A)	SW Perth Canning R. (FW1B)	SW Beverley Region Upper Avon R. (FW1A)	SW Northam Region Middle Avon R. (FW1A)	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=33
2,3,7,8-TCDD	<0.1	<0.02	<0.02	<0.04	<0.1	0.11	0.023	<0.2	<0.06	<0.03	0.11	<0.1	<0.05	<0.01	3	<0.01	<0.2	<0.05	-	60
Total TCDD isomers	0.66	<0.1	0.035	0.3	1.2	0.87	2.6	<1	<0.4	2.4	5.5	5.5	0.39	0.28	23	0.035	5.5	0.66	1.3	
1,2,3,7,8-PeCDD	<0.2	<0.03	<0.04	0.11	0.3	0.2	0.12	<0.07	<0.1	<0.1	<0.4	<0.4	<0.03	<0.08	7	<0.03	<0.4	0.098	-	52
Total PeCDD isomers	<1	<0.1	<0.2	0.23	1.5	0.98	0.36	<0.5	<0.6	0.47	0.8	3.8	0.1	0.23	15	<0.1	3.8	0.53	-	
1,2,3,4,7,8-HxCDD	<0.2	<0.03	<0.04	0.16	<0.5	0.5	0.13	<0.08	<0.08	<0.08	<0.4	<0.4	<0.03	<0.008	7	<0.008	0.5	<0.08	-	79
1,2,3,6,7,8-HxCDD	<0.2	<0.03	0.12	0.34	0.72	0.84	0.96	<0.06	<0.07	0.69	1.7	1.7	0.2	0.37	17	<0.03	1.7	0.2	-	66
1,2,3,7,8,9-HxCDD	<0.09	<0.03	0.055	0.34	0.94	1.1	0.43	<0.1	<0.08	<0.9	<0.6	0.92	0.27	0.43	13	<0.03	1.1	0.19	-	
Total HxCDD isomers	<0.6	0.49	0.59	3.3	12	12	6.8	<0.5	<0.5	5.2	14	14	<0.7	1.3	28	0.12	14	1.4	3.5	
1,2,3,4,6,7,8-HpCDD	0.75	0.31	1	7.4	35	33	37	0.36	0.19	4.9	20	21	<0.5	0.78	31	0.16	37	2.5	8.1	58
Total HpCDD isomers	0.75	0.72	3.2	18	83	80	68	0.4	0.2	11	41	40	1.2	1.7	32	<0.2	83	7	18	
OCDD	43	3.5	25	320	3400	3060	770	<3	27	46	160	170	<6	9.3	31	<3	3400	140	460	50
2,3,7,8-TCDF	<0.2	<0.01	<0.2	<0.03	0.1	<0.2	0.17	<0.08	<0.05	0.26	1.6	1.3	0.11	<0.05	10	<0.01	1.6	<0.05	-	65
Total TCDF isomers	1.6	<0.2	<0.3	0.15	2.2	0.66	1.9	<0.3	<0.4	6.1	26	27	0.99	1.2	19	<0.08	27	<0.5	-	
1,2,3,7,8-PeCDF	<0.06	<0.01	<0.009	<0.02	<0.04	<0.08	0.078	<0.04	<0.05	0.3	1.4	1.1	0.09	0.067	7	<0.009	1.4	<0.05	-	54
2,3,4,7,8-PeCDF	<0.07	<0.01	<0.02	<0.02	0.099	<0.08	<0.2	<0.07	<0.07	0.37	<1	1.9	0.06	<0.05	5	<0.01	1.9	<0.05	-	54
Total PeCDF isomers	<0.5	0.11	<0.1	<0.1	0.91	0.1	1.8	<0.7	<0.7	2.9	12	15	0.37	0.29	12	<0.1	15	<0.4	-	
1,2,3,4,7,8-HxCDF	<0.07	<0.01	<0.03	<0.04	<0.1	<0.1	0.23	<0.06	<0.03	<0.09	1.4	2.3	<0.07	<0.07	3	<0.01	2.3	<0.05	-	75
1,2,3,6,7,8-HxCDF	<0.09	<0.01	<0.06	<0.02	<0.1	<0.06	<0.1	<0.07	<0.04	0.45	1.8	1.5	<0.06	0.085	7	<0.01	1.8	<0.06	-	73
2,3,4,6,7,8-HxCDF	<0.1	<0.01	<0.02	<0.03	0.14	<0.05	0.17	<0.04	<0.03	0.25	1.6	0.85	0.027	0.035	11	<0.005	1.6	<0.04	-	77
1,2,3,7,8,9-HxCDF	<0.07	<0.009	<0.03	<0.02	0.034	<0.03	<0.02	<0.02	<0.07	0.2	<0.3	0.34	0.033	0.05	6	<0.008	0.34	0.034	-	73
Total HxCDF isomers	<0.5	<0.1	<0.6	<0.2	1.1	0.6	2.5	<0.5	<0.4	2.7	14	13	<0.4	0.35	14	0.06	14	<0.5	-	
1,2,3,4,6,7,8-HpCDF	<0.3	0.094	<0.1	<0.2	0.82	0.73	5.1	<0.1	<0.04	1.4	9.8	11	<0.04	0.22	14	<0.03	11	<0.1	-	56
1,2,3,4,7,8,9-HpCDF	<0.2	<0.02	<0.04	<0.02	<0.1	0.13	0.39	<0.2	<0.05	<0.1	0.89	0.95	0.024	<0.04	8	<0.008	0.95	<0.06	-	58
Total HpCDF isomers	<0.5	0.17	<0.2	0.23	1.5	1.2	17	<0.4	<0.2	2.6	18	27	<0.1	<0.4	14	<0.08	27	0.38	-	
OCDF	<0.6	<0.3	<0.2	0.38	2	2.8	25	<0.1	<0.2	2.2	16	28	<0.1	<0.3	12	<0.06	28	<0.2	-	
Sum of PCDD/-F (exc)[1]	**46**	**5.0**	**29**	**340**	**3500**	**3200**	**900**	**0.4**	**27**	**82**	**310**	**340**	**3.6**	**15**		**0**	**3500**	**150**	**490**	
WHO_{98}-TEQ_{DF} (inc)[2]	**0.23**	**0.039**	**0.085**	**0.33**	**1.3**	**1.2**	**0.92**	**0.18**	**0.13**	**0.57**	**1.8**	**2.5**	**0.15**	**0.18**		**0.039**	**2.5**	**0.18**	**0.44**	
WHO_{98}-TEQ_{DF} (exc)[1]	**0.012**	**0.0044**	**0.03**	**0.30**	**1.2**	**1.2**	**0.86**	**0.0036**	**0.0046**	**0.45**	**1.3**	**2.2**	**0.099**	**0.11**		**0.00054**	**2.2**	**0.072**	**0.32**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCDD/PCDF congener detected on more than 66% of occasions (minimum of 22 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table D1b cont'd Concentrations of PCB in Australian freshwater sediments (pg g^{-1} dm)

Congener	SE Derwent R. Meadowbank Lake (FW1B)	SE Lake St. Clair (FW1A)	SE Renmark Region Murray R. (FW1A)	SE Upper Torrens R. (FW1A)	SE Adelaide Torrens R. (FW1A)	SE Adelaide Torrens R. (FW1B)	SE Adelaide Lower Torrens R. (FW1A)	SW Wandering Region Upper Serpentine R. (FW1A)	SW Serpentine Region Lower Serpentine R. (FW1A)	SW Perth Upper Swan R. (FW1A)	SW Perth Canning R. (FW1A)	SW Perth Canning R. (FW1B)	SW Beverley Region Upper Avon R. (FW1A)	SW Northam Region Middle Avon R. (FW1A)	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=33
PCB 77	<0.2	<0.9	<0.2	<0.6	2	<2	8	1.2	0.49	6.5	73	74	<0.2	1.1	17	<0.2	74	1	-	57
PCB 81	<0.03	<0.1	<0.06	<0.02	<0.2	<0.2	0.22	<0.08	<0.06	0.29	3.5	3.2	<0.07	0.071	12	0.017	3.5	<0.08	-	55
PCB 126	<0.08	<0.04	<0.07	<0.07	<0.2	<0.2	1.6	0.11	<0.1	0.83	7.4	5.1	<0.09	<0.07	8	<0.02	7.4	<0.09	-	78
PCB 169	<0.1	<0.02	<0.03	<0.01	<0.05	<0.2	<0.04	<0.04	<0.1	<0.3	0.43	<0.2	<0.05	<0.04	2	<0.006	<0.5	<0.06	-	75
PCB 105	<0.9	<0.8	<4	<3	<10	<10	140	6.1	12	49	210	160	<1	6.1	14	<0.8	270	5.2	-	74
PCB 114	<0.5	<0.1	0.25	<0.2	<0.2	<0.6	6.2	<0.1	<0.4	1.3	9.8	6.9	<0.2	<0.5	9	<0.07	13	<0.4	-	74
PCB 118	<5	3.5	<10	<8	<20	<40	270	<10	35	110	570	350	<3	16	14	<3	810	<10	-	69
PCB 123	<0.08	<0.2	<0.4	<0.2	<1	<2	<10	<2	<0.8	2.8	14	<20	<0.3	<0.6	8	<0.08	24	<0.8	-	75
PCB 156	<0.7	<0.5	<1	<1	4.5	<4	50	<0.9	3.6	13	70	50	<0.4	<1	15	<0.2	110	<1	-	75
PCB 157	<0.9	<0.09	<0.3	<0.2	1	<0.3	13	<0.06	<0.6	3	18	16	<0.8	<0.5	10	<0.03	25	<0.7	-	73
PCB 167	<0.1	<0.1	<0.2	<0.5	<1	6.3	<20	3.2	5.8	13	130	<20	<0.2	<1	6	<0.09	130	<1	-	81
PCB 189	<0.2	<0.09	<0.1	<0.1	0.83	<0.6	3.4	<0.2	<0.09	0.93	6.5	3.8	<0.2	<0.3	8	<0.02	6.5	<0.3	-	81
Sum of PCB (exc)[1]	**0**	**3.5**	**0.25**	**0**	**8.3**	**6.3**	**490**	**11**	**57**	**200**	**1100**	**670**	**0**	**23**		**0**	**1300**	**6.2**	**160**	
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.0053**	**0.0027**	**0.0048**	**0.0045**	**0.015**	**0.015**	**0.24**	**0.013**	**0.012**	**0.11**	**0.88**	**0.61**	**0.0053**	**0.0066**		**0.0014**	**0.88**	**0.011**	**0.093**	
WHO_{98}-TEQ_{PCB} (exc)[1]	**0**	**0.00035**	**0.00013**	**0**	**0.0030**	**0.000063**	**0.24**	**0.012**	**0.0066**	**0.11**	**0.88**	**0.61**	**0**	**0.0023**		**0**	**0.88**	**0.0012**	**0.087**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCB congener detected on more than 66% of occasions (minimum of 22 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table D1c cont'd TEQ_{DF+PCB} in Australian freshwater sediments (pg TEQ g^{-1} dm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.24**	**0.042**	**0.090**	**0.34**	**1.3**	**1.3**	**1.2**	**0.20**	**0.14**	**0.69**	**2.7**	**3.1**	**0.16**	**0.18**		**0.042**	**3.1**	**2.0**	**0.53**	
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	**0.012**	**0.0047**	**0.030**	**0.30**	**1.2**	**1.2**	**1.1**	**0.015**	**0.011**	**0.57**	**2.2**	**2.9**	**0.099**	**0.11**		**0.0020**	**2.9**	**0.072**	**0.41**	

Table D1d cont'd Total Organic Carbon (TOC) in Australian freshwater sediments (%)

Total Organic Carbon %	**1.4**	**0.37**	**0.19**	**0.62**	**1.4**	**1.4**	**0.35**	**1.7**	**0.56**	**3.2**	**1.7**	**4.4**	**0.38**	**0.50**		0.093	5.9	0.6	1.2	

Table D2a Concentrations of PCDD/PCDF in Australian estuarine sediments (pg g^{-1} dm)

