4 Summary of findings

This report details findings from a study of dioxins, furans and dioxin-like PCBs in Australian air across a wide range of locations. Nine sites were originally proposed for the study and a tenth site, Netley, which is close to the Adelaide airport and is designated “light industrial”, was added in early 2003.

Measurements of the 17 toxic dioxin and furan compounds as well as supporting concentrations of the total homologue groups, the 12 dioxin like PCB congeners and a suite of inorganic and light organic aerosol components were conducted over a complete annual cycle, with predominantly one-month integral collections. At two sites, Mutdapilly in south-east Qld and Netley in SA, the sample period was adjusted to two-monthly integrals after the start of the study.

One of the major findings of this study is the very clear, strong, seasonal cycle in PCDD/PCDF concentrations, both as mass concentrations and TEQ, with a winter concentration maximum that occurs in all of the major population centres studied, from Perth, through Adelaide, Melbourne, Sydney and as far north as Brisbane. In these cities, the difference between winter maximum and summer minimum concentrations is large, and summer concentrations in general are very low by world standards.

The seasonal variation in PCDD/PCDF concentration, correlation with aerosol nssK, a tracer for biomass burning, and association of PCDD/PCDF with nssK by factor analysis, all point to a residential wood smoke source for this strong winter enhancement. This is further supported by the “winter” congener pattern which shows strong resemblances to congener patterns found previously in a controlled study of wood smoke emissions from Australian residential wood heaters – and to homologue patterns observed in Christchurch and Masterton NZ during winter.

Even with the winter enhancement in PCDD/PCDF, mean concentrations in the major cities are low by world standards.

Seasonal cycles in TEQ_{DF} were also observed in rural Queensland and rural Victoria, although these were weaker than in the major urban locations. Likewise, a weak dry season to wet season difference was found in Darwin (Berrimah) with $TEQ_{DF,}$ concentrations in the dry season around four times those found during the wet season. Mean concentrations are very low, however, with the obvious conclusion that the impact of top-end dry season burning appears relatively minor on PCDD/F concentrations (during the study period).

Extremely low PCDD/PCDF concentrations were observed in clean marine air and also in rural locations removed from the major urban centres. In both cases, this indicates a very clean regional background with the major sources being local and associated with the urban population. Even so, for the urban/industrial locations studied, mean concentrations must be considered to be low compared with international cities. Concentrations typically are comparable, and tending to be less than corresponding New Zealand locations.

The relative contributions of TEQ_{DF} and TEQ_{P} vary across the different locations. For the urban locations the PCB concentrations appear to be more location specific than the PCDD/PCDF concentrations. The SA site in Netley has the highest dioxin-like PCB levels in ambient air of the locations studied and the highest fraction of PCBs in the $TEQ_{DF\&P}$. Other important differences include the patterns of seasonal variation, with PCB concentrations typically being higher in the warmer seasons, compared with the winter maxima for dioxins. Also, the general lack of correlation between concentrations of these dioxin-like PCBs and the dioxins which points to different sources or transformation histories for these species. Of the PCBs, PCB169 appears to correlate most strongly with the PCDD/PCDFs.

A local pollution event at Cape Grim, the reference site for the study, occurred in May-June 2003. This coincided with an electrical burnout of a plastic-encapsulated electronic component assembly in a nearby sampler, and this gave very high local loadings of heavier, highly chlorinated dioxins and furans.

Overall, the one-year study shows that concentrations of PCDD/PCDF and dioxin-like PCBs in Australian air are very low. PCDD/PCDFs have a pronounced seasonal cycle with a winter maximum in most large Australian cities, and this appears to be largely due to wood burning for residential heating.

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Appendix A Quality assurance plan

Quality assurance plan used for the ambient sampling program.

The quality assurance plan comprises a set of standard operating procedures, data quality objectives and quality control measures. Within the standard procedures for sampling and analysis there are a number of specific quality control measures, as outlined below.

Quality Control (QC) procedures for Stage 1 (sampling program)

<u>Field blanks</u>

Five percent of samples – these are samples that undergo all operations except extended exposure. Extraction and analyses are the same as for regular samples (principal analyst, AGAL). *This procedure checks trap cleaning and maintenance of integrity during handling (loading, unloading etc) and shipping procedures.*

<u>Collocated samples</u>

Fiver percent of samples – two samplers are operated side by side in the field; the paired samples undergo normal procedures. One of each pair of samples is treated the same as normal samples, with extraction and analysis by the principal analysts (AGAL) and the other sample in each pair extracted and analysed by independent analysts. These samples will be collected at the Alphington site. *This procedure provides a check of overall reproducibility (extraction, clean-up plus analytical precision).*

<u>Replicate analyses</u>

Equivalent to 10% of samples – this set includes all collocated samples plus 5% of the normal sample stream split into two aliquots after extraction and clean-up at AGAL (primary analysts). Analyses by the independent analysts. *This procedure provides a measure of determination accuracy.*

<u>Flow calibration</u>

Integrated flow will be referenced to either a CSIRO dry gas meter (S.I.M Brunt, model G6, S/N 07615), which has been calibrated using a wet-test meter (CAR Aspendale, 14/5/02), or independently certified. Calibrated orifice plates will be available for flow checking in the field. Differential pressure gauges will be referenced to a Wallace and Tiernan absolute pressure sensor (Model FA129 S/N EE15626), located at CAR Aspendale. *These procedures provide a check of the flow metering system for each sample.*

Specific quality control procedures for Stage 2 (sample analyses)

- A laboratory blank will be analysed with each batch of samples
- A matrix spike will be analysed with each batch of samples as a replicate to assess method precision
- Laboratory spiking of the sample cartridge with a range of isotopically-labelled standards, prior to sampling, will be used to assess breakthrough (if any) during the sampling period
- The HRMS resolution, performance and sensitivity will be established for each MS run

- The recoveries of all isotopically-labelled surrogate standards will be calculated and reported
- Ten percent of all samples will be analysed by an independent crosscheck quality control laboratory (as outlined in sampling procedures section).

Analyte identification and quantification criteria

For positive identification and quantification, the following criteria will be required to be met for the analysis of the samples and duplicate samples:

- The retention time of the analyte must be within one second of the retention time of the corresponding ^{13}C surrogate standard
- The ion ratio obtained for the analyte must be ±10% (±20% for PCBs) of the theoretical ion ratio
- The signal-to-noise ratio must be greater than 3:1
- Levels of PCDD/PCDF and 'dioxin-like' PCB congeners in a sample must be 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 must be in the range 10-120%.

Data Quality Objectives (stage1 & stage 2)

- Air flow: calibrated accuracy < ± 3%
- Intact sample return: 100%
- Blank levels: Concentrations of target compounds less than or equal to 2-20 pg for tetra-, penta-, and hexa- and 40 to 150 pg for hepta- and octa-CDDs for each pair of filter and trap assembly (for unexposed traps)
- Analytical precision (determined from replicate matrix spikes), < ±10% for congener means. Note: this may not be achievable at concentrations less than 10x LOD. (e.g. for the NZ study* precision was generally < ±10% for congener means and for OCDD ±21%)
- Accuracy of determination (as estimated by inter-laboratory determinations): < ±25% overall, total TEQ (e.g., for the NZ study* individual congener differences for five replicate analyses were 0.7-95%, and for total TEQ, 7-53%)
- Overall sensitivity/LOD: 1-10 pg per sample extract (for 2,3,7,8-TCDD). For a sample volume of 5000 m^3 this is equivalent to ambient concentrations less than 2 fg m^{-3}.

(*Buckland, S.J., H.K. Ellis and R.T. Salter, 1999)

Appendix B Sampling schedule tables, by site.

Tables B1 to B11 in this appendix give the sample start and finish times for each filter and trap by site also the standardised volume flow data for each sampling period.

Table B1 Wattleup, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow+ (m^3)
2/09/2002 11:15	6/09/2002 16:30	DX9	DAU0802F	1126
6/09/2002 17:00	13/09/2002 12:10	DX10	DAU0802F	1800
13/09/2002 12:30	20/09/2002 17:35	DX31	DAU0802F	1902
20/09/2002 18:00	28/09/2002 12:50	DX32	DAU0802F	2045
28/09/2002 13:40	5/10/2002 14:00	DX56	DAU0911I	1662
5/10/2002 14:30	11/10/2002 12:25	DX57	DAU0911I	1536
11/10/2002 13:05	18/10/2002 17:50	DX71	DAU0911I	2319
18/10/2002 17:50	25/10/2002 15:20	DX72	DAU0911I	1795
25/10/2002 15:20	1/11/2002 17:20	DX81	DAU0911I	1832
1/11/2002 18:00	7/11/2002 17:55	DX95	DAU1016F	1541
7/11/2002 18:15	15/11/02 10:45	DX106	DAU1016F	1864
15/11/02 11:05	21/11/2002 17:05	DX107	DAU1016F	1854
21/11/2002 17:35	29/11/2002 12:15	DX114	DAU1016F	2228
29/11/2002 12:45	5/12/2002 18:15	DX115	DAU1211C	1580
5/12/2002 18:35	12/12/2002 15:40	DX129	DAU1211C	1761
12/12/2002 16:15	19/12/2002 17:30	DX136	DAU1211C	1817
19/12/2002 17:45	27/12/2002 19:15	DX137	DAU1211C	1971
27/12/2002 19:35	2/01/2003 12:25	DX154	DAU1211C	1437
2/01/2003 12:55	9/01/2003 14:27	DX155	DAU1216D	1849
9/01/2003 14:55	22/01/2003 11:50	DX156	DAU1216D	3250
22/01/2003 12:15	2/02/2003 17:05	DX190	DAU1216D	2784
2/02/2003 17:35	10/02/2003 18:35	DX191	DAU012103B	2032
10/02/2003 18:35	14/02/2003 18:15	DX214	DAU012103B	987
14/02/2003 18:40	22/02/2003 10:50	DX215	DAU012103B	1885
22/02/2003 11:15	28/02/2003 16:25	DX231	DAU012103B	1544
28/02/2003 16:55	10/03/2003 10:20	DX232	DAU021403F	2369
10/03/2003 10:45	17/03/2003 11:25	DX249	DAU021403F	1796
17/03/2003 11:50	25/03/2003 15:10	DX248	DAU021403F	2067
25/03/2003 15:35	31/03/2003 12:10	DX265	DAU021403F	1507
31/03/2003 12:40	7/04/2003 11:20	DX266	DAU031703B	1743
7/04/2003 11:45	15/04/2003 16:50	DX279	DAU031703B	2058
15/04/2003 17:15	24/04/2003 16:20	DX280	DAU031703B	2276
24/04/2003 16:45	30/04/2003 12:40	DX306	DAU031703B	1469
30/04/2003 13:10	6/05/2003 10:45	DX307	DAU041603G	1462
6/05/2003 11:05	13/05/2003 10:40	DX308	DAU041603G	1778
13/05/2003 11:05	21/05/2003 13:35	DX334	DAU041603G	2078
21/05/2003 14:00	3/06/2003 21:40	DX335	DAU041603G	3415
3/06/2003 22:10	10/06/2003 11:10	DX367	DAU052903I	1667
10/06/2003 11:30	19/06/2003 11:30	DX368	DAU052903I	2259
19/06/2003 11:50	27/06/2003 10:20	DX381	DAU052903I	2064
27/06/2003 10:45	3/07/2003 10:40	DX393	DAU053003H	1579
3/07/2003 11:05	10/07/2003 8:10	DX394	DAU053003H	1839
10/07/2003 8:25	18/07/2003 12:15	DX411	DAU053003H	2089
18/07/2003 12:40	25/07/2003 11:55	DX412	DAU053003H	1970
25/07/2003 12:20	1/08/2003 11:45	DX432	DAU053003H	1885
1/08/2003 12:15	8/08/2003 15:45	DX433	DAU072103J	1923
8/08/2003 16:05	15/08/2003 9:35	DX449	DAU072103J	1781
15/08/2003 9:50	22/08/2003 13:10	DX450	DAU072103J	1896
22/08/2003 13:30	1/09/2003 10:05	DX468	DAU072103J	2595