	N	N	N	N	N	N	N	N	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Congener	Darwin Port of Darwin (ES1A)	Cooktown Region Endeavour R. (ES1A)	Innisfail Lower Johnstone R. (ES1A)	Innisfail Johnstone R. Estuary (ES1A)	Brisbane Lower Brisbane R. (ES1A)	Brisbane Port of Brisbane (ES1A)	Brisbane Port of Brisbane (ES1B)	Redland Bay (ES1A)	Newcastle Hunter River (ES1A)	Sydney Lower Parramatta R. (ES1A)	Sydney Lower Parramatta R. (ES1B)	Sydney Port Jackson West (ES2A)	Sydney Port Jackson West (ES2B)	Sydney Port Jackson East (ES1A)	Sydney Botany Bay (ES1A)	Sydney Botany Bay (ES1B)	Wollongong Lake Illawarra (ES1A)	Wollongong Lake Illawarra (ES1B)
2,3,7,8-TCDD	<0.1	<0.03	<0.05	<0.06	0.67	<0.08	<0.1	<0.3	<0.07	41	360	39	45	<0.1	2.1	0.87	0.14	<0.1
Total TCDD isomers	2.7	9	2.9	22	65	1.8	11	39	5.9	160	650	230	310	1.9	92	75	36	39
1,2,3,7,8-PeCDD	0.4	0.17	<0.06	<0.02	<0.6	<0.06	<0.2	0.72	0.13	7.2	13	5.9	13	0.12	6.1	4.8	1.1	1.4
Total PeCDD isomers	6.9	15	1.5	1.7	50	2.2	14	51	4.2	130	340	240	320	3.3	230	170	69	79
1,2,3,4,7,8-HxCDD	0.55	0.29	0.1	<0.08	1.5	0.061	<0.3	1.5	0.38	18	29	16	27	0.3	14	8.4	2.7	2.9
1,2,3,6,7,8-HxCDD	0.79	0.66	0.19	<0.09	5.2	0.2	<1	3.2	0.94	85	240	36	87	0.8	29	18	4.5	4.8
1,2,3,7,8,9-HxCDD	1.4	<2	0.57	<0.1	5.4	0.33	<1	5.9	<0.5	34	66	38	62	0.7	41	26	7.4	7.8
Total HxCDD isomers	27	92	18	3	360	15	90	290	45	750	1580	1500	2570	31	1940	1320	390	470
1,2,3,4,6,7,8-HpCDD	9.8	37	7.5	3	130	5.2	23	87	33	2400	6110	1200	2080	25	800	530	130	150
Total HpCDD isomers	33	220	33	8	570	24	140	360	130	4700	11300	4100	6650	84	3460	2300	580	700
OCDD	180	1700	390	250	3740	130	630	2600	1200	46000	94400	41000	77100	670	25100	14100	4400	5250
2,3,7,8-TCDF	<0.06	<0.04	<0.06	<0.04	1.2	0.026	<0.09	<0.09	0.26	4	13	4.8	14	0.13	9.1	5.2	1	0.87
Total TCDF isomers	<0.5	0.073	<0.5	1.7	15	<0.2	0.089	0.29	4.7	91	410	71	170	0.48	64	31	19	15
1,2,3,7,8-PeCDF	<0.03	<0.02	<0.02	<0.03	<0.5	<0.01	<0.1	0.078	0.21	2.1	4.2	1.9	6.1	0.065	2.2	1.3	0.85	0.68
2,3,4,7,8-PeCDF	<0.05	<0.03	<0.03	<0.03	0.84	<0.02	<0.09	<0.05	<0.3	6.6	22	4.8	14	0.098	4.2	2.4	1.4	0.91
Total PeCDF isomers	<0.6	0.12	<0.3	<0.2	13	<0.1	<0.8	0.27	2.3	110	290	60	170	0.74	32	15	14	7.3
1,2,3,4,7,8-HxCDF	0.19	<0.07	<0.06	<0.04	<1	<0.01	<0.2	<0.05	<0.2	24	78	5.9	27	<0.1	<1	1.8	0.74	0.98
1,2,3,6,7,8-HxCDF	<0.06	<0.03	<0.03	<0.01	1.7	<0.04	<0.2	<0.07	0.27	6.5	15	3.5	11	0.061	2.2	1	1	0.88
2,3,4,6,7,8-HxCDF	<0.05	<0.02	<0.03	<0.01	0.58	<0.03	<0.2	<0.02	0.17	4.9	12	3.7	11	0.085	1.7	0.73	0.84	0.65
1,2,3,7,8,9-HxCDF	<0.05	<0.03	0.05	<0.02	0.31	<0.02	<0.2	<0.03	0.08	<0.7	<3	0.5	<0.9	<0.01	<0.3	<0.2	0.29	0.25
Total HxCDF isomers	<0.6	<0.5	<0.4	<0.1	20	<0.4	<1	0.085	4.2	220	580	87	210	1.6	31	15	8.3	7.4
1,2,3,4,6,7,8-HpCDF	<0.1	<0.09	<0.1	<0.1	14	0.13	<0.5	<0.02	3.9	200	530	73	170	2.4	22	11	3.1	2.8
1,2,3,4,7,8,9-HpCDF	<0.07	<0.06	0.05	<0.02	1.5	<0.01	<0.3	<0.06	0.47	18	52	5.1	12	0.077	<2	0.78	0.35	0.29
Total HpCDF isomers	<0.4	<0.3	<0.2	<0.2	50	0.22	<1	<0.1	12	650	1970	210	460	4.6	45	24	4.8	4.6
OCDF	<0.6	<0.08	0.71	<0.2	61	0.16	<0.7	<0.3	17	720	2540	220	520	5.4	42	18	2.7	2.8
Sum of PCDD/-F (exc)[1]	**250**	**2000**	**450**	**290**	**4900**	**170**	**890**	**3300**	**1400**	**54000**	**110000**	**48000**	**89000**	**800**	**31000**	**18000**	**5500**	**6600**
WHO_{98}-TEQ_{DF} (inc)[2]	**0.88**	**0.94**	**0.28**	**0.12**	**4.9**	**0.21**	**0.63**	**3.1**	**0.99**	**100**	**510**	**75**	**120**	**0.78**	**31**	**20**	**5.6**	**5.9**
WHO_{98}-TEQ_{DF} (exc)[1]	**0.81**	**0.81**	**0.21**	**0.055**	**4.5**	**0.12**	**0.29**	**2.9**	**0.85**	**100**	**510**	**75**	**120**	**0.72**	**31**	**20**	**5.6**	**5.9**

1 = excluding LOD values
2 = including half LOD values

Table D2b Concentrations of PCB in Australian estuarine sediments (pg g^{-1} dm)

	N	N	N	N	N	N	N	N	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Congener	Darwin Port of Darwin (ES1A)	Cooktown Region - Endeavour R. (ES1A)	Innisfail Lower Johnstone R. (ES1A)	Innisfail Johnstone R. Estuary (ES1A)	Brisbane Lower Brisbane R. (ES1A)	Brisbane Port of Brisbane (ES1A)	Brisbane Port of Brisbane (ES1B)	Redland Bay (ES1A)	Newcastle Hunter River (ES1A)	Sydney Lower Parramatta R. (ES1A)	Sydney Lower Parramatta R. (ES1B)	Sydney Port Jackson West (ES2A)	Sydney Port Jackson West (ES2B)	Sydney Port Jackson East (ES1A)	Sydney Botany Bay (ES1A)	Sydney Botany Bay (ES1B)	Wollongong Lake Illawarra (ES1A)	Wollongong Lake Illawarra (ES1B)
PCB 77	<0.8	<0.3	<0.6	<0.3	120	1	<3	1.4	6.4	270	2070	320	1030	2.9	710	310	46	32
PCB 81	<0.03	<0.04	<0.04	<0.07	4.3	<0.05	<0.1	<0.1	0.29	10	67	13	41	0.1	13	7.2	1.9	1.5
PCB 126	<0.09	<0.1	<0.07	<0.2	10	<0.06	<0.09	<0.04	0.64	21	94	23	110	0.32	28	16	2.5	1.8
PCB 169	<0.1	<0.06	<0.05	0.09	0.71	<0.2	<0.07	<0.01	<0.1	1.5	4	2.1	<5	<0.02	0.83	<0.7	0.4	<0.4
PCB 105	<4	<0.7	<8	<5	1030	2.7	<10	<6	55	1500	7810	1300	5780	11	1480	820	110	100
PCB 114	<0.3	<0.03	<0.5	<0.4	41	<0.3	<0.6	<0.2	2.2	62	440	54	250	<0.2	52	26	5.5	<4
PCB 118	<10	<3	<20	<30	3860	<8	<40	<20	150	3500	14400	3100	13200	36	5580	2940	280	230
PCB 123	0.44	<0.8	0.74	2	300	<2	<1	<2	4.1	110	<700	160	<400	1.3	160	78	7.1	<4
PCB 156	<2	<0.7	2.5	9	570	1.1	<5	<2	16	380	2540	270	1470	4.9	460	210	23	22
PCB 157	<0.6	<0.1	0.54	<0.6	130	<0.2	<0.9	<0.2	4.6	110	580	70	440	<1	150	74	6.7	7.1
PCB 167	<0.6	<0.2	0.75	<4	<200	<0.3	<2	<1	<5	100	<500	110	<600	<3	<100	<90	<9	<5
PCB 189	<0.5	<0.5	<0.2	1.8	72	<0.07	<0.7	<0.4	1.1	36	160	43	110	<0.6	27	14	<1	1.7
Sum of PCB (exc)[1]	**0.44**	**0**	**4.5**	**13**	**6100**	**4.8**	**0**	**1.4**	**240**	**6100**	**28000**	**5500**	**22000**	**57**	**8700**	**4500**	**480**	**400**
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.0065**	**0.0058**	**0.0069**	**0.018**	**1.9**	**0.0056**	**0.0092**	**0.0042**	**0.098**	**2.9**	**14**	**3.0**	**14**	**0.040**	**3.9**	**2.2**	**0.32**	**0.23**
WHO_{98}-TEQ_{PCB} (exc)[1]	**0.000044**	**0**	**0.0016**	**0.0058**	**1.9**	**0.00092**	**0**	**0.00014**	**0.097**	**2.9**	**14**	**3.0**	**14**	**0.040**	**3.9**	**2.2**	**0.32**	**0.23**

1 = excluding LOD values
2 = including half LOD values

Table D2c TEQ_{DF+PCB} in Australian estuarine sediments (pg TEQ g^{-1} dm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.89**	**0.94**	**0.29**	**0.14**	**6.8**	**0.21**	**0.64**	**3.1**	**1.1**	**100**	**520**	**78**	**130**	**0.82**	**35**	**22**	**5.9**	**6.1**
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	**0.81**	**0.81**	**0.21**	**0.061**	**6.4**	**0.13**	**0.29**	**2.9**	**0.94**	**100**	**520**	**78**	**130**	**0.76**	**35**	**22**	**5.9**	**6.1**

Table D2d Total Organic Carbon in Australian estuarine sediments (%)

Total Organic Carbon %	**0.35**	**1.4**	**0.69**	**3.5**	**0.17**	**0.28**	**3.0**	**0.31**	**1.6**	**2.6**	**3.2**	**1.9**	**5.3**	**0.099**	**2.5**	**1.5**	**2.5**	**2.8**

Table D2a cont'd Concentrations of PCDD/PCDF in Australian estuarine sediments (pg g^{-1} dm)

Congener	SE Gippsland Lakes (ES1A)	SE Latrobe Valley Latrobe R. (ES1A)	SE Melbourne Lower Yarra R. (ES1A)	SE Melbourne Lower Yarra R. (ES1B)	SE Melbourne Hobsons Bay (ES1A)	SE Launceston Region Lower Tamar R. (ES1A)	SE Hobart Derwent R. Estuary (ES1A)	SE Hobart Lower Derwent R. (ES1A)	SE Adelaide Torrens R. Estuary (ES1A)	SW Leschenault Inlet (ES1A)	SW Perth Lower Swan R. (ES1A)	SW Perth Lower Swan R. (ES1B)	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=30
2,3,7,8-TCDD	<0.08	<0.5	0.7	<0.2	<0.4	<0.06	0.12	<0.04	<0.09	<0.05	<0.1	<0.2	10	<0.03	360	0.11		62
Total TCDD isomers	4.2	18	14	4.5	<3	0.23	7.1	6.7	2.2	0.086	12	6.7	29	0.086	650	10	61	
1,2,3,7,8-PeCDD	<0.2	<0.3	2.4	0.19	<0.3	<0.08	0.53	0.23	<0.04	<0.03	0.77	0.58	18	<0.02	13	0.35		60
Total PeCDD isomers	<1	5.6	11	2.7	<2	0.24	3	2.4	0.4	<0.2	11	3.5	27	<0.2	340	6.3	59	
1,2,3,4,7,8-HxCDD	<0.2	0.48	4.1	0.22	<0.1	0.047	0.84	0.6	<0.07	<0.03	<1	0.66	23	<0.03	29	0.58	4.4	112
1,2,3,6,7,8-HxCDD	<0.1	1.9	9.3	0.8	<0.1	0.11	1.4	8.8	<0.2	<0.03	6.7	3.2	24	<0.03	240	1.7	18	74
1,2,3,7,8,9-HxCDD	<0.6	2	7.3	0.72	<0.09	<0.08	1.5	1.7	0.16	<0.03	3.6	1.9	21	<0.03	66	1.8	11	
Total HxCDD isomers	9	34	100	23	1.4	2.3	27	70	5.7	<0.1	73	32	28	<0.1	2570	58	400	
1,2,3,4,6,7,8-HpCDD	6.1	61	260	18	<2	2.8	35	220	3.8	0.32	130	47	28	0.32	6110	42	480	74
Total HpCDD isomers	18	140	580	56	7.8	8.6	120	450	11	0.61	260	99	30	0.61	11300	140	1200	
OCDD	190	1770	14600	610	100	120	1320	2040	70	6.4	960	340	30	6.4	94400	1300	11000	65
2,3,7,8-TCDF	<0.1	1.1	1.9	0.22	<0.4	<0.04	0.18	0.38	<0.1	<0.04	1.4	2.5	19	0.026	14	0.32		66
Total TCDF isomers	<0.8	7.5	34	1.8	<3	<0.3	9.5	4	4	0.37	28	31	23	0.073	410	4.4	34	
1,2,3,7,8-PeCDF	<0.06	1.4	0.99	<0.07	<0.1	<0.05	0.087	0.34	0.15	<0.02	0.74	1	17	<0.01	6.1	0.18		61
2,3,4,7,8-PeCDF	<0.05	0.55	1.6	0.15	<0.2	<0.04	0.12	0.26	<0.2	<0.03	1.2	1.3	16	<0.02	22	0.23		62
Total PeCDF isomers	<0.8	5.6	19	0.58	<1	0.21	0.72	5.8	2	0.089	15	11	22	0.089	290	2.15	26	
1,2,3,4,7,8-HxCDF	<0.2	5.3	<2	0.21	<0.08	<0.05	<0.08	1.4	0.13	<0.02	<0.8	1.5	12	<0.01	78	0.21		86
1,2,3,6,7,8-HxCDF	<0.02	0.86	1.6	0.12	<0.2	<0.01	0.1	0.91	0.18	<0.02	1.6	1.1	18	<0.01	15	0.24		81
2,3,4,6,7,8-HxCDF	<0.02	<1	1.7	<0.06	<0.1	<0.03	0.07	0.75	0.3	<0.02	1.5	0.9	16	<0.01	12	0.25		86
1,2,3,7,8,9-HxCDF	<0.03	0.2	0.28	<0.04	<0.09	<0.02	<0.07	0.28	<0.02	<0.02	0.25	<0.4	10	<0.01	<3	0.15		79
Total HxCDF isomers	<1	8.6	34	1.1	<1	<0.2	0.92	44	3.2	<0.1	32	12	19	0.085	580	3.7		
1,2,3,4,6,7,8-HpCDF	<0.04	4.9	31	2.1	<0.1	0.24	0.46	52	1.5	<0.08	30	11	21	<0.02	530	2.6	39	71
1,2,3,4,7,8,9-HpCDF	<0.06	0.88	2.4	0.14	<0.2	<0.03	<0.03	4.8	0.11	<0.04	2.4	1.1	19	<0.01	52	0.30		72
Total HpCDF isomers	<0.2	12	95	5.9	<0.4	0.46	0.7	190	2.6	<0.2	95	31	20	<0.1	1970	4.7	130	
OCDF	<0.06	7.4	120	7.3	<0.5	0.74	1.6	270	1.5	<0.2	100	34	22	<0.06	2540	4.1	160	
Sum of PCDD/-F (exc)[1]	**220**	**2000**	**16000**	**710**	**110**	**130**	**1500**	**3100**	**100**	**7.6**	**1600**	**600**		**7.6**	**110000**	**1500**	**14000**	
WHO_{98}-TEQ_{DF} (inc)[2]	**0.30**	**2.8**	**11**	**0.86**	**0.48**	**0.15**	**1.6**	**4.9**	**0.28**	**0.063**	**4.8**	**3.2**		**0.063**	**510**	**2.2**	**30**	
WHO_{98}-TEQ_{DF} (exc)[1]	**0.08**	**2.4**	**10**	**0.76**	**0.010**	**0.062**	**1.6**	**4.9**	**0.15**	**0.0038**	**4.6**	**3.1**		**0.0038**	**510**	**2.0**	**30**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCDD/PCDF congener detected on more than 66% of occasions (minimum of 20 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table D2b cont'd Concentrations of PCB in Australian estuarine sediments (pg g^{-1} dm)

Congener	SE Gippsland Lakes (ES1A)	SE Latrobe Valley Latrobe R. (ES1A)	SE Melbourne Lower Yarra R. (ES1A)	SE Melbourne Lower Yarra R. (ES1B)	SE Melbourne Hobsons Bay (ES1A)	SE Launceston Region Lower Tamar R. (ES1A)	SE Hobart Derwent R. Estuary (ES1A)	SE Hobart Lower Derwent R. (ES1A)	SE Adelaide Torrens R. Estuary (ES1A)	SW Leschenault Inlet (ES1A)	SW Perth Lower Swan R. (ES1A)	SW Perth Lower Swan R. (ES1B)	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=30
PCB 77	<0.3	5.5	230	51	<1	1.2	9.4	3.7	7.3	<0.4	57	28	22	<0.3	2070	6.9	180	57
PCB 81	0.042	0.28	7.2	2.1	<0.2	0.085	<0.3	<0.3	<0.3	<0.02	2.4	1.4	18	<0.02	67	0.30		55
PCB 126	<0.1	<0.8	47	1.8	<0.2	<0.1	1.2	<0.2	1.2	<0.03	5.5	3.1	17	<0.03	110	1.0		72
PCB 169	<0.2	<0.5	2.3	<0.4	<0.2	<0.8	<0.2	<0.04	<0.03	<0.04	<0.2	0.29	9	<0.01	<5	0.20		79
PCB 105	<0.8	25	2300	170	<9	3	19	14	120	<2	290	170	20	<0.7	7810	40	770	75
PCB 114	<1	<0.9	110	8.7	<3	<0.4	0.55	<0.4	<4	<0.06	8.1	6.9	13	<0.03	440	2.6		72
PCB 118	<4	58	5300	360	35	<8	42	35	230	<8	800	470	19	<3	14400	100		71
PCB 123	<1	1.4	140	13	<4	<0.6	1.2	<0.9	<9	<0.7	18	15	17	0.44	<700	4.0		75
PCB 156	<1	6.6	950	38	<5	<1	5.8	3.5	33	<0.9	78	50	22	<0.7	2540	13	240	76
PCB 157	<1	<2	240	10	<0.5	<0.9	<1	<0.3	9.8	<0.2	22	15	16	<0.1	580	3.3		76
PCB 167	<0.4	7.9	<300	<10	<1	<1	<3	<1	<20	<0.4	160	<20	5	<0.2	<600	5.0		82
PCB 189	<0.3	<2	57	3.3	0.34	<0.6	<0.4	<0.3	1.7	<0.3	5.5	<3	15	<0.07	160	1.4		80
Sum of PCB (exc)[1]	**0.042**	**100**	**9400**	**660**	**35**	**4.3**	**79**	**56**	**400**	**0**	**1400**	**760**		**0**	**28000**	**170**	**3200**	
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.0071**	**0.056**	**6.2**	**0.27**	**0.017**	**0.01**	**0.13**	**0.017**	**0.18**	**0.0026**	**0.72**	**0.42**		**0.0026**	**14**	**0.11**	**1.7**	
WHO_{98}-TEQ_{PCB} (exc)[1]	**0.0000042**	**0.012**	**6.2**	**0.27**	**0.0035**	**0.00043**	**0.13**	**0.007**	**0.18**	**0**	**0.72**	**0.42**		**0**	**14**	**0.11**	**1.7**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCB congener detected on more than 66% of occasions (minimum of 20 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table D2c cont'd TEQ_{DF+PCB} in Australian estuarine sediments (pg TEQ g^{-1} dm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-$TEQ_{DF\&P}$ (inc)[2]	**0.31**	**2.9**	**17**	**1.1**	**0.5**	**0.16**	**1.7**	**4.9**	**0.46**	**0.066**	**5.5**	**3.6**		**0.066**	**520**	**2.3**	**32**	
WHO_{98}-$TEQ_{DF\&P}$ (exc)[1]	**0.08**	**2.4**	**17**	**1.0**	**0.014**	**0.063**	**1.7**	**4.9**	**0.32**	**0.0038**	**5.4**	**3.5**		**0.0038**	**520**	**2.1**	**32**	

Table D2d cont'd Total Organic Carbon in Australian estuarine sediments (%)

Total Organic Carbon %	**1.5**	**3.3**	**4.1**	**0.46**	**0.044**	**0.26**	**6.7**	**2.8**	**0.47**	**0.28**	**3.1**	**2.7**		**0.044**	**6.7**	**1.8**	**2.0**	

Table D3a Concentrations of PCDD/PCDF in Australian marine sediments (pg g^{-1} dm)

Congener	N Arafura Sea (MA1A)	N Heron Island (MA1A)	SE Newcastle Port Hunter (MA1A)	SE Melbourne Port Phillip Bay East (MA1A)	SE Melbourne Port Phillip Bay Central (MA1A)	SE Melbourne Port Phillip Bay Central (MA1B)	SE Cape Grim (MA1A)	SE Port Pirie (MA1A)	SE Franklin Harbour (MA1A)	SE Coffin Bay (MA1A)	SW Perth Kwinana Beach (MA1A)	SW Rottnest Island (MA1A)	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=12
2,3,7,8-TCDD	<0.01	<0.02	<0.05	<0.3	0.92	<0.08	<0.02	<0.02	<0.1	<0.02	<0.09	<0.07	1	<0.01	0.92	0.06	-	57
Total TCDD isomers	<0.1	0.13	3.3	<1	16	9.4	<0.1	0.54	0.32	<0.3	<0.6	<0.5	6	<0.1	16	0.52	-	
1,2,3,7,8-PeCDD	<0.01	<0.02	<0.04	<0.2	0.88	<0.6	<0.02	0.05	<0.2	<0.05	<0.07	<0.07	2	<0.01	0.88	0.06	-	61
Total PeCDD isomers	0.03	<0.1	1.8	<1	24	34	<0.1	0.22	<1	<0.6	<0.5	<0.5	5	0.03	34	0.55	-	
1,2,3,4,7,8-HxCDD	<0.02	<0.05	<0.05	<0.3	1.2	0.94	<0.02	<0.05	<0.06	<0.02	<0.08	<0.05	2	<0.02	1.2	0.05	-	85
1,2,3,6,7,8-HxCDD	<0.02	0.027	<0.06	0.27	2.6	2.3	<0.02	<0.2	<0.08	<0.02	<0.1	<0.07	4	<0.02	2.6	0.075	-	70
1,2,3,7,8,9-HxCDD	<0.02	<0.01	<0.05	<0.3	<2	3	<0.02	0.38	<0.06	<0.02	<0.09	<0.04	2	<0.01	3	0.055	-	
Total HxCDD isomers	<0.1	<0.2	4.6	7.4	250	220	<0.07	1.9	1.1	<0.1	<0.6	<0.4	6	<0.07	250	0.85	-	
1,2,3,4,6,7,8-HpCDD	0.24	0.38	<0.5	8	65	64	<0.06	2	0.58	<0.1	0.41	<0.2	8	<0.06	65	0.455	12	74
Total HpCDD isomers	0.55	0.82	3	27	300	310	<0.06	6.1	1.8	<0.2	0.79	<0.4	9	<0.06	310	1.31	54	
OCDD	48	7.4	32	380	1780	1860	<2	41	<10	5.3	20	14	10	<2	1860	26	350	64
2,3,7,8-TCDF	<0.01	<0.01	<0.02	<0.3	1.2	0.97	<0.01	<0.04	<0.07	<0.02	<0.06	<0.06	2	<0.01	1.2	0.05	-	59
Total TCDF isomers	<0.2	<0.8	<0.6	<2	7	5.2	<0.08	0.038	<0.6	<0.3	<0.8	<0.5	3	0.038	7	0.6	-	
1,2,3,7,8-PeCDF	<0.007	<0.01	<0.01	<0.1	<0.5	0.24	<0.01	0.028	<0.05	<0.02	<0.05	<0.03	2	<0.007	<0.5	0.029	-	60
2,3,4,7,8-PeCDF	<0.009	<0.01	<0.02	<0.2	<0.5	0.48	<0.01	0.017	<0.03	<0.01	<0.03	<0.03	2	<0.009	<0.5	0.025	-	62
Total PeCDF isomers	<0.1	<0.7	<0.3	<1	4.8	2.7	<0.07	0.06	<0.3	<0.3	<0.4	<0.4	3	0.06	4.8	0.35	-	
1,2,3,4,7,8-HxCDF	<0.005	<0.01	<0.02	<0.06	<0.5	<0.5	<0.01	<0.04	<0.03	<0.01	<0.08	<0.03	0	<0.005	<0.5	0.03	-	78
1,2,3,6,7,8-HxCDF	<0.006	<0.01	<0.02	<0.05	0.31	0.16	<0.009	0.042	<0.04	<0.01	<0.06	<0.03	3	<0.006	0.31	0.035	-	75
2,3,4,6,7,8-HxCDF	<0.009	<0.01	<0.02	<0.07	0.28	<0.2	<0.01	0.018	<0.02	<0.01	<0.07	<0.03	2	<0.009	0.28	0.02	-	81
1,2,3,7,8,9-HxCDF	<0.007	<0.01	<0.02	<0.1	<0.2	<0.04	<0.009	0.16	<0.03	<0.01	<0.06	<0.04	1	<0.007	<0.2	0.035	-	74
Total HxCDF isomers	<0.1	<0.6	<0.6	0.3	3.4	2.4	<0.06	0.3	<0.4	<0.1	<0.8	<0.4	4	<0.06	3.4	0.4	-	
1,2,3,4,6,7,8-HpCDF	<0.01	<0.01	<0.03	<0.3	3.8	3.6	<0.02	<0.1	<0.009	<0.01	<0.1	<0.04	2	<0.009	3.8	0.035	-	71
1,2,3,4,7,8,9-HpCDF	<0.007	<0.02	<0.03	<0.1	0.24	0.27	<0.007	<0.02	<0.04	<0.02	<0.02	<0.02	2	<0.007	0.27	0.02	-	73
Total HpCDF isomers	<0.04	<0.08	<0.1	0.45	8.4	8.9	<0.3	0.097	<0.1	<0.08	<0.2	<0.2	3	<0.04	8.9	0.15	-	
OCDF	<0.04	<0.1	<0.04	<0.9	12	10	<0.03	<0.05	<0.06	<0.03	<0.2	<0.2	2	<0.03	12	0.08	-	
Sum of PCDD/-F (exc)[1]	**49**	**8.4**	**45**	**420**	**2400**	**2500**	**0**	**50**	**3.2**	**5.3**	**21**	**14**		**0**	**2500**	**33**	**460**	
WHO_{98}-TEQ_{DF} (inc)[2]	**0.025**	**0.036**	**0.069**	**0.51**	**3.5**	**2.2**	**0.029**	**0.17**	**0.18**	**0.045**	**0.13**	**0.098**		**0.025**	**3.5**	**0.11**	**0.59**	
WHO_{98}-TEQ_{DF} (exc)[1]	**0.0072**	**0.0072**	**0.0032**	**0.15**	**3.2**	**1.9**	**0**	**0.14**	**0.0058**	**0.00053**	**0.0061**	**0.0014**		**0**	**3.2**	**0.0067**	**0.45**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCDD/PCDF congener detected on more than 66% of occasions (minimum of 8 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table D3b Concentrations of PCB in Australian marine sediments (pg g^{-1} dm)