Table B2 Duncraig, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow[+] (m^3)
03/9/02 11:20	10/9/02 12:32	DX3	DAU0802K	1762
10/9/02 13:06	17/9/02 11:12	DX4	DAU0802K	1739
17/9/02 11:33	24/9/02 11:33	DX23	DAU0802K	1718
24/9/02 11:53	01/10/02 11:49	DX24	DAU0802K	1766
01/10/02 12:27	08/10/02 15:33	DX58	DAU0911E	2019
08/10/02 16:00	15/10/02 14:48	DX59	DAU0911E	1856
15/10/02 15:03	22/10/02 11:13	DX73	DAU0911E	1875
22/10/02 11:29	29/10/02 11:50	DX74	DAU0911E	1924
29/10/02 12:12	05/11/02 13:28	DX80	DAU1016B	1924
05/11/02 13:28	12/11/02 11:10	DX93	DAU1016B	1893
12/11/02 11:26	19/11/02 11:09	DX94	DAU1016B	2000
19/11/02 11:30	26/11/02 11:05	DX110	DAU1016B	2058
26/11/02 11:17	03/12/02 11:20	DX111	DAU1016B	2121
03/12/02 11:20	10/12/02 13:26	DX130	DAU1211E	1921
10/12/02 13:24	17/12/02 12:12	DX134	DAU1211E	1989
17/12/02 12:29	24/12/02 12:25	DX135	DAU1211E	1972
24/12/02 12:38	31/12/02 11:20	DX147	DAU1211E	2037
31/12/02 11:36	07/1/03 10:58	DX151	DAU1216C	2022
07/1/03 11:17	14/1/03 11:47	DX152	DAU1216C	2024
21/1/03 13:55	28/1/03 11:35	DX182	DAU1216C	2062
28/1/03 11:35	04/2/03 15:00	DX184	DAU1216C	2271
04/2/03 15:00	11/2/03 11:20	DX185	DAU012103D	2238
11/2/03 11:58	18/2/03 15:05	DX208	DAU012103D	1899
18/2/03 16:20	25/2/03 10:37	DX209	DAU012103D	1908
25/2/03 10:55	04/3/03 15:16	DX237	DAU012403B	1954
04/3/03 15:30	11/3/03 15:42	DX238	DAU012403B	1978
11/3/03 15:56	18/3/03 12:55	DX242	DAU012403B	1994
18/3/03 13:10	25/3/03 11:06	DX243	DAU012403B	1959
25/3/03 11:18	01/4/03 11:42	DX263	DAU012403B	2050
01/4/03 12:00	08/4/03 11:14	DX264	DAU031403D	2066
08/4/03 11:14	15/4/03 09:47	DX277	DAU031403D	2068
15/4/03 09:57	22/4/03 00:49	DX278	DAU031403D	2167
25/4/03 12:00	29/4/03 12:17	DX319	DAU031403D	1280
29/4/03 12:17	06/5/03 11:33	DX320	DAU041603E	1786
06/5/03 11:47	13/5/03 11:26	DX321	DAU041603E	1884
13/5/03 11:40	20/5/03 10:55	DX328	DAU041603E	1969
20/5/03 11:07	27/5/03 11:34	DX329	DAU041603E	1961
27/5/03 11:47	03/6/03 12:23	DX348	DAU041603E	2033
03/6/03 12:42	12/6/03 10:30	DX349	DAU052903G	2573
19/6/03 11:10	26/6/03 10:00	DX375	DAU052903G	2136
26/6/03 11:20	03/7/03 10:45	DX376	DAU053003F	2082
03/7/03 11:15	10/7/03 12:00	DX387	DAU053003F	1825
10/7/03 12:00	17/7/03 14:45	DX388	DAU053003F	1862
17/7/03 15:06	24/7/03 11:00	DX405	DAU053003F	1769
24/7/03 11:15	31/7/03 10:34	DX406	DAU053003F	1817
31/7/03 11:26	08/8/03 13:15	DX427	DAU072103I	2058
08/8/03 13:40	18/8/03 09:00	DX443	DAU072103I	2484
18/8/03 09:30	28/8/03 09:20	DX444	DAU072103I	2509
28/8/03 09:35	04/9/03 14:15	DX473	DAU072103I	1802

Table B3 Berrimah, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow+ (m^3)
22/8/02 11:30	29/8/02 15:00	DX6	DAU0802J	1675
29/8/02 15:00	05/9/02 13:20	DX5	DAU0802J	1676
05/9/02 13:45	12/9/02 09:15	DX25	DAU0802J	1652
12/9/02 09:25	20/9/02 08:45	DX26	DAU0802J	1933
20/9/02 08:45	26/9/02 11:00	DX40	DAU0802J	1480
26/9/02 12:15	03/10/02 09:25	DX48	DAU0911J	1607
03/10/02 10:45	10/10/02 09:05	DX69	DAU0911J	1623
10/10/02 09:30	17/10/02 09:35	DX70	DAU0911J	1649
18/10/02 10:15	25/10/02 14:35	DX47	DAU0911J	1992
25/10/02 15:07	01/11/02 09:20	DX78	DAU0911J	1700
01/11/02 10:16	07/11/02 09:25	DX90	DAU1016A	1477
07/11/02 10:04	14/11/02 08:15	DX89	DAU1016A	1734
14/11/02 08:50	21/11/02 08:50	DX101	DAU1016A	1752
21/11/02 09:20	04/12/02 09:00	DX102	DAU1016A	3331
04/12/02 10:00	12/12/02 09:40	DX126	DAU1211B	1864
12/12/02 10:00	20/12/02 08:45	DX127	DAU1211B	1926
20/12/02 09:00	04/1/03 10:50	DX148	DAU1211B	3751
04/1/03 10:50	09/1/03 08:40	DX149	DAU1107A	1606
09/1/03 01:33	23/1/03 09:00	DX150	DAU1107A	3393
23/1/03 09:20	30/1/03 09:30	DX183	DAU1107A	1745
30/1/03 10:20	10/2/03 08:45	DX186	DAU012103A	2613
10/2/03 09:06	14/2/03 09:45	DX187	DAU012103A	1047
14/2/03 10:02	20/2/03 10:43	DX210	DAU012103A	1516
20/2/03 11:12	27/2/03 11:21	DX211	DAU012103A	1759
27/2/03 12:14	06/3/03 09:25	DX229	DAU012103A	1743
06/3/03 09:52	13/3/03 09:14	DX230	DAU021403J	1715
13/3/03 09:37	20/3/03 09:20	DX244	DAU021403J	1727
20/3/03 09:44	31/3/03 08:45	DX245	DAU021403J	2710
31/3/03 09:25	03/4/03 09:00	DX262	DAU031403F	702
03/4/03 09:18	10/4/03 12:00	DX261	DAU031403F	1674
10/4/03 12:19	22/4/03 09:23	DX285	DAU031403F	2802
22/4/03 09:42	28/4/03 08:56	DX286	DAU031403F	1430
28/4/03 08:56	02/5/03 09:30	DX296	DAU041603K	1039
02/5/03 09:58	08/5/03 09:33	DX297	DAU041603K	1557
08/5/03 09:56	15/5/03 08:27	DX303	DAU041603K	1680
15/5/03 08:43	23/5/03 08:45	DX304	DAU041603K	2021
23/5/03 09:04	03/6/03 09:30	DX305	DAU041603K	2687
03/6/03 09:56	11/6/03 08:47	DX350	DAU031403H	2067
11/6/03 09:32	21/6/03 09:14	DX351	DAU031403H	2588
21/6/03 09:43	30/6/03 09:29	DX378	DAU031403H	2399
30/6/03 10:37	08/7/03 17:00	DX377	DAU052903B	2069
08/7/03 17:15	16/7/03 09:30	DX389	DAU052903B	1928
16/7/03 09:45	24/7/03 08:20	DX390	DAU052903B	1992
24/7/03 08:36	31/7/03 09:00	DX407	DAU052903B	1730
31/7/03 09:27	07/8/03 08:59	DX429	DAU072103L	1643
07/8/03 09:25	14/8/03 09:37	DX408	DAU072103L	1709
14/8/03 09:53	21/8/03 09:02	DX428	DAU072103L	1737
21/8/03 09:18	01/9/03 09:16	DX445	DAU072103L	2736

Table B4 Eagle Farm, dioxin filter and PUF trap sampling details (*lost filter).

start	end	filter	PUF	flow+ (m^3)
27/08/2002 9:50	02/9/02 13:30	DX13	DAU0802L	742
2/09/2002 13:55	06/9/02 09:30	DX14	DAU0802L	460
6/09/2002 9:45	09/9/02 10:00	DX33	DAU0802L	387
9/09/2002 10:00	16/9/02 10:30	DX34	DAU0802L	822
16/09/2002 10:48	20/9/02 09:40	DX49	DAU0802L	476
20/09/2002 9:40	23/9/02 09:37	DX50	DAU0802L	361
23/09/2002 10:00	27/9/02 10:30	DX60	DAU0802L	486
27/09/2002 10:50	30/9/02 14:05	DX55	DAU0802L	379
30/09/2002 14:30	04/10/02 13:30	DX64	DAU0911F	466
4/10/2002 14:50	08/10/02 14:35	DX63	DAU0911F	473
8/10/2002 14:35	14/10/02 14:40	DX65	DAU0911F	702
14/10/2002 14:45	18/10/02 08:10	DX67	DAU0911F	438
18/10/2002 8:25	25/10/02 11:20	DX42	DAU0911F	837
25/10/02 11:20	31/10/02 10:10	DX82	DAU0911F	696
31/10/2002 10:10	08/11/02 11:25	DX86	DAU1016G	927
08/11/02 11:37	15/11/02 13:00	DX103	DAU1016G	823
15/11/2002 13:34	22/11/02 09:15	DX116	DAU1016G	796
22/11/2002 9:43	29/11/02 12:00	DX104	DAU1016G	827
29/11/02 12:30	09/12/02 11:42	DX119	DAU1211F	1149
9/12/2002 11:55	16/12/02 11:00	DX125	DAU1211F	793
16/12/02 11:30	23/12/02 13:00	DX141	DAU1211F	110
23/12/02 13:11	02/1/03 14:30	DX163	DAU1211F	1157
02/1/03 14:55	09/1/03 11:10	DX165	DAU1216H	765
09/1/03 11:23	15/1/03 15:10	DX167	DAU1216H	701
15/1/03 15:25	23/1/03 13:20	DX180	DAU1216H	893
23/1/03 13:32	31/1/03 13:51	DX194	DAU1216H	905
31/1/03 14:20	10/2/03 12:58	DX196	DAU012103F	1136
10/2/03 13:11	17/2/03 12:56	DX218	DAU012103F	797
17/2/03 13:11	25/2/03 10:00	DX197	DAU012103F	891
25/2/03 10:15	28/2/03 13:15	DX225	DAU012103F	244
28/2/03 13:47	07/3/03 08:44	DX228	DAU021403I	773
07/3/03 08:55	14/3/03 14:00	DX253	DAU021403I	828
14/3/03 14:00	20/3/03 13:15	DX250	DAU021403I	666
20/3/03 13:28	28/3/03 10:15	DX251	DAU021403I	901
28/3/03 10:33	04/4/03 10:10	DX273*	DAU031403G	802
04/4/03 10:20	11/4/03 14:00	DX284	DAU031403G	800
11/4/03 14:08	17/4/03 10:30	DX274	DAU031403G	674
17/4/03 10:45	24/4/03 11:40	DX281	DAU031403G	795
24/4/03 11:50	30/4/03 12:44	DX309	DAU031403G	697
30/4/03 13:29	09/5/03 11:55	DX313	DAU041603C	1033
09/5/03 11:55	16/5/03 13:30	DX315	DAU041603C	819
16/5/03 01:45	26/5/03 12:00	DX337	DAU041603C	1138
26/5/03 12:10	03/6/03 14:58	DX338	DAU041603C	938
03/6/03 15:21	11/6/03 13:30	DX360	DAU052903H	914
11/6/03 13:46	20/6/03 10:41	DX362	DAU052903H	1030
20/6/03 10:53	27/6/03 11:00	DX395	DAU052903H	816
27/6/03 11:12	03/7/03 14:05	DX398	DAU052903H	695
03/7/03 14:35	11/7/03 11:40	DX414	DAU052903E	919
11/7/03 00:00	18/7/03 13:48	DX416	DAU052903E	806
18/7/03 13:48	25/7/03 11:59	DX435	DAU052903E	347
25/7/03 12:15	31/7/03 13:50	DX437	DAU052903E	685
31/7/03 14:10	08/8/03 11:30	DX452	DAU053003D	893
08/8/03 11:43	14/8/03 12:14	DX456	DAU053003D	680
14/8/03 12:23	21/8/03 13:46	DX461	DAU053003D	805
21/8/03 13:57	29/8/03 11:28	DX464	DAU053003D	901

Table B5 Mutdapilly, dioxin filter and PUF trap sampling details (*lost filter).

start	end	filter	PUF	flow+ (m^3)
26/08/2002 15:50	2/09/2002 15:10	DX15	DAU0802B	762
2/09/2002 15:36	9/09/2002 15:00	DX16	DAU0802B	748
9/09/2002 15:00	16/09/2002 11:55	DX35	DAU0802B	748
16/09/2002 12:10	23/09/2002 11:00	DX36	DAU0802B	754
23/09/2002 11:20	30/09/2002 15:53	DX51	DAU0802B	780
30/09/2002 16:13	8/10/2002 16:10	DX52	DAU0911H	765
8/10/2002 16:10	14/10/2002 15:00	DX66	DAU0911H	435
14/10/2002 15:50	18/10/2002 10:15	DX68	DAU0911H	398
18/10/2002 10:30	25/10/2002 12:30	DX43	DAU0911H	762
25/10/2002 13:00	31/10/2002 11:36	DX83	DAU0911H	630
31/10/2002 11:52	8/11/2002 10:11	DX88	DAU1016H	830
8/11/2002 10:11	18/11/2002 14:20	DX87	DAU1016H	1037
18/11/2002 14:50	22/11/2002 10:26	DX117	DAU1016H	382
22/11/2002 10:56	29/11/2002 14:00	DX105	DAU1016H	710
29/11/2002 14:25	9/12/2002 13:00	DX118	DAU1016H	997
9/12/2002 13:15	16/12/2002 12:30	DX142	DAU1016H	687
16/12/2002 13:00	23/12/2002 11:40	DX143	DAU1016H	694
23/12/2002 12:00	2/01/2003 13:00	DX162	DAU1016H	1005
2/01/2003 13:25	9/01/2003 9:55	DX164	DAU1216E	684
9/01/2003 10:10	15/01/2003 13:40	DX166	DAU1216E	612
15/01/2003 13:50	23/01/2003 11:45	DX168	DAU1216E	787
23/01/2003 11:55	31/01/2003 12:30	DX181	DAU1216E	796
31/01/2003 12:45	10/02/2003 11:50	DX195A	DAU1216E	1005
10/02/2003 12:00	17/02/2003 14:53	DX219	DAU1216E	723
17/02/2003 15:08	28/02/2003 11:11	DX216	DAU1216E	1098
28/02/2003 12:13	4/03/2003 13:07	DX227	DAU020413A	410
4/03/2003 13:21	14/03/2003 12:42	DX217	DAU020413A	1006
14/03/2003 12:42	28/03/2003 11:37	DX252	DAU020413A	1392
28/03/2003 11:52	4/04/2003 11:15	DX271*	DAU020413A	699
4/04/2003 11:28	11/04/2003 15:12	DX272	DAU020413A	727
11/04/2003 15:25	17/04/2003 9:16	DX282	DAU020413A	584
17/04/2003 9:29	24/04/2003 13:10	DX283	DAU020413A	719
24/04/2003 13:25	30/04/2003 10:50	DX310	DAU020413A	581
30/04/2003 11:17	9/05/2003 10:40	DX311	DAU041603F	921
9/05/2003 10:51	16/05/2003 12:15	DX314	DAU041603F	737
16/05/2003 12:30	26/05/2003 13:45	DX336	DAU041603F	1045
26/05/2003 14:00	3/06/2003 16:27	DX339	DAU041603F	833
3/06/2003 16:40	10/06/2003 15:39	DX361	DAU041603F	833
10/06/2003 16:11	20/06/2003 9:23	DX363	DAU041603F	899
20/06/2003 9:44	27/06/2003 9:50	DX396	DAU041603F	723
27/06/2003 10:02	3/07/2003 11:50	DX397	DAU041603F	620
3/07/2003 12:25	11/07/2003 10:20	DX413	DAU052903C	812
11/07/2003 10:35	18/07/2003 12:30	DX415	DAU052903C	716
18/07/2003 12:41	25/07/2003 10:36	DX434	DAU052903C	704
25/07/2003 10:50	31/07/2003 12:04	DX436	DAU052903C	607
31/07/2003 12:15	8/08/2003 10:20	DX451	DAU052903C	820
8/08/2003 10:30	14/08/2003 13:20	DX455	DAU052903C	634
14/08/2003 13:30	21/08/2003 12:37	DX462	DAU052903C	718
21/08/2003 12:50	29/08/2003 13:53	DX463	DAU052903C	827

Table B6 Westmead, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow+ (m^3)
12/09/2002 11:30	19/09/2002 11:30	DX7	DAU0802H	1755
19/09/2002 11:50	26/09/2002 13:50	DX8	DAU0802H	1800
26/09/2002 14:10	3/10/2002 17:20	DX29	DAU0802H	1792
3/10/2002 17:45	10/10/2002 14:00	DX30	DAU0911G	1638
10/10/2002 14:10	17/10/2002 13:55	DX75	DAU0911G	1700
17/10/2002 14:06	24/10/2002 11:40	DX41	DAU0911G	1756
24/10/2002 12:10	31/10/2002 11:55	DX79	DAU0911G	1744
31/10/2002 12:30	7/11/2002 14:10	DX91	DAU1016C	1765
7/11/2002 14:25	14/11/2002 14:10	DX92	DAU1016C	1789
14/11/2002 14:30	21/11/2002 13:25	DX112	DAU1016C	1856
21/11/2002 13:40	29/11/2002 10:10	DX113	DAU1016C	2099
29/11/2002 10:20	5/12/2002 14:25	DX122	DAU1211D	1365
5/12/2002 2:35	12/12/2002 13:40	DX123	DAU1211D	1293
12/12/2002 13:50	19/12/2002 13:30	DX139	DAU1211D	1648
19/12/2002 13:40	27/12/2002 11:00	DX140	DAU1211D	1951
27/12/2002 11:30	3/01/2003 11:30	DX159	DAU1216F	1710
3/01/2003 11:45	10/01/2003 11:15	DX160	DAU1216F	1762
10/01/2003 11:35	21/01/2003 14:00	DX161	DAU1216F	2674
21/01/2003 14:10	28/01/2003 13:55	DX176	DAU1216F	1695
28/01/2003 14:05	4/02/2003 14:07	DX188	DAU1216F	1810
4/02/2003 14:25	12/02/2003 14:15	DX189	DAU012103E	1998
12/02/2003 2:30	19/02/2003 10:00	DX203	DAU012103E	1759
19/02/2003 10:30	26/02/2003 12:45	DX204	DAU012103E	1870
26/02/2003 12:55	5/03/2003 13:30	DX212	DAU012103E	1617
5/03/2003 13:45	12/03/2003 13:40	DX213	DAU021403C	1647
12/03/2003 13:50	19/03/2003 13:40	DX235	DAU021403C	1657
19/03/2003 13:50	26/03/2003 13:25	DX236	DAU021403C	1604
26/03/2003 13:45	2/04/2003 14:00	DX246	DAU021403C	1646
2/04/2003 14:15	9/04/2003 13:45	DX247	DAU031703A	1615
9/04/2003 13:53	16/04/2003 14:00	DX269	DAU031703A	1639
16/04/2003 14:10	23/04/2003 13:28	DX270	DAU031703A	1678
23/04/2003 13:38	30/04/2003 14:05	DX298	DAU031703A	1697
30/04/2003 14:15	7/05/2003 14:50	DX299	DAU041603I	1818
7/05/2003 14:50	13/05/2003 14:07	DX312	DAU041603I	1761
13/05/2003 2:15	21/05/2003 13:45	DX330	DAU041603I	1703
21/05/2003 1:55	28/05/2003 12:10	DX331	DAU041603I	1703
28/05/2003 12:15	4/06/2003 13:45	DX358	DAU041603I	1791
4/06/2003 14:00	12/06/2003 13:53	DX359	DAU052903F	2278
12/06/2003 13:53	19/06/2003 12:13	DX379	DAU052903F	1973
19/06/2003 12:20	26/06/2003 14:55	DX380	DAU052903F	1874
26/06/2003 15:45	3/07/2003 14:00	DX391	DAU052903F	1822
3/07/2003 14:35	22/07/2003 15:30	DX392	DAU053003J	2678
22/07/2003 15:30	30/07/2003 14:05	DX430	DAU053003J	2090
30/07/2003 14:05	8/08/2003 15:30	DX431	DAU053003J	2300
8/08/2003 15:50	16/08/2003 7:15	DX447	DAU053003J	1962
16/08/2003 7:25	22/08/2003 11:30	DX448	DAU053003J	1832
22/08/2003 11:39	29/08/2003 17:10	DX410	DAU053003J	1562
29/08/2003 17:20	8/09/2003 11:00	DX409	DAU053003J	2464

Table B7 Boorolite, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow+ (m^3)
16/08/2002 16:55	3/09/2002 15:15	DX11	DAU0802G	4108
3/09/2002 15:23	7/09/2002 14:15	DX48A	DAU0802G	911
30/09/2002 18:10	5/10/2002 14:50	DX49A	DAU0911D	1074
6/10/2002 17:46	12/10/2002 8:55	DX49A	DAU0911D	1230
13/10/2002 15:37	19/10/2002 14:08	DX44	DAU0911D	1285
20/10/2002 17:41	26/10/2002 12:26	DX77	DAU0911D	1295
26/10/2002 16:29	3/11/2002 10:33	DX85	DAU0911D	1530
5/11/2002 13:30	10/11/2002 10:23	DX100	DAU1016J	1163
10/11/2002 16:32	17/11/2002 9:29	DX99	DAU1016J	1669
17/11/2002 15:07	24/11/2002 15:48	DX120	DAU1016J	1465
24/11/2002 15:57	1/12/2002 8:45	DX124	DAU1016J	1458
2/12/2002 15:33	8/12/2002 8:27	DX128	DAU1016D	1249
8/12/2002 14:37	14/12/2002 16:36	DX144	DAU1016D	1327
15/12/2002 14:24	22/12/2002 14:27	DX146	DAU1016D	1449
22/12/2002 19:12	1/01/2003 15:56	DX169	DAU1016D	2207
1/01/2003 16:18	11/01/2003 15:07	DX170	DAU1218A	2072
11/01/2003 15:07	18/01/2003 17:02	DX171	DAU1218A	1457
18/01/2003 17:02	27/01/2003 9:09	DX172	DAU1218A	1372
27/01/2003 13:12	1/02/2003 16:22	DX201	DAU1218A	1138
1/02/2003 16:37	8/02/2003 13:04	DX202	DAU012103G	487
8/02/2003 1:12	18/02/2003 7:10	DX206	DAU012103G	2284
18/02/2003 7:22	2/03/2003 13:28	DX222	DAU012103G	2883
2/03/2003 13:45	10/03/2003 9:31	DX240	DAU012403E	1849
10/03/2003 9:43	15/03/2003 13:36	DX241	DAU012403E	1222
15/03/2003 13:36	1/04/2003 12:08	DX254	DAU012403E	3831
1/04/2003 12:27	12/04/2003 14:30	DX289	DAU012403E	2662
12/04/2003 14:47	21/04/2003 15:05	DX290	DAU012403E	2216
21/04/2003 15:16	26/04/2003 16:23	DX291	DAU012403E	1234
27/04/2003 17:36	4/05/2003 14:53	DX302	DAU012403E	1655
4/05/2003 14:53	10/05/2003 16:32	DX322	DAU031403E	1519
10/05/2003 16:48	18/05/2003 12:16	DX327	DAU031403E	1934
18/05/2003 12:26	24/05/2003 10:17	DX342	DAU031403E	1454
25/05/2003 11:14	31/05/2003 16:41	DX345	DAU031403E	1544
1/06/2003 12:43	9/06/2003 11:27	DX366	DAU052903J	1870
9/06/2003 16:24	15/06/2003 14:46	DX369	DAU052903J	1332
15/06/2003 14:59	29/06/2003 16:33	DX372	DAU052903J	3703
29/06/2003 16:53	7/07/2003 9:49	DX386	DAU005303E	1883
7/07/2003 10:09	13/07/2003 16:29	DX419	DAU005303E	1525
13/07/2003 16:40	20/07/2003 15:45	DX420	DAU005303E	1806
20/07/2003 15:56	27/07/2003 15:13	DX423	DAU005303E	1675
27/07/2003 15:33	3/08/2003 15:26	DX440	DAU005303E	1757
3/08/2003 15:45	10/08/2003 16:18	DX457	DAU005303G	1695
10/08/2003 17:10	17/08/2003 15:57	DX460	DAU005303G	1640
17/08/2003 16:09	24/08/2003 11:45	DX470	DAU005303G	1675
24/08/2003 11:58	31/08/2003 14:05	DX469	DAU005303G	1457