Congener	N Arafura Sea (MA1A)	N Heron Island (MA1A)	SE Newcastle Port Hunter (MA1A)	SE Melbourne Port Phillip Bay East (MA1A)	SE Melbourne Port Phillip Bay Central (MA1A)	SE Melbourne Port Phillip Bay Central (MA1B)	SE Cape Grim (MA1A)	SE Port Pirie (MA1A)	SE Franklin Harbour (MA1A)	SE Coffin Bay (MA1A)	SW Perth Kwinana Beach (MA1A)	SW Rottnest Island (MA1A)	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=12
PCB 77	<0.3	<0.2	0.83	<3	34	27	<0.1	<0.4	<0.5	<0.2	2	0.12	5	<0.1	34	0.45	-	52
PCB 81	<0.02	<0.02	<0.03	<0.2	2.3	1.1	0.018	<0.02	<0.2	<0.008	<0.04	<0.04	3	<0.008	2.3	0.035	-	49
PCB 126	<0.03	<0.02	<0.02	<0.2	6	1.8	<0.008	<0.05	<0.2	<0.02	<0.02	<0.2	2	<0.008	6	0.04	-	68
PCB 169	<0.02	<0.02	<0.03	<0.1	0.89	<0.2	<0.001	<0.009	<0.4	<0.02	<0.1	<0.1	1	<0.001	0.89	0.065	-	76
PCB 105	4.7	<2	22	<9	85	73	<1	13	1.3	<0.7	<2	<2	6	<0.7	85	3.35	-	70
PCB 114	<0.2	<0.1	<1	<0.8	<4	<3	<0.1	0.54	<0.2	<0.08	<0.4	<0.8	1	<0.08	<4	0.47	-	68
PCB 118	14	<6	71	31	240	190	<6	<30	<3	<3	<6	<4	5	<3	240	10	-	65
PCB 123	<0.3	0.12	1.6	<4	6.5	7.6	<0.05	<0.8	<0.6	<0.1	<0.4	<0.05	4	<0.05	7.6	0.5	-	69
PCB 156	0.82	0.51	5.6	<4	21	24	<0.1	<3	<0.3	0.32	<0.8	<0.7	6	<0.1	24	0.81	-	73
PCB 157	<0.2	<0.05	1.2	<1	<5	8	<0.1	0.65	<0.4	<0.1	<0.04	<0.1	3	<0.04	8	0.3	-	71
PCB 167	<0.3	<0.2	<2	6.1	41	<8	<0.3	<1	<0.7	<0.3	<1	0.91	3	<0.2	41	0.955	-	78
PCB 189	<0.04	<0.05	<0.2	<0.5	<5	2.9	<0.03	<0.2	<0.4	<0.04	<0.08	<0.4	1	<0.03	<5	0.2	-	79
Sum of PCB (exc)[1]	20	0.63	100	37	440	340	0.018	14	1.3	0.32	2.0	1.0		**0.018**	**440**	**8.1**	**79**	
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.004**	**0.0018**	**0.014**	**0.016**	**0.66**	**0.23**	**0.00084**	**0.0068**	**0.013**	**0.0015**	**0.0024**	**0.011**		**0.00084**	**0.66**	**0.0090**	**0.080**	
WHO_{98}-TEQ_{PCB} (exc)[1]	**0.0023**	**0.00027**	**0.013**	**0.0032**	**0.66**	**0.23**	**0.0000018**	**0.0019**	**0.00013**	**0.00016**	**0.0002**	**0.000021**		**0.0000018**	**0.66**	**0.0011**	**0.075**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCB congener detected on more than 66% of occasions (minimum of 8 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table D3c TEQ_{DF+PCB} in Australian marine sediments (pg TEQ g^{-1} dm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-$TEQ_{DF\&P}$ (inc)[2]	**0.029**	**0.037**	**0.084**	**0.52**	**4.2**	**2.5**	**0.030**	**0.18**	**0.20**	**0.047**	**0.13**	**0.11**		**0.029**	**4.2**	**0.11**	**0.67**	
WHO_{98}-$TEQ_{DF\&P}$ (exc)[1]	**0.0095**	**0.0075**	**0.016**	**0.15**	**3.9**	**2.1**	**0.0000018**	**0.15**	**0.0059**	**0.00069**	**0.0063**	**0.0014**		**0.0000018**	**3.9**	**0.0085**	**0.53**	

Table D3d Total Organic Carbon in Australian marine sediments (%)

Total Organic Carbon %	**0.086**	**0.21**	**0.10**	**0.096**	**1.2**	**1.4**	**0.060**	**0.21**	**0.35**	**0.048**	**0.11**	**0.10**		**0.048**	**1.4**	**0.11**	**0.32**	

Appendix E Concentrations of PCDD/PCDF and PCB in Australian bivalves and fish

This appendix reports the concentrations of PCDD/PCDF and PCB in Australian bivalves and fish.

For PCDD/PCDF, the tables report the results for each of the 2,3,7,8-dioxin substituted congeners, the concentration of the sum of all congeners in a homologue group and the calculated sum of all the tetra- to octa-chlorinated PCDD/PCDF (a).

For PCB, the tables report the results for each of the dioxin-like PCB congeners and the calculated sum for each sample (b).

TEQ_{DF} (a), TEQ_{PCB} (b), TEQ_{DF+PCB} for fish (c) and TEQ_{DF+PCB} for human (d) were calculated, both including half LOD values and excluding LOD values, using the WHO_{98} scheme (van den Berg et al. 1998).

The lipid content is reported for each sample (e).

Table E1 Concentrations in bivalve samples.

Table E2 Concentrations in fish samples.

Table E1a Concentrations of PCDD/PCDF in bivalve samples from Australia (pg g^{-1} fm)

Congener	N Darwin Port of Darwin (ES1A) Black Lip Oyster *Saccostrea echinata*	N Innisfail Lower Johnstone R. (ES1A) Oysters *Saccostrea sp.*	N Heron Island (MA1A) Spiny Oysters Shell *Spondylus sp.*	N Upper Brisbane R. (FW1A) Mussels *Cucumerunio novaehollandae*	N Brisbane Port of Brisbane (ES1A) Sydney Rock Oysters *Saccostrea commercialis*	N Redland Bay (ES1A) Sydney Rock Oysters *Saccostrea commercialis*	N Eastern Moreton Bay (MA1B) Sydney Rock Oysters *Saccostrea commercialis*	SE Sydney Port Jackson West (ES1A) Mussels	SE Gippsland Lakes (ES1A) Blue Mussel *Mytilus edulis*	SE Melbourne Lower Yarra R. (ES1A) Sydney Rock Oysters *Saccostrea commercialis*	SE Melbourne Hobsons Bay (ES1A) Blue Mussel *Mytilus edulis*	SE Melbourne Port Phillip Bay East (MA1A) Blue Mussel *Mytilus edulis*	SE Launceston Region Lower Tamar R. (ES1A) Oysters	SE Hobart Lower Derwent R. (ES1A) Mussels	SE Adelaide Lower Torrens R. (ES1A) Mussels	SE Coffin Bay (MA1A) Pacific Oysters *Crassostrea gigas*	SE Coffin Bay (MA1B) Pacific Oysters *Crassostrea gigas*
2,3,7,8-TCDD	<0.03	<0.03	<0.009	<0.007	0.028	0.024	0.067	0.7	<0.009	0.12	0.021	0.018	<0.01	0.018	<0.002	0.15	<0.005
Total TCDD isomers	6.2	20	0.082	1	14	3.2	14	7.2	0.67	3.5	0.99	0.5	3.3	0.78	0.091	4.7	0.39
1,2,3,7,8-PeCDD	0.25	<0.04	<0.02	0.0086	0.1	0.076	0.24	0.13	<0.02	0.19	0.035	0.043	0.06	0.021	<0.003	0.24	<0.006
Total PeCDD isomers	5.7	1.5	0.037	0.078	6.5	2.8	11	2.9	0.12	1.7	0.31	0.29	0.5	0.54	<0.02	1.5	<0.04
1,2,3,4,7,8-HxCDD	0.11	0.068	<0.008	0.0057	0.11	0.079	0.16	0.19	<0.03	0.12	0.037	0.047	0.03	0.014	<0.002	0.19	<0.003
1,2,3,6,7,8-HxCDD	0.22	0.12	<0.007	0.025	0.2	0.15	0.33	0.48	<0.04	0.44	0.084	0.084	0.089	0.14	<0.002	0.61	<0.004
1,2,3,7,8,9-HxCDD	<0.09	0.076	<0.01	<0.02	0.3	0.15	0.36	0.32	<0.01	0.23	<0.03	0.04	0.063	0.041	<0.002	0.28	<0.004
Total HxCDD isomers	7.5	4.1	0.047	0.3	14	7.1	19	11	1.3	4	1.4	2.2	1.3	2	<0.007	5.8	0.019
1,2,3,4,6,7,8-HpCDD	0.85	1.3	<0.01	0.24	1.6	1.5	2.9	9.7	0.72	3.8	1	2.1	0.35	1.2	0.012	5	0.015
Total HpCDD isomers	2.6	4.4	0.039	0.7	8.5	6.8	12	30	2.8	9	3.1	6.5	1.1	2.8	0.02	12	0.037
OCDD	2.9	16	<0.4	7.1	14	24	25	160	14	27	12	39	5.1	5.6	<0.2	39	0.19
2,3,7,8-TCDF	0.16	0.06	<0.009	0.016	0.26	0.12	0.061	1.1	0.15	1	0.62	0.21	0.46	0.19	<0.004	1.3	0.014
Total TCDF isomers	4.1	1.9	2.4	0.48	2.2	1.2	0.9	10	1.2	15	3.4	1.5	6.4	1.9	0.19	20	0.32
1,2,3,7,8-PeCDF	<0.03	<0.009	<0.008	<0.01	<0.02	0.037	<0.02	0.054	<0.02	<0.07	<0.02	<0.02	0.075	<0.02	<0.003	0.076	0.042
2,3,4,7,8-PeCDF	0.049	0.02	<0.01	0.0079	0.068	0.053	<0.01	0.17	<0.02	0.15	0.09	0.035	0.18	0.025	<0.002	0.24	<0.005
Total PeCDF isomers	<0.4	0.085	0.018	0.073	0.31	0.16	0.034	1.5	0.14	1.8	0.49	0.21	1.1	0.38	<0.02	2.5	0.043
1,2,3,4,7,8-HxCDF	<0.01	<0.005	<0.01	<0.006	<0.01	<0.01	<0.005	0.076	<0.009	<0.03	<0.007	<0.007	<0.006	0.016	<0.002	<0.03	<0.002
1,2,3,6,7,8-HxCDF	<0.02	0.0055	<0.005	<0.007	<0.009	<0.02	<0.005	0.04	<0.009	0.035	0.009	<0.01	0.02	0.018	<0.002	0.038	<0.004
2,3,4,6,7,8-HxCDF	<0.02	<0.004	<0.008	<0.006	0.011	<0.009	<0.005	0.051	<0.006	0.024	<0.01	<0.007	0.026	0.024	<0.002	0.04	<0.003
1,2,3,7,8,9-HxCDF	<0.01	<0.004	<0.005	<0.007	<0.004	<0.009	<0.006	<0.003	<0.01	<0.01	<0.009	<0.009	<0.002	0.0029	<0.002	<0.009	<0.003
Total HxCDF isomers	<0.08	<0.04	0.028	<0.07	<0.1	0.05	<0.1	0.93	<0.05	0.85	0.18	0.076	0.18	0.52	<0.01	1.2	<0.02
1,2,3,4,6,7,8-HpCDF	<0.01	0.032	<0.01	<0.005	0.0074	0.008	<0.006	0.58	<0.02	0.37	0.079	0.038	0.023	0.29	<0.002	0.5	<0.004
1,2,3,4,7,8,9-HpCDF	<0.02	<0.003	<0.01	<0.01	<0.005	<0.007	<0.007	0.039	<0.02	0.037	<0.009	<0.007	<0.002	0.021	<0.002	0.067	<0.004
Total HpCDF isomers	<0.07	0.06	<0.04	<0.02	<0.02	<0.02	<0.03	1.6	0.13	1.1	0.15	0.073	<0.04	0.96	<0.004	1.7	<0.008
OCDF	<0.03	<0.03	<0.01	<0.02	<0.008	<0.009	<0.008	1.5	<0.02	0.89	0.11	0.06	0.057	0.94	<0.003	1.3	<0.005
Sum of PCDD/-F (exc)[1]	29	48	2.7	9.7	60	45	82	230	21	65	22	50	19	16	0.30	90	1.0
WHO_{98}-TEQ_{DF} (inc)[2]	0.36	0.089	0.021	0.023	0.24	0.20	0.41	1.1	0.039	0.52	0.16	0.12	0.20	0.081	0.0041	0.71	0.011
WHO_{98}-TEQ_{DF} (exc)[1]	0.34	0.053	0	0.017	0.24	0.20	0.40	1.1	0.0096	0.52	0.16	0.12	0.20	0.081	0.000012	0.71	0.0028

1 = excluding LOD values
2 = including half LOD values

Table E1b Concentrations of PCB in bivalve samples from Australia (pg g^{-1} fm)

Congener	N Darwin Port of Darwin (ES1A) Black Lip Oyster *Saccostrea echinata*	N Innisfail Lower Johnstone R. (ES1A) Oysters *Saccostrea sp.*	N Heron Island (MA1A) Spiny Oysters Shell *Spondylus sp.*	N Upper Brisbane R. (FW1A) Mussels *Cucumerunio novaehollandae*	N Brisbane Port of Brisbane (ES1A) Sydney Rock Oysters *Saccostrea commercialis*	N Redland Bay (ES1A) Sydney Rock Oysters *Saccostrea commercialis*	N Eastern Moreton Bay (MA1B) Sydney Rock Oysters *Saccostrea commercialis*	SE Sydney Port Jackson West (ES1A) Mussels	SE Gippsland Lakes (ES1A) Blue Mussel *Mytilus edulis*	SE Melbourne Lower Yarra R. (ES1A) Sydney Rock Oysters *Saccostrea commercialis*	SE Melbourne Hobsons Bay (ES1A) Blue Mussel *Mytilus edulis*	SE Melbourne Port Phillip Bay East (MA1A) Blue Mussel *Mytilus edulis*	SE Launceston Region Lower Tamar R. (ES1A) Oysters	SE Hobart Lower Derwent R. (ES1A) Mussels	SE Adelaide Lower Torrens R. (ES1A) Mussels	SE Coffin Bay (MA1A) Pacific Oysters *Crassostrea gigas*	SE Coffin Bay (MA1B) Pacific Oysters *Crassostrea gigas*
PCB 77	3.4	1.5	<0.1	<0.8	5.4	11	1.5	64	5.9	440	32	6.5	6.1	4.1	0.65	630	0.68
PCB 81	0.2	0.086	0.03	<0.05	0.24	0.62	0.067	3.4	0.16	22	1.6	0.33	0.32	0.23	0.044	30	0.053
PCB 126	0.65	0.4	<0.05	<0.1	1.3	2.9	0.44	6.3	0.84	14	4.1	1.2	1.8	0.52	0.015	17	0.086
PCB 169	0.4	0.15	0.02	<0.09	0.21	0.64	0.089	0.26	<0.05	0.27	<0.2	<0.1	0.36	0.034	<0.002	0.4	0.042
PCB 105	-	18	<0.6	4.3	46	31	12	540	59	1300	240	39	59	31	1.9	1580	2.3
PCB 114	-	1.1	<0.05	<0.2	2.3	1.6	0.5	27	1.4	75	9.5	2	2.3	1.7	<0.2	100	0.24
PCB 118	-	62	<3	12	210	170	50	1770	300	3370	700	120	230	99	6.9	4380	7.6
PCB 123	-	2.2	<0.13	0.18	13	<5	<1	65	6.3	120	28	5.2	18	2.3	<0.3	170	<0.2
PCB 156	-	8.2	<0.7	1.7	26	19	6.3	100	19	190	52	12	20	7.7	0.3	270	0.49
PCB 157	-	2.5	<0.2	0.14	5.8	4.4	1.7	34	6.8	57	18	3.5	11	1.8	0.073	65	<0.2
PCB 167	-	<3	<0.3	<0.6	<10	<9	12	<30	<20	<40	<30	<9	63	<4	<0.08	<80	<0.4
PCB 189	-	0.4	<0.2	<0.2	5.5	<0.8	0.32	5.6	<0.8	8.9	3.1	1.2	1	<0.2	<0.04	11	<0.05
Sum of PCB (exc)[1]	4.7	97	0.050	18	320	240	85	2600	400	5600	1100	190	410	150	9.9	7300	11
WHO_{98}-TEQ_{PCB} (inc)[2]	0.0037	0.0027	0.00016	0.00040	0.0087	0.017	0.0028	0.052	0.0069	0.15	0.030	0.0078	0.012	0.0039	0.00021	0.20	0.00058
WHO_{98}-TEQ_{PCB} (exc)[1]	0.0037	0.0027	0.000016	0.000092	0.0087	0.017	0.0028	0.052	0.0068	0.15	0.030	0.0077	0.012	0.0038	0.00021	0.20	0.00058

1 = excluding LOD values
2 = including half LOD values

Table E1c TEQ_{DF+PCB} in bivalve samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{FISH} (van den Berg *et al*. 1998)

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.36**	**0.091**	**0.021**	**0.023**	**0.25**	**0.20**	**0.41**	**1.2**	**0.046**	**0.67**	**0.19**	**0.13**	**0.22**	**0.086**	**0.0043**	**0.90**	**0.012**
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	**0.35**	**0.055**	**0.000020**	**0.018**	**0.25**	**0.20**	**0.41**	**1.2**	**0.016**	**0.67**	**0.19**	**0.13**	**0.21**	**0.085**	**0.00022**	**0.90**	**0.0034**

Table E1d TEQ_{DF}, TEQ_{PCB} and TEQ_{DF+PCB} in bivalve samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{HUMANS} (van den Berg *et al*. 1998)

WHO_{98}-TEQ_{DF} (inc)[2]	**0.36**	**0.094**	**0.020**	**0.026**	**0.27**	**0.20**	**0.43**	**1.3**	**0.050**	**0.62**	**0.19**	**0.14**	**0.23**	**0.11**	**0.0041**	**0.82**	**0.012**
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.069**	**0.056**	**0.0031**	**0.0081**	**0.18**	**0.33**	**0.056**	**0.96**	**0.14**	**2.1**	**0.55**	**0.15**	**0.23**	**0.072**	**0.0027**	**2.6**	**0.011**
WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.43**	**0.15**	**0.024**	**0.035**	**0.45**	**0.53**	**0.49**	**2.2**	**0.18**	**2.7**	**0.74**	**0.29**	**0.46**	**0.18**	**0.0068**	**3.4**	**0.022**

Table E1e Lipid content in bivalve samples from Australia (%)

Lipid content %	**3.1**	**1.4**	**0.90**	**1.8**	**1.5**	**1.0**	**1.2**	**2.4**	**4.3**	**1.9**	**0.92**	**0.74**	**1.9**	**0.90**	**0.50**	**2.4**	**3.7**

Table E1a cont'd Concentrations of PCDD/PCDF in bivalve samples from Australia (pg g^{-1} fm)

Congener	SW Perth Kwinana Beach (MA1A) Blue Mussel *Mytilus galloprovincialis*	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=18
2,3,7,8-TCDD	<0.003	9	<0.002	0.7	0.020	-	61
Total TCDD isomers	0.19	18	0.082	20	2.1	4.5	
1,2,3,7,8-PeCDD	<0.005	12	<0.003	0.25	0.042	0.080	54
Total PeCDD isomers	0.054	16	<0.02	11	0.52	2.0	
1,2,3,4,7,8-HxCDD	<0.002	13	<0.002	0.19	0.042	0.066	88
1,2,3,6,7,8-HxCDD	<0.006	13	<0.002	0.61	0.10	0.17	71
1,2,3,7,8,9-HxCDD	<0.005	10	<0.002	0.36	0.052	-	
Total HxCDD isomers	0.084	17	<0.007	19	2.1	4.5	
1,2,3,4,6,7,8-HpCDD	0.068	17	<0.01	9.7	1.1	1.8	71
Total HpCDD isomers	0.2	18	0.02	30	3.0	5.7	
OCDD	0.34	16	0.19	160	13	22	66
2,3,7,8-TCDF	0.058	16	<0.004	1.3	0.16	0.32	64
Total TCDF isomers	0.64	18	0.19	20	1.9	4.1	
1,2,3,7,8-PeCDF	0.0089	6	<0.003	0.076	0.02	-	56
2,3,4,7,8-PeCDF	0.013	13	<0.002	0.24	0.03	0.062	55
Total PeCDF isomers	0.1	16	0.018	2.5	0.19	0.51	
1,2,3,4,7,8-HxCDF	0.0024	3	<0.002	0.076	0.008	-	82
1,2,3,6,7,8-HxCDF	<0.004	7	<0.002	0.04	0.009	-	79
2,3,4,6,7,8-HxCDF	0.0042	6	<0.002	0.051	0.0085	-	83
1,2,3,7,8,9-HxCDF	<0.002	1	<0.002	<0.01	0.0055	-	75
Total HxCDF isomers	0.029	10	<0.01	1.2	0.078	-	
1,2,3,4,6,7,8-HpCDF	<0.009	10	<0.002	0.58	0.015	-	69
1,2,3,4,7,8,9-HpCDF	<0.002	4	<0.002	0.067	0.008	-	69
Total HpCDF isomers	0.014	9	<0.004	1.7	0.05	-	
OCDF	0.012	8	<0.003	1.5	0.025	-	
Sum of PCDD/-F (exc)[1]	1.7		0.30	230	26	44	
WHO_{98}-TEQ_{DF} (inc)[2]	0.016		0.0041	1.1	0.14	0.24	
WHO_{98}-TEQ_{DF} (exc)[1]	0.011		0	1.1	0.14	0.23	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCDD/PCDF congener detected on more than 66% of occasions (minimum of 12 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table E1b cont'd Concentrations of PCB in bivalve samples from Australia (pg g^{-1} fm)

Congener	SW Perth Kwinana Beach (MA1A) Blue Mussel *Mytilus galloprovincialis*	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=18
PCB 77	2.2	16	<0.1	630	4.75	68	58
PCB 81	0.11	17	0.03	30	0.215	3.3	59
PCB 126	0.63	16	0.015	17	0.745	2.9	70
PCB 169	0.1	13	<0.002	0.64	0.125	0.18	64
PCB 105	17	16	<0.6	1580	31	230	85
PCB 114	0.63	14	<0.05	100	1.6	13	83
PCB 118	58	16	<3	4380	120	680	78
PCB 123	3.2	12	<0.13	170	5	26	82
PCB 156	6.8	16	0.3	270	12	44	69
PCB 157	2.5	15	0.073	65	3.5	13	65
PCB 167	<3	2	<0.08	<80	9	-	69
PCB 189	0.54	10	<0.04	11	0.8	-	76
Sum of PCB (exc)[1]	92		0.050	7300	170	1000	
WHO_{98}-TEQ_{PCB} (inc)[2]	0.0039		0.00016	0.20	0.0054	0.028	
WHO_{98}-TEQ_{PCB} (exc)[1]	0.0039		0.000016	0.20	0.0054	0.028	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCB congener detected on more than 66% of occasions (minimum of 12 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table E1c cont'd TEQ_{DF+PCB} in bivalve samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{FISH} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.019**	**0.0043**	**1.2**	**0.16**	**0.27**
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	**0.015**	**0.00002**	**1.2**	**0.16**	**0.26**

Table E1d cont'd TEQ_{DF}, TEQ_{PCB} and TEQ_{DF+PCB} in bivalve samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF} (inc)[2]	**0.019**	**0.0041**	**1.3**	**0.17**	**0.27**
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.077**	**0.0027**	**2.6**	**0.11**	**0.42**
WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.096**	**0.0068**	**3.4**	**0.36**	**0.69**

Table E1e cont'd Lipid content in bivalve samples from Australia (%)

Lipid content %	**1.0**	**0.50**	**4.3**	**1.5**	**1.8**

Table E2a Concentrations of PCDD/PCDF in fish samples from Australia (pg g^{-1} fm)

Congener	N Roebuck Bay Barramundi *Lates calcarifer*	N Darwin Region Barramundi *Lates calcarifer*	N Gulf of Carpentaria Barramundi *Lates calcarifer*	N Cairns Region Barramundi *Lates calcarifer*	N Cooper Creek Golden Perch *Macquaria ambigua*	N Moreton Bay Bream *Acanthopagrus sp.*	N Moreton Bay Flathead *Platycephalus sp.*	N Moreton Bay Sand Whiting *Sillago ciliata*	SE Port Jackson Bream *Acanthopagrus sp.*	SE Port Jackson Flathead *Platycephalus sp.*	SE Port Jackson King George Whiting *Sillaginoides punctata*	SE Latrobe River Short-finned Eel *Anguilla australis*	SE Melbourne Region Flathead *Platycephalus sp.*	SE Melbourne Region Green Backed Flounder *Rhombosolea tapirina*	SE Melbourne Region King George Whiting *Sillaginoides punctata*	SE Triabunna Region Flathead *Platycephalus sp.*	SE Hobart - Storm Bay Australian Salmon *Arripis spp.*	SE Murray River Golden Perch *Macquaria ambigua*
2,3,7,8-TCDD	<0.004	<0.004	<0.03	<0.02	0.043	<0.02	0.0067	0.0079	0.078	<0.002	0.011	0.015	0.0072	<0.005	0.02	<0.004	<0.02	0.0079
Total TCDD isomers	<0.03	0.15	0.038	0.11	0.053	0.087	0.028	0.042	0.41	<0.03	0.065	0.017	0.013	0.16	0.18	0.009	<0.5	0.015
1,2,3,7,8-PeCDD	<0.01	0.02	0.17	<0.02	0.29	<0.03	0.027	0.041	0.27	<0.005	0.05	0.05	0.026	<0.02	0.058	<0.02	0.02	0.016
Total PeCDD isomers	<0.1	0.04	0.19	0.026	0.31	0.035	<0.1	0.06	0.38	<0.06	0.081	0.05	<0.2	0.037	0.083	<0.1	0.02	<0.1
1,2,3,4,7,8-HxCDD	<0.009	0.011	0.036	<0.01	<0.006	0.011	<0.01	0.0097	0.09	<0.001	0.015	0.025	<0.008	<0.008	0.011	<0.01	<0.01	<0.004
1,2,3,6,7,8-HxCDD	<0.01	0.051	0.35	0.028	0.61	0.025	0.037	0.017	0.19	0.0016	0.046	0.053	0.022	0.026	0.017	<0.008	<0.02	0.018
1,2,3,7,8,9-HxCDD	<0.01	<0.01	0.18	0.022	0.27	0.017	0.021	0.0072	0.091	<0.003	0.016	<0.02	<0.01	0.014	<0.009	<0.009	<0.02	<0.005
Total HxCDD isomers	<0.1	0.12	0.57	0.064	0.89	0.1	<0.2	0.11	0.84	<0.02	0.11	0.12	<0.1	0.072	0.15	<0.06	<0.07	0.029
1,2,3,4,6,7,8-HpCDD	<0.02	0.047	0.3	0.06	0.22	0.052	0.048	<0.02	0.41	0.0051	0.1	0.066	<0.03	0.1	<0.02	0.025	<0.02	0.019
Total HpCDD isomers	0.008	0.06	0.37	0.079	0.39	0.078	0.075	0.043	0.59	0.0051	0.14	0.087	0.044	0.15	0.027	0.025	0.022	0.026
OCDD	<0.1	0.17	2.2	0.39	1.7	0.41	<0.2	<0.1	1.5	0.059	2.6	0.34	<0.1	<0.5	<0.3	0.73	<0.2	0.16
2,3,7,8-TCDF	<0.01	<0.006	<0.03	<0.01	<0.009	0.013	<0.004	0.0075	0.31	0.003	0.045	0.015	<0.004	0.028	0.06	<0.02	0.088	0.043
Total TCDF isomers	<0.08	0.018	<0.3	0.024	0.022	0.019	<0.03	0.0083	0.38	<0.05	0.067	0.037	0.013	0.034	0.086	<0.2	<0.6	0.048
1,2,3,7,8-PeCDF	<0.003	0.0027	0.031	<0.005	0.055	<0.004	<0.002	<0.002	0.041	<0.002	0.004	<0.004	<0.004	<0.004	<0.004	<0.005	0.0098	0.0069
2,3,4,7,8-PeCDF	<0.005	0.0023	<0.02	<0.009	0.0078	<0.006	<0.004	<0.004	0.11	0.001	0.0086	0.012	<0.004	<0.004	0.0093	<0.01	<0.04	0.0071
Total PeCDF isomers	<0.06	0.0062	0.033	<0.07	0.063	<0.04	0.0094	<0.04	0.22	<0.03	0.017	<0.1	<0.06	<0.06	0.011	0.016	<0.1	0.011
1,2,3,4,7,8-HxCDF	<0.008	<0.002	0.014	<0.006	<0.005	<0.003	<0.005	<0.003	<0.008	<0.002	<0.003	<0.006	<0.004	<0.006	<0.006	<0.009	<0.02	<0.003
1,2,3,6,7,8-HxCDF	<0.006	<0.001	<0.02	<0.005	0.021	<0.003	<0.006	<0.003	0.0085	<0.001	<0.003	<0.009	<0.004	<0.006	<0.007	<0.006	0.0086	<0.005
2,3,4,6,7,8-HxCDF	<0.003	<0.002	<0.01	<0.007	0.038	<0.006	<0.006	<0.005	0.026	<0.002	<0.003	<0.005	<0.007	<0.01	<0.008	<0.005	0.016	<0.002
1,2,3,7,8,9-HxCDF	<0.007	<0.003	<0.01	<0.006	<0.003	<0.002	<0.005	<0.004	0.0056	<0.002	<0.004	<0.01	<0.004	<0.008	<0.007	<0.007	<0.01	<0.005
Total HxCDF isomers	<0.07	<0.04	0.07	<0.07	<0.06	<0.02	<0.4	<0.04	0.038	<0.02	<0.04	<0.05	<0.04	<0.05	<0.05	<0.07	<0.1	<0.06
1,2,3,4,6,7,8-HpCDF	<0.009	<0.002	0.021	<0.007	<0.003	<0.002	<0.007	<0.003	<0.002	<0.002	<0.001	<0.008	<0.007	<0.01	<0.006	<0.005	0.021	<0.002
1,2,3,4,7,8,9-HpCDF	<0.009	<0.001	<0.02	<0.006	0.015	<0.003	<0.008	<0.005	<0.003	<0.002	<0.002	<0.01	<0.005	<0.01	<0.01	<0.005	0.025	<0.004
Total HpCDF isomers	<0.02	<0.008	0.024	<0.02	0.062	<0.01	<0.02	<0.02	0.019	<0.008	<0.01	<0.03	<0.02	<0.04	<0.02	<0.02	0.04	<0.008
OCDF	<0.02	<0.002	<0.05	<0.02	0.041	<0.004	<0.009	<0.009	<0.02	<0.002	<0.004	<0.02	<0.03	<0.04	<0.02	<0.01	0.067	<0.002
Sum of PCDD/-F (exc)[1]	**0.0080**	**0.56**	**3.5**	**0.69**	**3.5**	**0.73**	**0.11**	**0.26**	**4.4**	**0.064**	**3.1**	**0.65**	**0.07**	**0.45**	**0.54**	**0.78**	**0.15**	**0.29**
WHO_{98}-TEQ_{DF} (inc)[2]	**0.012**	**0.030**	**0.22**	**0.027**	**0.36**	**0.034**	**0.039**	**0.056**	**0.47**	**0.0049**	**0.077**	**0.087**	**0.038**	**0.019**	**0.093**	**0.019**	**0.052**	**0.032**
WHO_{98}-TEQ_{DF} (exc)[1]	**0.0**	**0.027**	**0.20**	**0.00060**	**0.35**	**0.0067**	**0.034**	**0.054**	**0.47**	**0.00068**	**0.076**	**0.085**	**0.033**	**0.0019**	**0.091**	**0.00010**	**0.028**	**0.030**