Table B8 Alphington, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow+ (m^3)
3/9/02 16:40	10/9/02 8:28	DX37	DAU0802C	1690
10/9/02 8:47	17/9/02 7:40	DX38	DAU0802C	1640
17/9/02 8:04	24/9/02 7:21	DX53	DAU0802C	1606
24/9/02 7:45	1/10/02 6:17	DX54	DAU0802C	1716
1/10/02 6:55	2/10/02 19:29	DX61	DAU0911B	361
8/10/02 13:45	16/10/02 9:38	DX61	DAU0911B	1877
16/10/02 10:16	23/10/02 9:46	DX76	DAU0911B	1840
23/10/02 10:15	31/10/02 7:15	DX84	DAU0911B	2128
31/10/02 8:15	7/11/02 8:20	DX98	DAU1016I	1709
7/11/02 8:20	14/11/02 7:30	DX108	DAU1016I	1702
14/11/02 7:51	22/11/02 8:20	DX109	DAU1016I	1965
22/11/02 8:36	29/11/02 7:32	DX121	DAU1016I	1708
29/11/02 8:11	6/12/02 9:40	DX131	DAU1016E	1706
6/12/02 9:58	13/12/02 8:10	DX138	DAU1016E	1715
13/12/02 8:30	20/12/02 8:05	DX145	DAU1016E	1649
20/12/02 8:20	3/1/03 16:38	DX153	DAU1016E	3484
3/1/03 16:58	10/1/03 15:40	DX173	DAU1216B	1517
10/1/03 15:57	17/1/03 6:52	DX174	DAU1216B	1465
17/1/03 7:10	24/1/03 7:31	DX175	DAU1216B	1666
24/1/03 7:41	1/2/03 7:05	DX200	DAU1216B	1881
1/2/03 7:25	8/2/03 14:05	DX205	DAU012103I	1502
8/2/03 2:23	13/2/03 7:20	DX207	DAU012103I	1263
13/2/03 7:28	20/2/03 7:55	DX223	DAU012103I	1548
20/2/03 8:05	5/3/03 10:14	DX239	DAU012103I	3126
5/3/03 12:15	15/3/03 9:45	DX256	DAU012103H	2335
15/3/03 10:26	22/3/03 10:48	DX259	DAU012103H	1639
22/3/03 11:25	29/3/03 10:56	DX275	DAU012103H	1742
29/3/03 11:24	5/4/03 8:45	DX287	DAU012103H	1685
5/4/03 9:28	12/4/03 13:48	DX292	DAU031803A	1648
12/4/03 13:48	19/4/03 11:32	DX294	DAU031803A	1603
19/4/03 11:52	29/4/03 7:10	DX300	DAU031803A	2303
29/4/03 7:32	5/5/03 7:43	DX323	DAU031803A	1420
5/5/03 8:31	11/5/03 13:47	DX325	DAU041603J	1511
11/5/03 14:01	17/5/03 17:08	DX332	DAU041603J	1452
17/5/03 17:23	26/5/03 11:14	DX343	DAU041603J	2124
26/5/03 11:31	4/6/03 8:03	DX364	DAU041603J	2266
4/6/03 8:40	10/6/03 8:58	DX370	DAU041603B	1485
10/6/03 9:22	15/6/03 18:02	DX373	DAU041603B	1192
15/6/03 18:25	19/6/03 20:11	DX384	DAU041603B	979
19/6/03 20:26	1/7/03 17:00	DX401	DAU041603B	2897
1/7/03 17:15	8/7/03 7:05	DX403	DAU053003B	1623
8/7/03 7:25	16/7/03 12:30	DX421	DAU053003B	1915
16/7/03 12:54	22/7/03 7:09	DX424	DAU053003B	1390
22/7/03 7:31	29/7/03 17:17	DX441	DAU053003B	1853
29/7/03 5:40	5/8/03 15:25	DX458	DAU053003I	1722
5/8/03 15:34	12/8/03 7:15	DX459	DAU053003I	1708
12/8/03 7:25	20/8/03 7:36	DX467	DAU053003I	1960
20/8/03 7:46	1/9/03 15:42	DX471	DAU053003I	3129

Table B9 Alphington collocated, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow+ (m^3)
5/3/03 12:18	15/3/03 10:20	DX257	DAU021403G	2480
15/3/03 10:26	22/3/03 10:48	DX260	DAU021403G	1743
22/3/03 11:28	29/3/03 10:58	DX276	DAU021403G	1811
29/3/03 11:28	5/4/03 8:43	DX288	DAU021403G	1771
5/4/03 9:47	12/4/03 13:40	DX293	DAU031403C	1753
12/4/03 14:05	19/4/03 11:32	DX295	DAU031403C	1754
19/4/03 11:52	29/4/03 7:10	DX301	DAU031403C	2486
29/4/03 7:32	5/5/03 7:43	DX324	DAU031403C	1542
5/5/03 8:33	11/5/03 13:47	DX326	DAU041603H	1625
11/5/03 14:01	17/5/03 17:08	DX333	DAU041603H	1547
17/5/03 17:23	26/5/03 11:14	DX344	DAU041603H	2381
26/5/03 11:31	4/6/03 8:03	DX365	DAU041603H	2394
4/6/03 8:40	10/6/03 8:58	DX371	DAU041603L	1568
10/6/03 9:22	15/6/03 18:02	DX374	DAU041603L	1310
15/6/03 18:25	19/6/03 20:11	DX385	DAU041603L	1108
19/6/03 20:26	1/7/03 17:00	DX402	DAU041603L	3184
1/7/03 17:15	8/7/03 7:05	DX404	DAU052903D	1816
8/7/03 7:25	16/7/03 12:30	DX422	DAU052903D	2185
16/7/03 12:54	22/7/03 7:09	DX425	DAU052903D	1577
22/7/03 7:31	29/7/03 17:17	DX442	DAU052903D	1980

Table B10 Cape Grim, dioxin filter and PUF trap sampling details*.

start	end	filter	PUF	fraction	flow+ (m^3)
02/9/02 12:02	01/10/02 16:00	DX17	DAU0802D	0.35	3034
01/10/02 16:15	01/11/02 13:58	DX18	DAU0911C	0.44	3834
01/11/02 13:58	02/12/02 12:00	DX96	DAU1016K	0.44	4422
02/12/02 12:00	31/12/02 14:05	DX97	DAU1016L	0.47	4247
31/12/02 14:55	31/1/03 15:16	DX157	DAU1216G	0.49	4913
31/1/03 03:50	02/3/03 14:35	DX158	DAU012103C	0.38	3576
26/2/03 12:48	03/4/03 16:12	QZ38	EA031803A	0.29	14411
03/4/03 16:49	05/5/03 14:20	QZ34	DAU031403A	0.20	8807
05/5/03 14:35	03/6/03 15:40	QZ42	DAU041603A	0.08	3188
03/6/03 15:58	01/7/03 14:24	QZ49	DAU052903A	0.36	14320
01/7/03 14:50	01/8/03 12:48	QZ55	DAU053003A	0.30	12847
01/8/03 13:22	02/9/03 16:46	QZ61	DAU072103M	0.27	12085

* These include start and end dates, also the fraction of time that clean marine conditions were encountered and sampled (as a fraction)

Table B11 Netley, dioxin filter and PUF trap sampling details.

start	end	filter	PUF	flow+ (m^3)
7/01/2003 16:53	14/01/2003 16:46	DX179	DAU1216A	1724
14/01/2003 16:33	21/01/2003 15:52	DX178	DAU1216A	1626
21/01/2003 16:09	28/01/2003 15:29	DX177	DAU1216A	1644
28/01/2003 15:29	4/02/2003 15:40	DX192	DAU1216A	1708
4/03/2003 16:00	11/03/2003 16:22	DX193	DAU021403D	1662
11/03/2003 16:35	18/03/2003 15:39	DX220	DAU021403D	1695
18/03/2003 15:56	25/03/2003 15:28	DX233	DAU021403D	1750
25/03/2003 15:49	1/04/2003 17:38	DX234	DAU021403D	1776
1/04/2003 17:50	8/04/2003 16:21	DX221	DAU021403D	1763
8/04/2003 16:31	15/04/2003 15:42	DX267	DAU021403D	1734
15/04/2003 16:08	23/04/2003 8:12	DX268	DAU021403D	1929
23/04/2003 8:32	29/04/2003 15:53	DX316	DAU021403D	1568
29/4/03 16:15	6/05/2003 16:38	DX317	DAU041603D	1770
6/05/2003 16:38	20/05/2003 16:35	DX318	DAU041603D	1725
13/05/2003 17:02	14/05/2003 16:44	DX340	DAU041603D	1686
14/05/2003 16:56	27/05/2003 17:25	DX341	DAU041603D	1732
27/05/2003 17:34	3/06/2003 17:00	DX346	DAU041603D	1713
3/06/2003 17:38	12/06/2003 17:00	DX347	DAU041603D	2319
12/06/2003 17:31	18/06/2003 15:04	DX383	DAU041603D	1530
18/06/2003 15:04	24/06/2003 17:23	DX382	DAU041603D	1487
24/06/2003 17:45	1/07/2003 17:02	DX400	DAU053003C	1754
1/07/2003 17:14	8/07/2003 17:01	DX399	DAU053003C	1724
8/07/2003 17:14	15/07/2003 16:30	DX417	DAU053003C	1750
15/07/2003 16:40	22/07/2003 17:04	DX438	DAU053003C	1826
22/07/2003 17:12	6/08/2003 13:43	DX439	DAU053003C	3612
6/08/2003 14:41	12/08/2003 17:05	DX418	DAU053003C	1517
12/08/2003 17:19	19/08/2003 15:33	DX466	DAU053003C	1736
19/08/2003 15:47	27/08/2003 16:09	DX465	DAU053003C	2024
27/08/2003 16:20	3/09/2003 16:17	DX479	DAU053003C	1788
3/09/2003 16:48	18/09/2003 14:28	DX480	DAU082203A	3589
18/09/2003 14:41	24/09/2003 16:22	DX481	DAU082203A	1499
24/09/2003 16:22	2/10/2003 7:53	DX482	DAU082203A	1925
2/10/2003 8:02	8/10/2003 9:03	DX483	DAU082203A	1519
8/10/2003 9:17	15/10/2003 18:19	DX484	DAU082203A	1861
15/10/2003 18:32	22/10/2003 13:10	DX485	DAU082203A	1674
22/10/2003 13:20	29/10/2003 15:23	DX486	DAU082203A	1733
29/10/2003 15:38	5/11/2003 14:50	DX487	DAU082203A	1763
5/11/2003 15:19	12/11/2003 14:12	DX488	DAU100303A	1717
12/11/2003 14:24	19/11/2003 15:56	DX489	DAU100303A	1738
19/11/2003 17:01	26/11/2003 12:13	DX490	DAU100303A	1802
26/11/2003 12:25	2/12/2003 15:00	DX492	DAU100303A	1551
2/12/2003 15:20	10/12/2003 15:50	DX491	DAU100303A	2122
10/12/2003 16:15	17/12/2003 13:34	DX494	DAU100303A	1678
17/12/2003 14:04	23/12/2003 15:56	DX493	DAU100303A	1513
23/12/2003 16:08	31/12/2003 7:58	DX495	DAU100303A	1815
31/12/2003 8:09	7/01/2004 14:38	DX496	DAU100303A	1735

Appendix C Labelled surrogate recoveries

The two tables included in this appendix (Tables C1 and C2) give the arithmetic mean and standard deviation of labeled surrogate recoveries (as percentages) across all determinations for the indicated month. The overall minimum recovery for the year September 2002 to August 2003 was 8.2% and the maximum 187%.