1 = excluding LOD values
2 = including half LOD values

Table E2b Concentrations of PCB in fish samples from Australia (pg g^{-1} fm)

Congener	N Roebuck Bay Barramundi *Lates calcarifer*	N Darwin Region Barramundi *Lates calcarifer*	N Gulf of Carpentaria Barramundi *Lates calcarifer*	N Cairns Region Barramundi *Lates calcarifer*	N Cooper Creek Golden Perch *Macquaria ambigua*	N Moreton Bay Bream *Acanthopagrus sp.*	N Moreton Bay Flathead *Platycephalus sp.*	N Moreton Bay Sand Whiting *Sillago ciliata*	SE Port Jackson Bream *Acanthopagrus sp.*	SE Port Jackson Flathead *Platycephalus sp.*	SE Port Jackson King George Whiting *Sillaginoides punctata*	SE Latrobe River Short-finned Eel *Anguilla australis*	SE Melbourne Region Flathead *Platycephalus sp.*	SE Melbourne Region Green Backed Flounder *Rhombosolea tapirina*	SE Melbourne Region King George Whiting *Sillaginoides punctata*	SE Triabunna Region Flathead *Platycephalus sp.*	SE Hobart - Storm Bay Australian Salmon *Arripis spp.*	SE Murray River Golden Perch *Macquaria ambigua*
PCB 77	0.46	0.28	0.58	0.96	0.58	0.76	0.56	0.4	8.9	0.25	0.58	0.69	0.72	1.1	1.6	0.6	2.7	0.59
PCB 81	0.038	0.022	0.08	<0.05	0.035	<0.1	0.031	0.027	0.56	0.019	0.043	0.048	0.055	0.075	0.13	0.043	0.11	0.025
PCB 126	0.11	0.095	<0.1	<0.2	0.055	<0.04	0.074	0.026	2.1	0.081	0.091	0.21	0.16	0.13	0.26	0.19	1.1	0.3
PCB 169	0.26	0.15	0.35	<0.2	0.046	<0.06	0.017	<0.009	0.17	0.024	0.033	<0.06	<0.01	0.014	0.087	<0.06	0.25	0.071
PCB 105	1.8	3.5	<1	12	4.6	5.5	4.7	2.1	220	2.3	6.9	14	8.8	6.6	8.9	5	33	14
PCB 114	0.18	0.23	<0.07	0.58	0.36	0.3	0.28	0.15	13	0.17	0.38	<0.2	0.53	0.44	0.6	0.25	1.6	0.6
PCB 118	5.8	<10	<4	40	13	18	15	6.1	720	<8	25	54	28	23	30	17	96	39
PCB 123	<0.07	<0.3	<0.26	<0.7	0.41	<0.5	0.21	0.21	22	<0.2	0.62	<0.9	0.41	0.4	0.62	0.46	3.4	0.76
PCB 156	0.46	1.7	<1	6.6	1.1	2.5	2	0.5	88	<0.9	2.4	<3	3.5	2	2.8	3	13	5.2
PCB 157	0.15	0.63	<0.08	1.9	<0.2	<0.5	0.75	0.12	25	<0.2	0.62	<0.7	1.1	0.67	1	0.64	3.3	1.4
PCB 167	<0.2	<0.7	<0.3	<5	0.42	<4	<0.6	<0.1	<30	1.2	<0.8	<1	<1	<0.9	<1	<6	28	<2
PCB 189	<0.09	<0.1	<0.2	0.57	<0.04	0.41	0.2	<0.07	5.7	0.11	0.14	<3	<0.4	<0.3	0.46	0.5	3.8	0.4
Sum of PCB (exc)[1]	**9.3**	**6.6**	**1.0**	**63**	**21**	**27**	**24**	**9.6**	**1100**	**4.2**	**37**	**69**	**43**	**34**	**46**	**28**	**190**	**62**
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.00067**	**0.00058**	**0.00038**	**0.00094**	**0.00045**	**0.00035**	**0.00056**	**0.00023**	**0.017**	**0.00048**	**0.00072**	**0.0015**	**0.0011**	**0.00097**	**0.0018**	**0.0012**	**0.0067**	**0.0019**
WHO_{98}-TEQ_{PCB} (exc)[1]	**0.00067**	**0.00055**	**0.00012**	**0.00040**	**0.00045**	**0.00021**	**0.00056**	**0.00023**	**0.017**	**0.00046**	**0.00072**	**0.0015**	**0.0011**	**0.00096**	**0.0018**	**0.0012**	**0.0067**	**0.0019**

1 = excluding LOD values
2 = including half LOD values

Table E2c TEQ_{DF+PCB} in fish samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{FISH} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.013**	**0.031**	**0.22**	**0.028**	**0.36**	**0.034**	**0.040**	**0.057**	**0.49**	**0.0054**	**0.078**	**0.089**	**0.039**	**0.020**	**0.095**	**0.020**	**0.060**	**0.034**
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	**0.00067**	**0.028**	**0.20**	**0.0010**	**0.35**	**0.0069**	**0.035**	**0.055**	**0.49**	**0.0011**	**0.077**	**0.087**	**0.035**	**0.0029**	**0.093**	**0.0013**	**0.035**	**0.032**

Table E2d TEQ_{DF}, TEQ_{PCB} and TEQ_{DF+PCB} in fish samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF} (inc)[2]	**0.012**	**0.031**	**0.26**	**0.03**	**0.44**	**0.034**	**0.043**	**0.055**	**0.48**	**0.0051**	**0.080**	**0.084**	**0.039**	**0.023**	**0.094**	**0.019**	**0.056**	**0.035**
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.015**	**0.013**	**0.0091**	**0.021**	**0.0086**	**0.0063**	**0.011**	**0.0039**	**0.37**	**0.0094**	**0.014**	**0.029**	**0.022**	**0.018**	**0.033**	**0.024**	**0.14**	**0.040**
WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.026**	**0.044**	**0.27**	**0.051**	**0.45**	**0.041**	**0.054**	**0.059**	**0.85**	**0.015**	**0.094**	**0.11**	**0.061**	**0.041**	**0.13**	**0.042**	**0.19**	**0.075**

Table E2e Lipid content in fish samples from Australia (%)

Lipid concentration %	**1.3**	**1.2**	**0.40**	**1.0**	**2.0**	**1.0**	**0.82**	**0.61**	**4.6**	**1.3**	**1.2**	**6.4**	**0.91**	**1.9**	**1.7**	**3.4**	**6.2**	**1.3**

Table E2a cont'd Concentrations of PCDD/PCDF in fish samples from Australia (pg g^{-1} fm)

Congener	SE Adelaide Region Flathead *Platycephalus sp.*	SE Adelaide Region Garfish *Hyporhamphus sp.*	SE Adelaide Region King George Whiting *Sillaginoides punctata*	SW Albany Region River Cobbler *Cnidoglanis macrocephalus*	SW Albany Region Flathead *Platycephalus sp.*	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=23
2,3,7,8-TCDD	<0.003	<0.01	<0.004	<0.007	<0.008	9	<0.002	0.078	0.0079	-	51
Total TCDD isomers	<0.03	<0.07	<0.03	0.046	<0.01	9	0.009	<0.5	0.042	-	
1,2,3,7,8-PeCDD	<0.004	<0.01	<0.007	<0.02	<0.02	12	<0.004	0.29	0.02	-	46
Total PeCDD isomers	<0.02	<0.07	<0.05	<0.1	<0.02	12	<0.02	0.38	<0.07	-	
1,2,3,4,7,8-HxCDD	<0.002	<0.004	<0.003	<0.02	<0.008	8	<0.001	0.09	<0.01	-	80
1,2,3,6,7,8-HxCDD	0.0063	<0.004	0.0044	<0.03	<0.005	15	0.0016	0.61	0.022	0.067	68
1,2,3,7,8,9-HxCDD	<0.001	<0.005	<0.003	0.016	<0.006	9	<0.001	0.27	<0.01	-	
Total HxCDD isomers	0.01	<0.02	<0.02	<0.08	<0.04	13	0.01	0.89	0.1	-	
1,2,3,4,6,7,8-HpCDD	0.012	0.0053	0.011	<0.04	<0.02	16	0.0051	0.41	<0.03	0.068	59
Total HpCDD isomers	0.021	0.015	0.018	<0.04	<0.02	21	0.0051	0.59	0.043	0.1	
OCDD	0.13	0.12	0.095	0.8	<0.3	15	0.059	2.6	<0.3	0.53	56
2,3,7,8-TCDF	<0.003	<0.01	0.013	<0.006	<0.007	11	<0.003	0.31	<0.01	-	55
Total TCDF isomers	<0.03	<0.08	0.022	0.05	<0.08	14	0.0083	<0.6	0.048	-	
1,2,3,7,8-PeCDF	<0.002	<0.003	<0.002	0.013	<0.004	8	<0.002	0.055	0.004	-	48
2,3,4,7,8-PeCDF	<0.002	<0.004	<0.003	<0.1	<0.008	8	0.001	0.11	0.0071	-	47
Total PeCDF isomers	<0.01	<0.03	<0.03	<0.2	<0.08	9	0.0062	0.22	<0.04	-	
1,2,3,4,7,8-HxCDF	<0.002	<0.003	<0.004	0.031	<0.004	2	<0.002	0.031	<0.005	-	76
1,2,3,6,7,8-HxCDF	<0.002	<0.004	<0.004	0.022	<0.002	4	<0.001	0.022	<0.005	-	76
2,3,4,6,7,8-HxCDF	<0.002	<0.002	<0.002	<0.03	<0.005	3	<0.002	0.038	<0.005	-	79
1,2,3,7,8,9-HxCDF	<0.002	<0.001	<0.004	0.032	<0.006	2	<0.001	0.032	<0.005	-	69
Total HxCDF isomers	<0.01	<0.04	<0.02	0.15	<0.05	3	<0.01	<0.4	<0.05	-	
1,2,3,4,6,7,8-HpCDF	<0.002	<0.003	<0.003	0.03	<0.004	3	<0.001	0.03	<0.004	-	60
1,2,3,4,7,8,9-HpCDF	<0.002	<0.005	<0.004	0.029	<0.004	3	<0.001	0.029	<0.005	-	57
Total HpCDF isomers	<0.004	<0.008	<0.008	0.094	<0.02	5	<0.004	0.094	<0.02	-	
OCDF	<0.006	<0.003	<0.004	<0.04	<0.007	2	<0.002	0.067	<0.01	-	
Sum of PCDD/-F (exc)[1]	**0.16**	**0.14**	**0.14**	**1.2**	**0**		**0**	**4.4**	**0.45**	**0.93**	
WHO_{98}-TEQ_{DF} (inc)[2]	**0.0051**	**0.013**	**0.0085**	**0.055**	**0.019**		**0.0049**	**0.47**	**0.034**	**0.077**	
WHO_{98}-TEQ_{DF} (exc)[1]	**0.000088**	**0.000017**	**0.00071**	**0.010**	**0**		**0**	**0.47**	**0.027**	**0.065**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCDD/PCDF congener detected on more than 66% of occasions (minimum of 15 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table E2b cont'd Concentrations of PCB in fish samples from Australia (pg g^{-1} fm)

Congener	SE Adelaide Region Flathead *Platycephalus sp.*	SE Adelaide Region Garfish *Hyporhamphus sp.*	SE Adelaide Region King George Whiting *Sillaginoides punctata*	SW Albany Region River Cobbler *Cnidoglanis macrocephalus*	SW Albany Region Flathead *Platycephalus sp.*	Number of positives	Minimum	Maximum	Median	Mean[3,4]	Mean of ^{13}C surrogate standard recoveries, %, n=23
PCB 77	0.14	0.44	0.4	<0.1	<0.1	21	<0.1	8.9	0.58	1.0	41
PCB 81	0.012	0.042	0.037	<0.02	<0.02	19	0.012	0.56	0.042	0.066	42
PCB 126	0.044	0.065	0.067	<0.01	0.087	19	<0.01	2.1	0.095	0.24	57
PCB 169	<0.02	<0.003	0.012	<0.05	0.048	14	<0.003	0.35	<0.05		58
PCB 105	1.8	5.5	2.9	1	2.2	22	<1	220	5	16	69
PCB 114	0.15	0.39	0.21	<0.05	<0.1	19	<0.05	13	0.28	0.90	70
PCB 118	<6	20	12	<4	8.8	18	<4	720	17	52	66
PCB 123	<0.1	<0.06	<0.2	<0.2	<0.1	11	<0.06	22	0.4		70
PCB 156	<0.6	1.3	0.86	<2	<2	17	0.46	88	2	6.2	64
PCB 157	<0.1	0.43	0.25	<0.2	<0.2	15	<0.08	25	0.62	1.7	59
PCB 167	<0.1	0.54	1.1	<0.2	1.2	6	<0.1	<30	<1		65
PCB 189	<0.04	0.045	<0.02	<0.2	<0.3	11	<0.02	5.7	0.2		70
Sum of PCB (exc)[1]	**2.1**	**29**	**18**	**1.0**	**12**		**1.0**	**1100**	**27**	**80**	
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.00027**	**0.00053**	**0.00048**	**0.000058**	**0.00052**		**0.000058**	**0.017**	**0.00058**	**0.0017**	
WHO_{98}-TEQ_{PCB} (exc)[1]	**0.00025**	**0.00053**	**0.00048**	**0.0000050**	**0.00050**		**0.0000050**	**0.017**	**0.00055**	**0.0017**	

1 = excluding LOD values
2 = including half LOD values
3 = Mean value reported only if a PCB congener detected on more than 66% of occasions (minimum of 15 positive determinations)
4 = For any individual congener, calculation of the mean includes half LOD values

Table E2c cont'd TEQ_{DF+PCB} in fish samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{FISH} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.0054**	**0.014**	**0.0091**	**0.057**	**0.020**		**0.0053**	**0.49**	**0.034**	**0.079**
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	**0.00034**	**0.00055**	**0.0012**	**0.013**	**0.00050**		**0.00034**	**0.49**	**0.028**	**0.067**

Table E2d cont'd TEQ_{DF}, TEQ_{PCB} and TEQ_{DF+PCB} in fish samples from Australia (pg TEQ g^{-1} fm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998)

WHO_{98}-TEQ_{DF} (inc)[2]	**0.0055**	**0.013**	**0.0092**	**0.054**	**0.018**		**0.0051**	**0.48**	**0.035**	**0.083**
WHO_{98}-TEQ_{PCB} (inc)[2]	**0.0053**	**0.010**	**0.0090**	**0.0016**	**0.011**		**0.0016**	**0.37**	**0.013**	**0.036**
WHO_{98}-TEQ_{DF+PCB} (inc)[2]	**0.011**	**0.023**	**0.018**	**0.056**	**0.029**		**0.011**	**0.85**	**0.054**	**0.12**

Table E2e cont'd Lipid content in fish samples from Australia (%)

Lipid concentration %	**1.4**	**2.0**	**2.5**	**1.0**	**1.0**		**0.40**	**6.4**	**1.3**	**2.0**

Appendix F Results of the interlaboratory calibration study

This appendix reports the comparison of the concentrations of PCDD/PCDF and PCB in the eight samples analysised by both AGAL and the Canadian Laboratory.

Figure F1 Interlaboratory analytical comparison between AGAL and MoE C laboratories in eight Australian sediments.

Table F1a Interlaboratory analytical comparison between AGAL and MoE C laboratories in eight Australian sediments. Concentrations of PCDD/PCDF (pg g^{-1} dm). Note that the AGAL results are reported also in Appendix D1 and D2.

	N		SE		SE		SE		SE		SE		SE		SE	
	Darwin Port of Darwin (ES1A)		Newcastle Hunter River (ES1A)		Sydney Parramatta R. (FW1A)		Sydney Lower Parramatta R. (ES1A)		Sydney Port Jackson West (ES2A)		Sydney Port Jackson East (ES1A)		Sydney Botany Bay (ES1A)		Wollongong Lake Illawarra (ES1A)	
Congener	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C
2,3,7,8-TCDD	<0.1	<0.3	<0.07	<0.4	<0.1	<0.3	41	46	39	15	<0.1	<0.5	2.1	1.6	0.14	0.5
Total TCDD isomers	2.7	2.2	5.9	5.5	1.4	1.6	160	180	230	230	1.9	1.8	92	130	36	45
1,2,3,7,8-PeCDD	0.4	<0.3	0.13	<0.3	0.24	<0.6	7.2	9.2	5.9	7.2	0.12	<0.5	6.1	6.2	1.1	1.5
Total PeCDD isomers	6.9	5.2	4.2	5.6	0.79	3.3	130	200	240	360	3.3	6.6	230	330	69	88
1,2,3,4,7,8-HxCDD	0.55	<0.6	0.38	<0.7	<0.5	<0.7	18	17	16	16	0.30	<0.7	14	14	2.7	3.7
1,2,3,6,7,8-HxCDD	0.79	<0.6	0.94	<1	0.91	1.5	85	97	36	41	0.80	1.3	29	27	4.5	5.2
1,2,3,7,8,9-HxCDD	1.4	1.5	<0.5	1.9	<0.5	1.9	34	56	38	67	0.70	2	41	60	7.4	15
Total HxCDD isomers	27	27	45	45	8.8	19	750	980	1500	2000	31	45	1940	2300	390	530
1,2,3,4,6,7,8-HpCDD	9.8	8.9	33	39	23	36	2400	3100	1200	1400	25	36	800	880	130	200
Total HpCDD isomers	33	30	130	140	51	86	4700	5900	4100	4500	84	120	3460	3800	580	870
OCDD	180	110	1200	1500	1600	2400	46000	57000	41000	47000	670	990	25100	30000	4400	7200
2,3,7,8-TCDF	<0.06	<0.1	0.26	0.66	0.17	0.55	4.0	13	4.8	9.6	0.13	<0.4	9.1	11	1.0	3.2
Total TCDF isomers	<0.5	<0.1	4.7	3.7	1.9	2	91	120	71	73	0.48	<0.4	64	66	19	24
1,2,3,7,8-PeCDF	<0.03	<0.2	0.21	<0.4	<0.08	<0.3	2.1	2.8	1.9	2.7	0.065	<0.3	2.2	2.3	0.85	1.2
2,3,4,7,8-PeCDF	<0.05	<0.1	<0.3	<0.4	<0.1	<0.3	6.6	7.3	4.8	4.9	0.098	<0.3	4.2	4	1.4	1.7
Total PeCDF isomers	<0.6	<0.2	2.3	2.3	1.1	1.2	110	110	60	61	0.74	0.74	32	33	14	16
1,2,3,4,7,8-HxCDF	0.19	<0.1	<0.2	0.94	<0.2	<0.3	24	28	5.9	13	<0.1	<0.6	<1	3.9	0.74	2.7
1,2,3,6,7,8-HxCDF	<0.06	<0.2	0.27	<0.5	0.29	<0.5	6.5	8.1	3.5	4.4	0.061	<0.4	2.2	2.2	1	1.4
2,3,4,6,7,8-HxCDF	<0.05	<0.3	0.17	<0.5	0.22	<0.3	4.9	5.8	3.7	4.5	0.085	<0.4	1.7	1.9	0.84	1.3
1,2,3,7,8,9-HxCDF	<0.05	<0.1	0.08	<0.2	<0.04	<0.2	<0.7	<0.7	0.45	<0.7	<0.01	<0.2	<0.3	<0.2	0.29	<0.4
Total HxCDF isomers	<0.6	<0.3	4.2	4.6	1.6	2.1	220	270	87	110	1.6	2.2	31	32	8.3	11
1,2,3,4,6,7,8-HpCDF	<0.1	<0.6	3.9	4.2	1.9	2.2	200	240	73	86	2.4	3.4	22	22	3.1	4.2
1,2,3,4,7,8,9-HpCDF	<0.07	<0.3	0.47	<0.8	0.19	<0.4	18	22	5.1	6.2	0.077	<0.3	<2	1.7	0.35	<0.7
Total HpCDF isomers	<0.4	<0.6	12	13	4.0	5.2	650	820	210	240	4.6	7	45	49	4.8	6.2
OCDF	<0.6	<0.5	17	14	5.7	5.5	720	910	220	270	5.4	7.3	42	39	2.7	3.9
Sum of PCDD/-F (exc)[1]	250	170	1400	1700	1700	2500	54000	66000	48000	55000	800	1200	31000	37000	5500	8800
WHO_{98}-TEQ_{DF} (inc)[2]	0.88	0.68	0.99	1.5	0.95	1.7	100	120	75	60	0.78	1.5	31	34	5.6	8.9
WHO_{98}-TEQ_{DF} (exc)[1]	0.81	0.25	0.85	0.93	0.81	1	100	120	75	60	0.72	0.82	31	34	5.6	8.9

1 = excluding LOD values
2 = including half LOD values

Table F1b Interlaboratory analytical comparison between AGAL and MoE C laboratories in eight Australian sediments. Concentrations of PCB (pg g^{-1} dm). Note that the AGAL results are reported also in Appendix D1 and D2.

	N		SE		SE		SE		SE		SE		SE		SE	
	Darwin Port of Darwin (ES1A)		Newcastle Hunter River (ES1A)		Sydney Parramatta R. (FW1A)		Sydney Lower Parramatta R. (ES1A)		Sydney Port Jackson West (ES2A)		Sydney Port Jackson East (ES1A)		Sydney Botany Bay (ES1A)		Wollongong Lake Illawarra (ES1A)	
Congener	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C	AGAL	MoE C
PCB 77	<0.8	<0.4	6.4	4.9	13	9	270	210	320	360	2.9	2.8	710	520	46	49
PCB 81	<0.03	<0.2	0.29	<0.3	0.39	0.4	10	8.3	13	12	0.1	<0.3	13	9.1	1.9	1.4
PCB 126	<0.09	<0.2	0.64	0.73	2.0	2.5	21	29	23	24	0.32	0.65	28	26	2.5	2.8
PCB 169	<0.1	<0.1	<0.1	<0.2	<0.2	0.2	1.5	1.9	2.1	2.2	<0.02	<0.2	0.83	1.2	0.4	<0.5
PCB 105	<4	2.2	55	73	190	290	1500	1900	1300	1800	11	17	1480	1600	110	140
PCB 114	<0.3	<0.8	2.2	3.6	8.2	11	62	80	54	77	<0.2	<1	52	50	5.5	5.5
PCB 118	<10	5.5	150	200	570	830	3500	4900	3100	4100	36	49	5580	5800	280	320
PCB 123	0.44	<0.4	4.1	8.9	20	31	110	180	160	220	1.3	5.1	160	160	7.1	9.4
PCB 156	<2	0.89	16	22	53	83	380	610	270	410	4.9	6.3	460	450	23	27
PCB 157	<0.6	<0.4	4.6	5.6	16	<22	110	170	70	110	<1	2.1	150	140	6.7	8.4
PCB 167	<0.6	<0.6	<5	8.9	<20	35	100	270	110	190	<3	4.3	<100	240	<9	12
PCB 189	<0.5	<0.3	1.1	1.3	2	3.4	36	46	43	43	<0.6	0.78	27	30	<1	2.1
Sum of PCB (exc)[1]	0.44	8.6	240	330	870	1300	6100	8400	5500	7300	57	88	8700	9000	480	580
WHO_{98}-TEQ_{PCB} (inc)[2]	0.0065	0.012	0.098	0.12	0.32	0.42	2.9	4.1	3.0	3.4	0.040	0.078	3.9	3.7	0.32	0.36
WHO_{98}-TEQ_{PCB} (exc)[1]	0.000044	0.0012	0.097	0.12	0.32	0.42	2.9	4.1	3.0	3.4	0.040	0.077	3.9	3.7	0.32	0.35

1 = excluding LOD values
2 = including half LOD values

Table F1c TEQ_{DF+PCB} in Australian sediments (pg TEQ g^{-1} dm). TEQ is based on TEF_{HUMANS} (van den Berg et al. 1998).

WHO_{98}-TEQ_{DF+PCB} (inc)[2]	0.89	0.70	1.1	1.7	1.3	2.1	100	130	78	63	0.82	1.6	35	38	5.9	9.3
WHO_{98}-TEQ_{DF+PCB} (exc)[1]	0.81	0.25	0.94	1.1	1.1	1.4	100	130	78	63	0.76	0.90	35	38	5.9	9.3

Appendix G Literature review

This Appendix attempts to summarise relevant data on dioxin-like chemicals in sediments, bivalves and fish from Australian studies and recent international studies.