Table C1 ^{13}C surrogate recovery mean and sd, September-February.

Recovery (%)	Sep-02		Oct-02		Nov-02		Dec-02		Jan-03		Feb-03	
PCDD Congeners	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
2,3,7,8-TCDD	74	5.2	70	6.4	73	8.6	80	6.4	57	9.9	61	7.4
1,2,3,7,8-PeCDD	65	6.3	70	12.3	65	5.5	75	8.3	41	8.3	67	9.2
1,2,3,4,7,8-HxCDD	95	4.1	96	10.4	90	5.7	88	8.9	83	34.1	107	7.5
1,2,3,6,7,8-HxCDD	90	5.1	88	9.1	99	5.7	100	8.1	75	14.4	86	9.5
1,2,3,4,6,7,8-HpCDD	75	4.1	82	7.5	72	10.1	81	6.9	51	9.7	77	8.7
OCDD	61	3.0	72	13.5	63	8.7	61	6.6	46	9.3	49	6.2
PCDF Congeners												
2,3,7,8-TCDF	87	6.9	71	6.9	82	5.8	79	6.0	63	11.9	59	8.5
1,2,3,7,8-PeCDF	73	7.6	67	11.5	69	5.2	75	7.0	45	9.4	65	7.5
2,3,4,7,8-PeCDF	89	4.7	87	5.5	87	3.4	83	7.3	81	32.7	101	3.0
1,2,3,4,7,8-HxCDF	99	4.2	93	6.2	95	3.1	87	7.1	87	34.7	104	7.6
1,2,3,6,7,8-HxCDF	103	4.3	104	23.3	100	6.3	103	9.5	81	15.2	88	12.0
1,2,3,4,6,7,8-HpCDF	88	6.5	89	9.2	82	7.4	89	7.3	60	12.0	85	9.6
1,2,3,4,7,8,9-HpCDF	74	4.0	68	5.4	70	5.6	62	6.1	65	25.7	71	5.5
Non-Ortho PCBs												
PCB 77	80	6.2	68	5.6	78	9.2	81	8.6	58	8.1	55	9.1
PCB 81	81	5.7	65	6.2	73	8.7	78	8.4	53	8.3	48	10.3
PCB 126	62	5.5	62	17.7	79	11.6	99	11.3	86	13.9	60	9.6
PCB 169	97	7.9	82	13.2	86	5.6	88	8.6	73	8.5	86	10.8
Mono-Ortho PCBs												
PCB 105	64	9.6	70	4.4	79	9.6	92	6.6	79	7.5	82	9.7
PCB 114	60	14.6	68	5.6	71	10.6	88	8.3	78	8.7	78	9.9
PCB 118	55	15.5	64	4.6	69	12.5	84	7.9	79	10.5	78	9.8
PCB 123	54	15.2	64	6.2	69	15.8	89	6.7	81	8.6	78	8.7
PCB 156	95	25.0	89	14.2	82	9.6	81	10.9	79	7.5	98	9.5
PCB 157	94	18.1	88	11.9	84	7.2	80	10.5	76	7.4	93	10.3
PCB 167	75	24.4	78	24.7	73	20.4	86	13.6	81	8.4	102	11.3
PCB 189	51	17.3	68	14.4	71	15.0	80	6.3	82	11.2	81	9.3
number of analyses	9		9		8		10		9		10	

Table C2 ^{13}C surrogate recovery mean and sd, March-August.

Recovery (%)	Mar-03		Apr-03		May-03		Jun-03		Jul-03		Aug-03	
PCDD Congeners	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
2,3,7,8-TCDD	53	16.7	45	17.9	50	15.8	54	11.4	43	16.6	62	11.7
1,2,3,7,8-PeCDD	53	14.2	49	14.6	47	11.3	49	10.5	42	14.6	53	12.3
1,2,3,4,7,8-HxCDD	123	34.9	118	13.6	108	7.5	118	13.6	117	7.0	103	10.7
1,2,3,6,7,8-HxCDD	68	17.8	61	14.0	60	15.4	58	13.6	48	19.2	74	15.4
1,2,3,4,6,7,8-HpCDD	61	15.0	63	12.4	56	14.2	54	11.4	48	17.4	57	13.0
OCDD	49	12.2	66	16.9	62	17.9	52	11.8	40	13.5	43	11.3
PCDF Congeners												
2,3,7,8-TCDF	56	17.6	48	18.1	54	17.8	55	13.6	44	16.6	67	12.2
1,2,3,7,8-PeCDF	52	14.8	51	13.9	49	13.3	51	11.7	46	14.5	57	10.5
2,3,4,7,8-PeCDF	112	32.5	97	8.9	84	4.7	84	5.4	87	5.5	93	8.5
1,2,3,4,7,8-HxCDF	119	33.3	103	12.8	93	7.0	104	10.0	97	4.2	99	9.5
1,2,3,6,7,8-HxCDF	73	19.7	69	16.0	70	18.5	63	16.4	60	20.4	85	17.3
1,2,3,4,6,7,8-HpCDF	69	17.8	69	13.9	59	14.7	50	17.2	56	19.7	67	13.1
1,2,3,4,7,8,9-HpCDF	84	25.6	80	6.8	84	10.1	99	21.2	71	8.3	73	5.2
Non-Ortho PCBs												
PCB 77	50	19.2	39	13.2	42	16.1	54	13.5	62	14.1	62	13.6
PCB 81	47	20.0	35	14.2	41	16.7	54	14.1	60	14.1	62	15.2
PCB 126	52	18.2	70	14.0	60	16.7	53	13.0	84	21.4	85	22.9
PCB 169	69	22.7	70	12.0	60	13.8	60	14.2	77	21.9	64	11.1
Mono-Ortho PCBs												
PCB 105	61	21.9	73	23.8	82	24.9	66	16.2	82	27.3	89	21.2
PCB 114	58	19.8	66	23.5	76	23.0	59	12.8	77	24.5	89	20.3
PCB 118	60	22.0	68	23.7	73	25.0	57	14.4	84	20.2	86	18.9
PCB 123	59	18.7	72	24.8	78	21.4	60	15.2	91	23.3	90	21.0
PCB 156	80	24.3	72	18.2	62	14.2	63	14.1	81	22.1	70	14.7
PCB 157	76	25.6	65	18.3	60	14.7	64	12.1	80	25.5	70	14.5
PCB 167	81	27.5	72	21.1	63	15.0	62	17.2	85	22.7	75	14.2
PCB 189	63	21.6	72	23.4	106	39.1	53	12.6	85	28.5	85	21.7
number of analyses	8		10		8		10		9		10	

Appendix D Field Blank concentrations of PCDD/F/P

Concentrations of the PCDD/F congeners, as pg of congener per sample, are shown in Table D1 for each of the four field blank samples analysed. These, typically, fall well within the bounds set out in the data quality objectives. Values reported as less than the LOD are shaded. Blank levels are also indicated in Table D2, as TEQ m^{-3} for an assumed sample flow of 6,000 m^{-3}. Arithmetic average and three times the standard deviation (s.d.) values for each congener are included to aid interpretation of concentrations determined for the cleanest locations. Values shown as shaded in Table D2 are ½ LOD for samples reported as less than LOD.

Table D1 Concentration of dioxins from the five blank samples.

PCDD Congeners	Sep.-A pg	Sep.-B pg	Dec. pg	Feb. pg	Jul. pg	objective pg
2,3,7,8-TCDD	<2	<2	<0.7	<0.4	<1	2 to 20
1,2,3,7,8-PeCDD	<3	<2	<1	<0.9	<2	2 to 20
1,2,3,4,7,8-HxCDD	<2	<2	<0.4	<1	<1	2 to 20
1,2,3,6,7,8-HxCDD	<5	<4	<0.8	<1	<0.8	2 to 20
1,2,3,7,8,9-HxCDD	<4	<3	<0.6	<0.6	<0.8	2 to 20
1,2,3,4,6,7,8-HpCDD	22	30	<5	<3	<9	40 to 150
OCDD	107	139	<30	<20	40	40 to 150
PCDF Congeners						
2,3,7,8-TCDF	<0.6	<0.6	<0.07	<0.6	<2	2 to 20
1,2,3,7,8-PeCDF	<0.4	<0.6	<0.3	<0.2	<0.5	2 to 20
2,3,4,7,8-PeCDF	<0.6	<0.8	0.27	<0.5	<0.7	2 to 20
1,2,3,4,7,8-HxCDF	<0.5	<0.9	0.38	<0.3	<0.8	2 to 20
1,2,3,6,7,8-HxCDF	<0.5	<0.9	<0.2	<0.3	<0.8	2 to 20
2,3,4,6,7,8-HxCDF	<0.3	<0.6	<0.3	<0.3	<1	2 to 20
1,2,3,7,8,9-HxCDF	<0.5	<0.7	0.33	<0.4	<0.7	2 to 20
1,2,3,4,6,7,8-HpCDF	0.5	1.7	<0.4	<1	<1	40 to 150
1,2,3,4,7,8,9-HpCDF	<0.7	<1	<0.5	<0.8	<0.8	40 to 150
OCDF	<2	<2	1.1	<1	1.7	40 to 150

Table D2 Blank concentrations as TEQ m^{-3} for a sample flow of 6,000 m^{-3}.

	All Concentrations fg[WHO$_{98}$-TEQ$_{dfp}$] m^{-3}						
PCDD Congeners	**Sep.-A**	**Sep.-B**	**Dec.**	**Feb.**	**Jul.**	**average**	**3 x s.d.**
2,3,7,8-TCDD	1.7E-01	1.7E-01	5.8E-02	3.3E-02	8.3E-02	1.0E-01	1.9E-01
1,2,3,7,8-PeCDD	2.5E-01	1.7E-01	8.3E-02	7.5E-02	1.7E-01	1.5E-01	2.2E-01
1,2,3,4,7,8-HxCDD	1.7E-02	1.7E-02	3.3E-03	8.3E-03	8.3E-03	1.1E-02	1.8E-02
1,2,3,6,7,8-HxCDD	4.2E-02	3.3E-02	6.7E-03	8.3E-03	6.7E-03	1.9E-02	5.1E-02
1,2,3,7,8,9-HxCDD	3.3E-02	2.5E-02	5.0E-03	5.0E-03	6.7E-03	1.5E-02	4.0E-02
1,2,3,4,6,7,8-HpCDD	3.7E-02	5.0E-02	4.2E-03	2.5E-03	7.5E-03	2.0E-02	6.5E-02
OCDD	1.8E-03	2.3E-03	2.5E-04	1.7E-04	6.7E-04	1.0E-03	2.9E-03
PCDF Congeners							
2,3,7,8-TCDF	5.0E-03	5.0E-03	5.8E-04	5.0E-03	1.7E-02	6.5E-03	1.8E-02
1,2,3,7,8-PeCDF	1.7E-03	2.5E-03	1.3E-03	8.3E-04	2.2E-03	1.7E-03	2.0E-03
2,3,4,7,8-PeCDF	2.5E-02	3.3E-02	2.3E-02	2.2E-02	3.0E-02	2.7E-02	1.5E-02
1,2,3,4,7,8-HxCDF	4.2E-03	7.5E-03	6.3E-03	2.5E-03	6.7E-03	5.4E-03	6.2E-03
1,2,3,6,7,8-HxCDF	4.2E-03	7.5E-03	1.7E-03	2.5E-03	6.7E-03	4.5E-03	7.6E-03
2,3,4,6,7,8-HxCDF	2.5E-03	5.0E-03	2.5E-03	2.5E-03	8.3E-03	4.2E-03	7.7E-03
1,2,3,7,8,9-HxCDF	4.2E-03	5.8E-03	5.5E-03	3.3E-03	5.8E-03	4.9E-03	3.4E-03
1,2,3,4,6,7,8-HpCDF	8.3E-04	2.8E-03	3.3E-04	8.3E-04	8.3E-04	1.1E-03	2.9E-03
1,2,3,4,7,8,9-HpCDF	5.8E-04	8.3E-04	4.2E-04	6.7E-04	6.7E-04	6.3E-04	4.5E-04
OCDF	1.7E-05	1.7E-05	1.8E-05	8.3E-06	2.8E-05	1.8E-05	2.1E-05
Non-Ortho PCBs							
PCB 77	5.0E-05	2.3E-04	8.3E-05	3.0E-04	1.7E-04	1.7E-04	3.1E-04
PCB 81	3.3E-05	3.5E-05	4.2E-06	5.8E-06	3.3E-05	2.2E-05	4.8E-05
PCB 126	1.7E-02	1.7E-02	2.5E-03	1.7E-02	1.7E-02	1.4E-02	1.9E-02
PCB 169	1.7E-03	4.2E-04	6.7E-05	2.5E-04	8.3E-04	6.5E-04	1.9E-03
Mono-Ortho PCBs							
PCB 105	1.2E-03	2.2E-03	3.8E-03	1.4E-02	5.5E-03	5.4E-03	1.6E-02
PCB 114	2.9E-04	4.2E-04	1.0E-03	4.0E-03	3.8E-04	1.2E-03	4.7E-03
PCB 118	8.3E-04	4.3E-03	8.7E-03	3.2E-02	1.2E-02	1.2E-02	3.6E-02
PCB 123	3.3E-04	5.0E-05	8.3E-05	3.3E-04	3.5E-04	2.3E-04	4.5E-04
PCB 156	2.9E-04	5.1E-03	2.8E-03	7.7E-03	7.2E-03	4.6E-03	9.2E-03
PCB 157	8.3E-04	4.2E-04	2.1E-04	4.2E-04	2.2E-03	8.1E-04	2.4E-03
PCB 167	1.7E-05	4.2E-05	1.7E-05	3.3E-05	3.3E-05	2.8E-05	3.4E-05
PCB 189	5.0E-06	8.3E-05	5.8E-06	1.7E-05	2.5E-05	2.7E-05	9.7E-05
Lower Bound TEQ[DFP]	**0.04**	**0.07**	**0.05**	**0.06**	**0.03**	**0.05**	**0.03**
Middle bound TEQ[DF]	**0.59**	**0.53**	**0.20**	**0.17**	**0.36**	**0.37**	**0.64**
Middle bound TEQ[DFP]	**0.62**	**0.56**	**0.22**	**0.25**	**0.40**	**0.41**	**0.73**

Appendix E PCDD/F/P concentration data by month and site.

Table E1 Concentrations of PCDD/Fs and dioxin-like PCBs at Wattelup, WA (fg m^{-3}).

Wattleup	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 1.0	< 0.4	< 0.3	< 0.2	< 0.3	< 0.1	< 0.04	< 0.08	1.3	4.2	1.4	1.8
1,2,3,7,8-PeCDD	1.3	1.0	< 1.2	0.6	< 0.3	< 0.3	0.4	2.7	3.2	10.2	5.0	3.8
1,2,3,4,7,8-HxCDD	1.2	0.7	< 0.8	< 0.4	< 0.3	0.4	0.3	3.0	3.9	9.3	5.9	3.8
1,2,3,6,7,8-HxCDD	2.2	1.4	< 1.3	1.2	0.5	0.7	0.5	4.0	6.3	14.0	8.3	5.5
1,2,3,7,8,9-HxCDD	< 1.5	3.4	< 1.2	< 0.7	< 0.1	0.3	< 0.8	2.7	4.1	11.5	7.3	3.9
1,2,3,4,6,7,8-HpCDD	16.4	8.7	< 9.4	11.3	6.6	6.8	6.2	22.5	44.7	83.5	68.4	35.4
OCDD	55.7	26.2	< 40	95.7	54.5	133.4	42.6	43.7	91.6	161.9	159.2	75.7
PCDF Congeners	0.00											
2,3,7,8-TCDF	6.5	14.2	2.8	2.5	1.2	1.4	4.0	67.6	11.0	33.4	17.1	14.6
1,2,3,7,8-PeCDF	3.6	4.8	2.4	1.5	1.2	1.1	1.3	11.3	9.0	23.4	12.8	11.2
2,3,4,7,8-PeCDF	5.4	7.3	2.9	1.5	1.1	< 1.6	1.7	15.9	14.9	36.7	20.3	17.1
1,2,3,4,7,8-HxCDF	4.4	3.6	2.9	2.3	1.2	2.0	< 1.2	15.9	12.6	35.1	19.2	11.3
1,2,3,6,7,8-HxCDF	4.1	3.1	2.7	1.6	< 0.8	1.2	0.9	11.8	10.8	28.4	16.0	11.5
2,3,4,6,7,8-HxCDF	3.2	2.7	3.1	1.0	< 0.5	1.5	0.9	14.6	13.7	26.7	15.0	9.9
1,2,3,7,8,9-HxCDF	0.6	0.2	< 0.3	< 0.1	< 0.09	< 0.1	< 0.1	1.2	0.7	2.3	1.3	0.7
1,2,3,4,6,7,8-HpCDF	11.2	7.8	7.7	6.3	3.2	5.1	3.0	37.1	35.5	63.4	42.7	25.6
1,2,3,4,7,8,9-HpCDF	1.9	0.9	1.1	0.8	< 0.3	< 0.3	< 0.3	5.7	5.3	14.4	5.8	3.7
OCDF	7.1	4.2	5.3	11.0	4.7	3.7	3.0	18.6	16.0	25.0	17.1	11.8
PCDD Homologue Groups												
TCDD	30.4	15.3	20.0	12.8	17.8	11.0	16.8	2.5	69.8	166.8	33.1	61.0
PeCDD	17.8	5.2	9.6	5.8	7.2	2.5	8.5	19.9	61.8	175.3	60.9	63.5
HxCDD	28.1	15.3	18.7	14.0	17.8	7.1	16.8	82.2	111.1	228.7	125.0	97.6
HpCDD	30.8	15.3	20.0	22.2	12.7	14.3	12.7	50.4	92.7	180.3	132.5	70.8
PCDF Homologue Groups												
TCDF	152.8	142.2	61.4	39.7	21.6	29.5	47.8	188.2	269.0	656.1	341.8	344.1
PeCDF	43.9	64.5	32.1	19.8	14.0	14.1	24.5	173.6	158.0	405.7	200.8	161.1
HxCDF	29.1	29.5	24.0	15.2	5.2	11.6	12.0	136.5	113.3	260.4	141.0	98.8
HpCDF	19.8	12.0	13.4	11.7	< 5.1	7.1	4.9	61.0	60.7	128.5	68.4	42.7
Non-Ortho PCBs												
PCB 77	50.2	75.5	89.5	109.7	126.9	152.0	133.1	94.1	85.9	85.1	27.8	57.4
PCB 81	3.8	5.4	5.2	4.0	6.7	7.8	5.8	8.7	6.0	8.5	2.6	5.4
PCB 126	4.1	8.0	7.1	6.2	< 6.3	8.1	6.7	12.3	9.5	15.0	3.7	7.0
PCB 169	< 0.6	< 0.3	< 0.7	0.4	< 0.05	< 0.2	< 0.3	< 2.7	1.4	2.0	0.8	< 1.2
Mono-Ortho PCBs												
PCB 105	200.8	1093.6	414.0	572.0	570.8	790.9	613.7	331.3	407.6	941.6	144.2	176.9
PCB 114	9.7	61.2	26.7	35.0	35.5	45.0	33.6	21.2	27.5	50.1	8.5	11.1
PCB 118	619.8	2624.6	1015.1	1284.1	1268.6	1861.0	1382.5	861.3	1247.9	1654.4	327.9	434.4
PCB 123	15.9	75.5	36.1	44.4	< 38	66.7	43.9	34.5	42.4	45.1	9.9	14.6
PCB 156	28.4	262.5	60.1	75.9	92.6	111.7	82.7	< 40	56.1	143.6	12.8	28.1
PCB 157	2.2	55.8	13.1	16.3	20.3	23.3	14.2	10.6	14.9	< 17	< 2.1	9.2
PCB 167	85.7	< 77	125.5	< 23	< 63	< 62	< 39	< 13	26.3	< 33	< 11	< 12
PCB 189	< 0.3	8.4	2.5	< 2.3	< 2.5	< 4.7	2.3	3.4	3.4	< 3.3	< 2.1	2.0
Sum of PCDD/Fs (exc)[1]	416	328	200	245	152	233	190	776	1044	2387	1282	1027
WHO$_{98}$ TEQ$_{DF}$ (inc)[2]	7.25	8.26	3.79	2.68	1.35	1.56	2.18	24.30	19.54	51.60	27.39	21.50
WHO$_{98}$ TEQ$_{DF}$ (exc)[1]	6.67	7.94	2.83	2.50	1.00	0.94	2.05	23.90	19.53	51.60	27.39	21.50
WHO$_{98}$ TEQ$_{PCB}$ (inc)[2]	0.52	1.38	0.92	0.89	0.59	1.19	0.96	1.40	1.19	1.90	0.44	0.80
WHO$_{98}$ TEQ$_{PCB}$ (exc)[1]	0.52	1.38	0.92	0.89	0.27	1.18	0.96	1.38	1.19	1.89	0.44	0.79

1= excluding LOD values
2= including half LOD values

Table E2 Concentrations of PCDD/Fs and dioxin-like PCBs at Duncraig, WA (fg m^{-3}).