Table G1 Summary of concentration of dioxin-like chemicals in sediments from Australian and international studies

Region	Sample Type	Date sampled	n	Analysis	∑17 PCDD/PCDF pg g^{-1} dm				pg TEQ g^{-1} dm				Reference
					Mean	Median	Min	Max	Mean	Median	Min	Max	
Australia/New Zealand													
Australia	Freshwater	2001-2002	33	WHO TEQ (exc LOD)	490	150	<4	8500	0.41	0.072	0.002	2.9	This study*
Australia	Estuarine	2001-2002	30	WHO TEQ (exc LOD)	14000	1500	7.6	110000	32	2.1	0.0038	520	This study*
Australia	Marine	2001-2002	12	WHO TEQ (exc LOD)	460	33	<3	2500	0.67	0.0085	0.000002	3.9	This study*
Australia,	Marine		8	I-TE	362	600	44	1300	0.89	1.4	0.09	2.8	Gaus et al. 2001
Australia, Coastal Queensland	Marine	1997	6	I-TE	851.4	355	14.7	2985	1.56	0.785	0.05	4.6	Muller et al. 19991
Australia, Coastal Queensland	Estuarine	1997	2	I-TE			2717	5621			5.4	9.9	Muller et al. 19991
Australia, Port Phillip Bay	Marine	1991-1992	6	I-TE					0.22	0.1	0.1	0.4	Moss and Haynes 1993
Australia, Port Phillip Bay	Marine		17	I-TE					3.5	0.995	0.13	32	Bremner et al. 1990
New Zealand	Estuarine		26	I-TE	100.8		1.85	532.59	0.53		0.081	2.71	Scobie et al. 1998
Asia													
Hong Kong Harbour	Marine		6	I-TE			310	11000			4	33	Muller et al. 2001
Hong Kong, Mai Po Marshes	Estuarine		4	I-TE			5000	6900	12.5		11	16	Muller et al. 2001
Japan, Tokyo Bay	Marine	2000	11	WHO TEQ							3.2	52	Hosomi et al. 2003
Japan, Tokyo Bay	Marine	1998	205	WHO_{PCB} TEQ					6.8	0.41	0	260	EA Japan 1999
Japan, Tokyo Bay	Marine	1995	7	I-TE							11.1	52.3	Sakurai et al. 2000
Korea	Marine	2000	19	I-TE			18.2	804			0.01	5.5	Moon et al. 2001
Russia, Caspian Sea	Marine		17	I-TE							0.7	28	Yu et al. 2002
Europe													
Germany, River Elbe	Freshwater	2002	41	I-TE							1	142	Knoth et al. 2003
Italy, Venice lagoon	Marine	1995	5	I-TE						4	0.39	27	Jiminez et al. 1999
Italy, Venice Lagoon	Marine	1992-2000	20	I-TE			9	3900			0.24	56	Miniero et al. 2003a
Italy, Northern Adriatic	Marine	1992-2000	12	I-TE			2.4	910			0.27	5	Miniero et al. 2003b
Italy, River Po	Freshwater		10	I-TE (1/2 LOD)			121	814			1.3	13	Fattore et al. 2002
Baltic Sea	Marine	1993	6	I-TE							26	71	Koistinen et al. 1997

Table G1 cont'd Summary of concentration of dioxin-like chemicals in sediments from Australian and international studies

Region	Sample Type	Date sampled	n	Analysis	∑17 PCDD/PCDF pg g^{-1} dm				pg TEQ g^{-1} dm				Reference
					Mean	Median	Min	Max	Mean	Median	Min	Max	
North Sea	Estuarine		5	I-TE						1.56	0.58	2.8	Tyler et al. 1994
North Sea, Humber Estuary	Estuarine	1991	25	I-TE			<48	3072			<1	38.9	Tyler and Millward 1996
Spain, Rivers and Coast	Freshwater/Marine	1988 and 1990's	11	I-TE total					4.15	3.69	0.42	8	Eljarrat et al. 2001
Finland	Freshwater/Marine	1999		I-TE							0.7	100	Fiedler et al. 1999
Germany	Freshwater/Marine	1999		I-TE							1.2	19	Fiedler et al. 1999
Italy	Freshwater/Marine	1999		I-TE							0.07	10	Fiedler et al. 1999
Netherlands	Freshwater/Marine	1999		I-TE							1	10	Fiedler et al. 1999
Sweden	Freshwater/Marine	1999		I-TE							0.8	207	Fiedler et al. 1999
North America													
Canada, Great Lakes	Freshwater	1995	6	I-TE							3.3	18	Marvin et al. 2002
USA, Florida	Marine		32	US EPA TEQ							0.5	77.8	Hemming et al. 2003
USA, New York Harbour	Marine		176	WHO TEQ							23	880	Litten et al. 20032
USA, Passaic River	Freshwater	1999-2000	15	I-TE							310	1400	Iannuzzi et al. 2001
USA, Roanoke River Basin	Freshwater	2001	45	WHO TEQ							0.3	34	Tysklind et al. 2002
South America													
Rio di Janiero, Guanara Bay	Marine			I-TE							900	2200	Carvalhaes et al. 2001
South Africa													
South Africa			22							0.34	0.2	22	Vosloo and Bouwman 2003

[1] Values converted from pg g^{-1} TOC (TOC-total organic carbon)
[2] Maximum and minimum means
* TEQ includes dioxin-like PCB

Table G2 Summary of concentration of dioxin-like chemicals in bivalves from Australian and international studies

Region	Species	Sample Type	n	Analysis	∑17 PCDD/PCDF pg g^{-1} fm				pg TEQ g^{-1} fm				Reference
					Mean	Median	Min	Max	Mean	Median	Min	Max	
Australia/New Zealand													
Australia	Bivalves	Freshwater	1	WHO_{FISH} TEQ (exc LOD)				9.8				0.023	This study*
Australia	Bivalves	Estarine	11	WHO_{FISH} TEQ (exc LOD)		29	0.43	230		0.2	0.0043	1.2	This study*
Australia	Bivalves	Marine	6	WHO_{FISH} TEQ (exc LOD)		26	1	90		0.08	0.012	0.9	This study*
Australia, Port Phillip Bay	Mussels, *Mytilus Edulis*	Marine		I-TEQ					0.359		0.298	0.709	Haynes and Toohey, 1995
Australia, Port Phillip Bay	Mussels, *Mytilus Edulis*	Marine									<0.1		EPA 1991
New Zealand	Shellfish	Estuarine	26	I-TEQ (excl LOD)		2.9	0	70.8		0.0031	0	0.23	Scobie et al. 1999
Asia													
China, Ya-Er Lake	Mussels, *Acuticosta chinensis*	Freshwater	2	I-TEQ			27.3	35.8			0.34	0.43	Wu et al. 2001
Japan, Tokyo Bay	Short necked clam	Marine	4	Total TEQs (incl. LOD)					0.1	0.09	0.07	0.14	Tsutsumi et al. 2003
Japan, Tokyo Bay	Oyster	Marine	5	Total TEQs (incl. LOD)					0.49	0.39	0.22	1.1	Tsutsumi et al. 2003
Korea	Mussels, *Mytilus coruscus*	Marine	10	WHO TEQ (excl LOD)					0.374		0.001	1.226	Choi et al. 2001
Korea	Little neck clam, *Rudiatapas philippinarium*	Marine	10	WHO TEQ (excl LOD)					0.028		0.001	0.019	Choi et al. 2001
Korea	Oyster, *Crassostrea gigas*	Marine	10	WHO TEQ (excl LOD)					0.147		0.002	0.196	Choi et al. 2001
Europe													
Norway, South Coast	Mussels	Marine									1.6	3	Karl et al. 2002
Germany											0.55	0.96	Umweltbundesamt 2002
Italy, Adriatic Sea	Clam, *Chamelea gallina*	Marine	3 pooled	I-TEQ					0.1	0.1	0.07	0.13	Bayarri et al. 2001
Italy, Adriatic Sea	Mussels, *Mytilus galloprovincialis*	Marine	3 pooled	I-TEQ					0.17	0.16	0.11	0.24	Bayarri et al. 2001
Italy, Venice Lagoon	Clams, *Tapes sp.*	Marine	20				2.9	32			0.17	1	Miniero et al. 2003

Table G2 cont'd Summary of concentration of dioxin-like chemicals in bivalves from Australian and international studies

Region	Species	Sample Type	n	Analysis	∑17 PCDD/PCDF pg g^{-1} fm				pg TEQ g^{-1} fm				Reference
					Mean	Median	Min	Max	Mean	Median	Min	Max	
Norway, Frierfjord	Mussels, *Mytilus edulis*	Marine	3 pools of 50	WHO ∑TEQ			62	128			1.6	3	Knutzen et al. 2003
Spain	Mussels	Marine		WHO TEQ (excl LOD)							0.11	0.54	Abad et al. in press
North America													
Canada, St Lawrence Estuary	Whelks, *Buccinum undatum*	Estuarine	2	I-TEQ (excl LOD)			36.1	36.6			1.79	1.84	Brochu et al. 1995
Canada, Great Lakes	Mussels, *Dreissena spp* and *Elliptio complanata*	Freshwater	5	I-TEQ							0.89	1.6	Marvin et al. 2002[2,3]
USA, Acata Bay	Mussels	Marine	1	WHO TEQ							1		Wenning et al. 2003
USA, Acata Bay	Oysters	Marine	9	WHO TEQ					0.22		0.16	0.25	Wenning et al. 2003[2]
USA, New York Harbour	Mussels, *Modiolus demissus*	Marine	81	WHO TEQ							1.5	38	Litten et al. 2003[2]
USA, Texas	Oysters	Marine		dm?			66	257			3.1	24.1	Gardinali and Wade, 1996[1]

[1] From Buckland et al. 1998
[2] Maximum and minimum means
[3] Converted from dry mass to wet mass using a conversion factor of 1/5.5 (Ref)
dm is dry mass
* TEQ includes dioxin-like PCB

Table G3 Summary of concentration of dioxin-like chemicals in fish from Australian and international studies

Region	Species	Sample Type	n	Analysis	∑17 PCDD/PCDF pg g^{-1} fm				pg TEQ g^{-1} fm				Reference
					Mean	Median	Min	Max	Mean	Median	Min	Max	
Australia/New Zealand													
Australia	Fish	Freshwater	3	WHO_{FISH} TEQ (exc LOD)		0.75	0.37	3.6		0.089	0.034	0.36	This study*
Australia	Fish	Estuarine	9	WHO_{FISH} TEQ (exc LOD)		1.1	0.17	4.4		0.044	0.0054	0.49	This study*
Australia	Fish	Marine	12	WHO_{FISH} TEQ (exc LOD)		0.48	0.22	1		0.027	0.0054	0.095	This study*
Australia, Bass Strait	Flathead and Whiting	Marine		I-TE							0.048	0.147	Moss and Haynes 1993
Australia, Port Phillip Bay	Flathead and Mullet	Marine									1	1.7	EPA 1991
Australia, Lake Coleman	Carp, *Cyprinus carpio*	Freshwater	4								0.48	4	Ahokas et al. 1994
New Zealand, Lake Rotarua	Rainbow Trout	Freshwater	8	I-TE					0.74		0.59	0.88	Gifford et al. 1996
New Zealand	Rainbow Trout	Freshwater	12	I-TE (1/2 LOD)	2.3	0.11	0	13.2	0.056	0.042	0	0.2	Buckland et al. 1998
New Zealand	Shortfinned Eels	Freshwater	16	I-TE (1/2 LOD)	0	0.17	0	1.61	0.06	0.033	0	0.38	Buckland et al. 1998
Asia													
China, Ya-Er Lake	Common carp and Bighead	Freshwater	5	I-TE (lipid)			1135	2600			122	134	Wu et al. 2001
India, Ganges River	Several fish sp.	Freshwater		lipid	130								Kumar et al. 2001
India, Bay of Bengal	Indian sardine and Golden Anchovy	Marine		lipid	12								Kumar et al. 2001
Japan, Tokyo Bay	Sole, Flounder and Sea Bass	Marine	3 (7 indiv)	WHO-TEQ	22.6	20.67	16.27	30.76	1.7	1.53	1.15	2.41	Naito et al. in press
Japan, Tokyo Bay	Fish	Marine	65	WHO-TEQ							0.05	23.09	Tsutsumi et al. 2003
Japan, Tokyo Bay	Fish	Marine	6	I-TE (excl LOD)					1.16	1.07	0.32	2.07	Sakurai et al. 2000
Korea	Mackerel	Marine	10	WHO TEQ (exc. LOD)					0.858		0.25	1.388	Choi et al. 2001
Europe													
Baltic	Baltic Herring	Marine		WHO TEQ					15		1.77	74	Kiviranta et al. 2003*
Europe	Fish			I-TE (fat)							2.4	214.3	Buckley-Golder 1999
Germany, Baltic Sea		Marine							1.9			3.2	Karl et al. 2002
Germany	Fish	Freshwater	7	I-TE							0.75	13	Umweltbundesamt 2002
Germany	Fish	Estuarine	5	I-TE							0.5	4.1	Umweltbundesamt 2002

Table G3 cont'd Summary of concentration of dioxin-like chemicals in fish from Australian and international studies

Region	Species	Sample Type	n	Analysis	∑17 PCDD/PCDF pg g^{-1} fm				pg TEQ g^{-1} fm				Reference
					Mean	Median	Min	Max	Mean	Median	Min	Max	
Italy, Adriatic Sea	Mackeral, Red mullet and Anchovy	Marine	9	I-TE							0.23	1.07	Bayarri et al. 2001
Mediterranean Sea	Fish	Marine		WHO-TEQ					0.187	0.148	0.042	2.2	Abad et al. 2003
Norway, Frierfjord	Cod, Sea Trout, Flounder, Eel and Herring	Marine		WHO ∑TEQ			7.9	184			1.9	26.2	Knutzen et al. 2003
Spain, Mediterranean Sea	Fish	Marine		WHO-TEQ					1.2	1.9	0.14	2.2	Abad et al. 2003*
Spain, Atlantic Ocean	Fish	Marine		WHO-TEQ					0.62	0.2	0.053	2.4	Abad et al. 2003*
Spain, Turia River	Trout	Freshwater	5	WHO TEQ	1.06		0.82	1.4	0.183		0.16	0.23	Bordajandi et al. in press
Spain, Turia River	Eel	Freshwater	11	WHO TEQ	2.19		1.19	3.15	0.369		0.2	0.58	Bordajandi et al. in press
Sweden	Fish			$I\text{-}TE_{DF}$ (lipid)								420	Fiedler 1999
UK	Fish			$I\text{-}TE_{DF}$ (lipid)								700	Fiedler 1999
UK	Pike, Roach, Eel and Brown Trout	Freshwater	6	I-TE			110	770			0.9	22	Rose and McKay 1996
North America													
Canada	Arctic Graying and Mountain Whitefish	Freshwater	4				0.48	0.78					Ikonomou et al. 1999[2]
Canada	Halibut and Plaice	Estuary	4	I-TE			1.3	9.9			0.4	1.98	Brochu et al. 1995
USA, New York Harbour	Striped bass	Marine	74	WHO TEQ							1.9[?]	29[?]	Litten et al. 2003[2]
USA, Prassaic River	Striped bass, White perch, Eel	Freshwater	15 sites	WHO-fish TEQ (1/2 LOD)							5.1	110	Iannuzzi et al. 2003
USA, Sanfrisco Bay	Sport fish (includ. white croaker, leopard shark)	Marine	18 pools	I-TE fm?							0.12	1.75	Fairey et al. 1997
Pacific													
Pacific Ocean	Fish	Marine		WHO-TEQ								0.37	Abad et al. 2003*

[1] from Buckland et al. 1998
[2] Minimum and maximum means
fm is fresh mass
*TEQ includes dioxin-like PCB
[?]assumed to fm