Duncraig	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 0.6	< 0.3	< 0.4	< 0.09	< 0.4	< 0.1	< 0.5	< 0.4	< 0.4	3.8	2.8	1.5
1,2,3,7,8-PeCDD	1.6	0.6	< 0.4	< 0.1	< 0.5	< 0.1	< 0.6	0.6	1.2	11.0	9.0	5.0
1,2,3,4,7,8-HxCDD	2.4	0.6	< 0.4	0.1	< 0.4	< 0.2	< 0.6	0.8	1.7	11.7	9.9	6.1
1,2,3,6,7,8-HxCDD	4.0	1.0	< 1.0	0.2	< 0.4	< 0.3	< 0.6	1.5	2.8	17.2	23.5	9.3
1,2,3,7,8,9-HxCDD	5.2	< 0.5	< 0.9	0.2	< 0.1	< 0.3	< 0.2	< 0.7	2.2	16.1	20.3	8.7
1,2,3,4,6,7,8-HpCDD	69.3	15.6	< 4.0	2.4	< 1.2	5.6	3.3	14.5	20.8	172.0	192.4	113.0
OCDD	211.9	53.4	< 20	17.7	10.4	38.0	22.1	29.0	47.8	505.4	389.1	337.8
PCDF Congeners												
2,3,7,8-TCDF	5.7	0.6	1.4	0.7	0.5	9.9	2.5	8.3	5.2	40.3	23.5	15.8
1,2,3,7,8-PeCDF	2.7	1.4	0.5	0.8	< 0.4	2.5	< 0.6	3.0	4.2	31.9	19.2	11.3
2,3,4,7,8-PeCDF	4.0	2.1	0.7	< 0.1	< 0.4	3.1	0.8	3.4	5.9	51.0	28.9	19.2
1,2,3,4,7,8-HxCDF	5.2	< 0.3	0.8	0.5	0.5	1.4	< 0.6	3.2	5.5	42.5	23.5	15.8
1,2,3,6,7,8-HxCDF	< 2.9	1.0	0.5	0.3	0.3	< 0.7	< 0.2	3.2	4.5	31.9	19.2	12.4
2,3,4,6,7,8-HxCDF	3.0		0.7	0.3	< 0.2	< 0.7	< 0.2	4.5	5.7	25.5	18.2	12.4
1,2,3,7,8,9-HxCDF	< 0.7	< 0.03	< 0.06	0.1	0.1	< 0.1	< 0.2	0.3	0.4	2.8	1.5	1.0
1,2,3,4,6,7,8-HpCDF	9.9	3.0	2.0	1.0	< 1.0	< 1.7	1.1	14.5	13.5	74.3	41.7	30.5
1,2,3,4,7,8,9-HpCDF	1.6	< 0.4	< 0.2	0.2	< 0.1	< 0.3	< 0.3	2.6	2.1	17.6	6.1	3.6
OCDF	9.6	1.3	1.5	0.8	1.1	< 1.3	1.6	12.1	5.8	29.7	28.9	14.7
PCDD Homologue Groups												
TCDD	6.4	6.6	7.5	4.5	3.0	6.3	3.9	1.3	24.9	72.2	38.5	39.5
PeCDD	5.4	2.2	5.3	0.7	< 1.2	1.8	1.1	4.7	24.9	144.4	73.8	57.6
HxCDD	26.5	12.4	11.0	3.3	4.9	4.6	0.7	22.4	42.6	246.3	243.7	136.7
HpCDD	113.5	50.8	8.4	4.5	1.9	10.1	3.5	29.0	41.5	329.1	342.0	218.0
PCDF Homologue Groups												
TCDF	107.7	63.9	25.0	16.4	6.4	76.1	26.2	44.8	139.1	781.4	399.8	328.7
PeCDF	28.8	18.2	10.0	5.4	3.8	21.5	3.6	35.6	62.3	490.5	292.9	185.3
HxCDF	23.8	8.1	6.1	2.7	1.7	4.6	0.9	33.0	44.6	316.4	177.4	123.1
HpCDF	17.5	< 3.9	3.1	1.6	< 1.2	< 3.3	0.8	25.1	22.8	165.6	73.8	52.0
Non-Ortho PCBs												
PCB 77	33.2	50.8	45.0	68.2	37.0	105.9	54.4	54.1	40.5	65.8	20.3	39.5
PCB 81	2.4	3.1	2.2	3.2	1.7	4.8	2.4	3.0	3.1	6.8	2.4	4.0
PCB 126	2.4	3.3	2.6	2.8	1.9	7.1	< 1.0	3.2	3.7	13.4	4.1	5.5
PCB 169	0.7	< 0.1	< 0.05	< 0.06	< 0.2	< 0.07	< 0.2	< 0.4	0.6	2.3	< 0.6	0.9
Mono-Ortho PCBs												
PCB 105	94.5	299.7	230.1	492.5	250.6	579.0	233.5	< 263	202.4	760.2	146.4	231.6
PCB 114	6.2	19.5	15.0	32.8	19.1	39.7	14.1	19.8	12.5	42.5	8.8	12.4
PCB 118	366.5	664.6	590.2	1212.2	620.6	1472.3	815.3	791.4	487.9	1418.4	318.5	502.7
PCB 123	8.0	20.8	21.0	42.9	21.5	48.0	14.1	26.4	18.7	42.5	8.3	14.7
PCB 156	19.9	39.1	29.0	53.0	35.8	91.0	40.3	< 40	26.0	142.3	17.1	41.8
PCB 157	3.7	10.2	5.6	12.1	< 4.8	19.9	< 10	6.9	6.3	34.0	4.0	12.4
PCB 167	41.1	76.9	140.1	< 25	< 24	< 50	< 10	< 26	4.3	< 42	< 7.5	< 23
PCB 189	< 1.0	< 1.3	< 0.9	1.2	< 0.8	3.8	4.1	< 1.0	0.8	5.7	< 1.0	2.9
Sum of PCDD and PCDF congeners												
Sum of PCDD/Fs (exc)[1]	551	222	78	58	33	164	64	237	457	3079	2063	1491
WHO_{98} TEQ_{DF} (inc)[2]	7.56	2.43	1.28	0.45	0.72	3.14	1.41	5.23	7.83	63.42	44.10	26.27
WHO_{98} TEQ_{DF} (exc)[1]	7.09	2.26	0.73	0.32	0.14	2.89	0.71	4.99	7.57	63.42	43.56	26.27
WHO_{98} TEQ_{PCB} (inc)[2]	0.32	0.47	0.38	0.51	0.31	1.01	0.19	0.44	0.48	1.70	0.47	0.68
WHO_{98} TEQ_{PCB} (exc)[1]	0.32	0.46	0.38	0.51	0.31	1.01	0.14	0.42	0.48	1.70	0.47	0.68

1= excluding LOD values
2= including half LOD values

Table E3 Concentrations of PCDD/Fs and dioxin-like PCBs at Berrimah, NT (fg m^{-3}).

Berrimah	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 0.5	< 0.3	< 0.4	< 0.1	< 0.1	< 0.07	< 1.0	< 0.5	< 0.3	< 0.9	< 0.4	< 0.3
1,2,3,7,8-PeCDD	2.5	0.7	< 0.5	0.2	< 0.1	< 0.2	0.4	< 0.5	0.5	0.5	< 0.5	0.7
1,2,3,4,7,8-HxCDD	3.2	0.7	< 0.5	0.3	< 0.06	< 0.2	< 0.3	< 0.5	0.7	0.4	< 0.5	1.2
1,2,3,6,7,8-HxCDD	4.5	1.2	< 0.9	0.4	0.4	0.4	0.6	< 0.8	1.0	1.1	< 0.3	1.8
1,2,3,7,8,9-HxCDD	10.3	< 1.3	< 0.9	0.3	< 0.1	< 0.2	< 0.7	< 0.6	< 0.9	1.3	< 0.3	2.2
1,2,3,4,6,7,8-HpCDD	84.5	< 13	< 6.0	4.9	3.6	5.4	8.6	8.0	13.4	13.5	11.5	29.4
OCDD	1182.5	174.6	55.0	62.3	34.1	35.7	66.6	57.5	183.6	137.5	161.9	429.4
PCDF Congeners												
2,3,7,8-TCDF	5.1	10.8	1.1	0.4	0.3	0.4	1.8	21.2	0.9	1.8	55.7	1.5
1,2,3,7,8-PeCDF	< 1.2	0.6	0.4	0.3	< 0.4	0.4	0.5	1.2	1.0	0.5	0.7	0.7
2,3,4,7,8-PeCDF	1.4	0.6	0.5	< 0.4	< 0.1	0.6	0.8	1.2	1.0	0.6	0.9	0.8
1,2,3,4,7,8-HxCDF	< 0.5	2.5	< 0.3	< 0.1	0.2	0.8	< 1.0	0.3	2.0	1.0	< 0.5	0.6
1,2,3,6,7,8-HxCDF	0.6	0.3	0.4	0.3	0.1	0.5	< 0.5	0.9	1.3	0.6	< 0.5	0.6
2,3,4,6,7,8-HxCDF	0.6	0.3	< 0.5	< 0.3	0.1	0.6	< 0.5	1.7	1.2	0.5	< 0.3	< 0.4
1,2,3,7,8,9-HxCDF	< 0.2	< 0.07	< 0.02	0.0	< 0.1	< 0.07	< 0.1	< 0.1	0.1	0.1	< 0.1	< 0.1
1,2,3,4,6,7,8-HpCDF	1.9	< 0.6	1.8	1.2	< 0.6	2.2	2.1	5.8	7.0	2.3	2.5	1.5
1,2,3,4,7,8,9-HpCDF	0.5	< 0.3	0.2	< 0.1	< 0.1	< 0.2	< 0.2	0.6	0.9	0.4	< 0.1	0.3
OCDF	1.4	0.7	0.9	< 0.5	< 0.1	1.4	1.6	2.9	5.5	< 1.4	1.4	1.9
PCDD Homologue Groups												
TCDD	27.9	12.7	13.0	10.6	6.2	4.1	8.5	0.5	11.1	14.2	6.3	11.2
PeCDD	32.2	9.9	8.6	2.9	< 3.0	2.0	3.6	3.2	2.9	7.9	< 2.6	7.0
HxCDD	90.0	21.8	13.0	10.3	8.3	8.6	13.2	8.2	17.8	17.0	16.8	31.9
HpCDD	203.2	50.9	15.0	12.5	9.6	15.0	22.8	10.0	32.3	29.8	28.5	69.0
PCDF Homologue Groups												
TCDF	93.1	39.3	35.0	15.9	7.7	9.8	29.3	46.9	40.1	49.6	221.5	43.4
PeCDF	8.4	5.8	10.0	4.2	1.9	6.6	8.9	10.1	16.7	7.4	10.0	8.4
HxCDF	7.5	4.5	5.4	3.3	1.4	4.5	4.1	9.4	14.5	5.0	4.5	2.7
HpCDF	3.3	< 2.9	2.2	1.9	< 0.7	3.6	3.1	6.7	10.6	3.4	< 0.6	1.9
Non-Ortho PCBs												
PCB 77	80.0	69.9	57.0	99.5	120.1	102.6	201.6	143.8	124.7	93.6	41.5	78.0
PCB 81	4.8	3.6	3.0	5.3	6.4	5.0	10.6	7.0	6.9	4.7	2.5	4.2
PCB 126	3.3	2.9	2.6	3.4	< 3.0	3.0	6.2	2.9	3.8	2.4	1.4	1.9
PCB 169	< 0.2	< 0.1	< 0.06	< 0.1	< 0.06	< 0.09	< 0.3	< 0.5	0.5	< 0.1	0.6	< 0.1
Mono-Ortho PCBs												
PCB 105	332.8	422.0	270.2	543.7	444.9	449.5	747.8	423.7	507.5	741.4	209.9	288.8
PCB 114	22.0	30.6	19.0	38.5	31.1	31.1	52.0	34.8	31.2	43.9	12.4	21.7
PCB 118	934.1	1106.1	730.4	1458.6	1156.6	1267.8	2113.3	1377.1	1580.4	1672.8	426.2	720.8
PCB 123	< 36	27.7	25.0	49.1	47.5	34.6	60.1	43.9	49.0	38.3	10.5	25.6
PCB 156	42.2	40.7	28.0	55.7	48.9	56.5	79.7	< 45	65.7	93.6	27.2	29.4
PCB 157	8.1	9.2	6.3	13.1	9.6	10.1	17.9	8.9	14.5	22.7	4.5	< 7.7
PCB 167	87.5	17.5	88.1	< 27	< 44	< 23	< 33	< 30	60.1	< 57	15.5	< 13
PCB 189	< 0.1	< 0.7	0.6	< 0.5	< 1.0	< 1.2	< 1.1	< 1.2	< 1.1	< 1.1	< 0.3	< 0.5
Sum of PCDD/Fs (exc)[1]	1652	320	160	125	70	91	161	156	335	269	451	607
WHO_{98} TEQ_{DF} (inc)[2]	6.93	2.93	1.09	0.67	0.37	0.84	1.83	3.77	2.24	2.14	6.79	2.45
WHO_{98} TEQ_{DF} (exc)[1]	6.63	2.65	0.45	0.49	0.16	0.65	1.19	3.21	2.02	1.71	6.22	2.30
WHO_{98} TEQ_{PCB} (inc)[2]	0.51	0.50	0.40	0.62	0.37	0.54	1.01	0.52	0.67	0.58	0.24	0.33
WHO_{98} TEQ_{PCB} (exc)[1]	0.50	0.49	0.40	0.61	0.22	0.53	1.01	0.51	0.67	0.58	0.24	0.33

1= excluding LOD values
2= including half LOD values

Table E4 Concentrations of PCDD/Fs and dioxin-like PCBs at Eagle Farm, Qld (fg m^{-3}).

Eagle Farm	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 0.7	< 0.3	< 0.6	< 0.2	< 0.6	< 0.2	< 0.3	< 0.9	< 0.8	< 0.6	< 1.5	< 0.6
1,2,3,7,8-PeCDD	< 1.2	< 0.6	< 1.2	0.5	< 1.5	< 0.3	0.8	0.5	0.7	1.7	< 0.4	< 1.2
1,2,3,4,7,8-HxCDD	1.1	0.5	< 0.9	0.3	< 0.6	< 0.2	< 0.3	0.5	1.1	3.2	< 1.1	1.4
1,2,3,6,7,8-HxCDD	2.1	0.9	< 1.8	0.9	< 0.9	< 0.7	1.3	< 0.9	1.9	5.2	< 2.2	2.9
1,2,3,7,8,9-HxCDD	< 1.9	< 0.6	< 2.4	0.3	< 1.2	< 0.7	< 1.3	< 0.9	1.1	4.1	< 0.7	2.5
1,2,3,4,6,7,8-HpCDD	21.6	11.1	< 15	9.0	< 12	7.2	19.6	11.9	20.9	57.9	20.3	28.1
OCDD	213.0	185.5	148.2	118.4	266.6	153.2	164.1	95.0	109.5	179.5	101.6	198.2
PCDF Congeners												
2,3,7,8-TCDF	5.8	1.4	1.7	1.2	1.2	8.5	12.0	< 0.3	2.8	254.8	268.4	5.2
1,2,3,7,8-PeCDF	1.4	0.6	< 0.3	0.6	0.5	4.6	1.8	< 0.6	1.7	28.7	10.2	< 2.1
2,3,4,7,8-PeCDF	2.3	0.9	0.8	< 0.9	0.9	7.8	3.5	1.7	3.1	11.6	6.5	4.9
1,2,3,4,7,8-HxCDF	< 1.2	0.5	0.9	< 0.3	0.6	3.1	2.3	1.2	2.8	7.8	3.6	5.2
1,2,3,6,7,8-HxCDF	1.3	1.1	0.7	< 0.6	0.9	1.7	< 1.3	1.1	2.8	5.8	2.9	3.7
2,3,4,6,7,8-HxCDF	< 1.0	0.7	< 0.9	0.8	< 0.6	1.5	1.4	< 1.2	2.8	4.9	3.2	3.7
1,2,3,7,8,9-HxCDF	< 0.5	0.1	< 0.09	< 0.06	< 0.6	< 0.2	< 0.1	< 0.2	< 0.2	0.8	< 0.7	0.3
1,2,3,4,6,7,8-HpCDF	6.3	3.6	3.3	3.7	4.0	3.3	7.3	5.3	11.5	16.8	9.8	13.4
1,2,3,4,7,8,9-HpCDF	0.8	< 0.3	0.4	0.3	< 0.6	< 0.7	< 0.6	0.6	1.9	2.6	1.0	1.4
OCDF	5.1	3.0	4.2	3.1	< 2.8	< 2.0	6.0	5.0	15.8	11.3	7.3	9.5
PCDD Homologue Groups												
TCDD	21.9	14.7	19.0	20.6	23.0	9.8	9.5	10.7	9.7	17.1	6.9	18.9
PeCDD	< 15	6.1	< 3.0	0.5	3.4	< 3.3	3.1	1.5	< 2.5	14.2	6.9	6.4
HxCDD	27.7	16.1	21.0	15.0	14.7	10.8	20.8	11.9	30.5	63.7	20.3	39.6
HpCDD	45.2	25.2	27.3	19.6	17.2	15.3	41.0	24.0	40.7	110.0	36.3	54.9
PCDF Homologue Groups												
TCDF	63.7	30.5	28.2	34.3	29.1	78.2	75.7	21.1	56.0	926.4	892.3	85.4
PeCDF	22.4	13.3	6.2	10.3	3.1	45.6	34.7	15.1	25.5	153.4	61.7	36.6
HxCDF	8.3	7.5	5.0	6.5	4.0	18.6	13.6	11.6	25.5	55.0	21.4	30.5
HpCDF	9.0	6.1	12.5	5.6	< 6.1	3.6	13.3	10.4	21.6	31.8	10.9	17.1
Non-Ortho PCBs												
PCB 77	374.5	207.7	240.1	292.9	260.5	313.0	337.7	350.3	277.5	344.5	170.5	301.9
PCB 81	17.3	10.8	11.6	14.0	12.9	14.3	16.4	16.0	13.7	17.7	9.4	15.9
PCB 126	29.7	13.8	16.6	19.6	< 12	19.2	18.6	15.1	15.3	18.8	10.9	22.0
PCB 169	< 1.0	< 0.6	0.6	< 0.2	< 0.9	< 0.3	< 0.6	< 0.3	0.6	< 0.9	< 1.1	1.2
Mono-Ortho PCBs												
PCB 105	1592.7	996.8	1037.7	1900.8	1379.0	1401.8	1540.2	1668.6	1143.1	3126.6	1059.2	1808.1
PCB 114	134.5	58.1	68.2	109.1	85.8	91.3	107.3	130.6	61.1	191.1	50.8	112.8
PCB 118	4498.4	2242.7	2697.9	4050.9	3033.9	3586.0	4008.3	4423.9	3080.4	6397.9	2024.1	4512.5
PCB 123	186.5	74.8	97.8	< 93	< 92	< 130	142.0	157.4	137.5	257.7	61.7	146.4
PCB 156	325.8	130.1	154.2	302.3	202.3	251.0	230.4	210.8	198.6	619.5	119.7	414.7
PCB 157	64.7	< 28	29.6	71.7	46.0	52.2	44.2	53.4	33.1	118.7	31.9	88.4
PCB 167	437.7	< 55	355.8	< 156	< 123	< 130	< 95	< 89	< 51	< 145	< 73	< 122
PCB 189	< 7.3	< 2.8	5.3	8.4	< 6.1	10.4	14.2	7.4	6.4	28.1	9.1	17.1
Sum of PCDD/Fs (exc)[1]	416	305	273	234	368	326	382	208	336	1563	1164	497
WHO_{98} TEQ_{DF} (inc)[2]	3.75	1.63	2.06	1.46	2.16	6.04	4.95	2.50	4.63	38.65	33.00	6.33
WHO_{98} TEQ_{DF} (exc)[1]	2.55	1.18	0.78	1.06	0.82	5.74	4.64	1.85	4.24	38.34	31.91	5.36
WHO_{98} TEQ_{PCB} (inc)[2]	3.91	1.84	2.21	2.84	1.26	2.66	2.68	2.38	2.15	3.37	1.53	3.20
WHO_{98} TEQ_{PCB} (exc)[1]	3.90	1.83	2.20	2.83	0.64	2.65	2.66	2.37	2.15	3.36	1.52	3.19

1= excluding LOD values
2= including half LOD values

Table E5 Concentrations of PCDD/Fs and dioxin-like PCBs at Mutdapilly, Qld (fg m^{-3}).

Mutdapilly PCDD Congeners	Sep-02	Oct-02	Nov-Dec 2002	Jan-Feb 2003	Mar-Apr 2003	May-Jun 2003	Jul-Aug 2003
2,3,7,8-TCDD	< 0.5	< 0.7	< 0.06	< 0.14	< 0.3	< 0.1	< 0.5
1,2,3,7,8-PeCDD	< 0.8	< 1.0	0.2	< 1.0	< 0.2	< 0.3	< 0.3
1,2,3,4,7,8-HxCDD	< 1.0	< 1.0	0.2	< 1.0	< 0.3	0.1	0.2
1,2,3,6,7,8-HxCDD	1.7	< 1.7	0.4	< 0.2	< 0.2	< 0.2	< 0.3
1,2,3,7,8,9-HxCDD	< 1.8	2.8	< 0.2	< 0.2	< 0.7	< 0.3	< 0.2
1,2,3,4,6,7,8-HpCDD	9.2	< 13	4.9	3.5	5.4	2.3	3.4
OCDD	94.1	150.5	91.5	66.6	29.5	16.6	34.3
PCDF Congeners							
2,3,7,8-TCDF	1.3	5.0	2.2	< 0.4	< 0.1	16.6	1.5
1,2,3,7,8-PeCDF	< 0.5	0.5	0.8	< 0.5	< 0.2	0.8	0.7
2,3,4,7,8-PeCDF	0.8	0.8	1.2	0.5	< 0.3	0.8	1.1
1,2,3,4,7,8-HxCDF	< 1.1	1.0	< 0.3	< 0.4	< 0.3	0.6	< 1.2
1,2,3,6,7,8-HxCDF	< 0.8	< 0.3	0.5	0.3	0.4	0.4	0.8
2,3,4,6,7,8-HxCDF	< 0.8	< 0.3	0.4	< 0.2	0.6	0.5	0.6
1,2,3,7,8,9-HxCDF	< 0.1	< 0.01	< 0.05	< 0.05	< 0.1	< 0.04	< 0.06
1,2,3,4,6,7,8-HpCDF	1.8	< 1.3	0.9	< 0.7	1.7	1.7	1.9
1,2,3,4,7,8,9-HpCDF	< 0.3	< 0.3	0.1	< 0.09	0.4	0.3	< 0.2
OCDF	2.1	< 1.3	< 0.6	< 0.7	1.5	< 1.1	1.5
PCDD Homologue Groups							
TCDD	15.3	20.7	8.5	7.2	1.3	2.7	5.1
PeCDD	< 11	< 3.3	1.7	< 1.2	12.1	1.2	< 1.5
HxCDD	15.6	22.1	6.9	1.4	1.9	3.6	5.3
HpCDD	18.2	12.7	11.8	9.3	12.5	5.4	7.7
PCDF Homologue Groups							
TCDF	24.5	26.8	31.5	4.9	6.4	68.1	29.1
PeCDF	9.0	9.4	12.5	6.8	4.7	7.0	11.5
HxCDF	1.3	< 3.3	3.9	1.0	2.3	3.5	5.7
HpCDF	< 5.3	< 3.3	1.3	< 1.4	3.1	2.1	3.1
Non-Ortho PCBs							
PCB 77	71.2	46.8	99.3	40.3	26.0	24.2	18.8
PCB 81	3.4	2.8	5.5	1.8	< 1.0	1.0	1.2
PCB 126	14.0	< 1.0	6.6	2.8	1.7	1.8	1.6
PCB 169	< 0.8	< 0.1	< 0.2	< 0.1	< 0.2	< 0.1	< 0.09
Mono-Ortho PCBs							
PCB 105	622.3	401.4	614.9	298.1	554.6	973.9	323.7
PCB 114	26.1	26.8	39.4	17.0	32.9	49.9	14.7
PCB 118	1181.2	936.7	1576.7	771.5	1213.3	1739.1	590.9
PCB 123	38.2	30.4	71.0	29.8	38.1	40.8	13.0
PCB 156	152.1	53.5	102.5	40.3	< 69	137.6	44.5
PCB 157	29.0	13.4	20.5	8.4	17.0	30.2	< 8.6
PCB 167	348.0	< 23	< 47	< 16	< 17	< 45	< 17
PCB 189	< 1.6	< 1.7	5.5	< 0.4	2.1	< 1.4	< 0.7
Sum of PCDD/Fs (exc)[1]	180	241	173	96	75	110	103
WHO_{98} TEQ_{DF} (inc)[2]	1.78	2.44	1.36	0.52	0.62	2.55	1.47
WHO_{98} TEQ_{DF} (exc)[1]	0.82	1.35	1.30	0.31	0.18	2.31	0.94
WHO_{98} TEQ_{PCB} (inc)[2]	1.70	0.24	0.98	0.43	0.40	0.57	0.29
WHO_{98} TEQ_{PCB} (exc)[1]	1.70	0.19	0.98	0.43	0.38	0.57	0.29

1= excluding LOD values
2= including half LOD values

Table E6 Concentrations of PCDD/Fs and dioxin-like PCBs at Westmead, NSW (fg m^{-3}).

Westmead	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 0.8	< 0.4	< 0.3	< 0.1	< 0.2	< 0.3	< 0.3	< 1.1	1.3	< 2.7	2.8	< 0.6
1,2,3,7,8-PeCDD	2.2	1.1	< 0.9	1.2	0.8	< 0.3	< 0.5	< 0.9	3.9	9.6	7.5	3.1
1,2,3,4,7,8-HxCDD	2.2	< 1.0	< 0.8	1.9	0.7	< 0.4	< 0.8	1.5	6.0	9.2	< 10	2.8
1,2,3,6,7,8-HxCDD	3.4	1.6	< 1.3	3.2	< 1.0	< 1.0	1.3	3.3	11.4	18.6	29.6	6.0
1,2,3,7,8,9-HxCDD	4.7	< 2.9	< 1.3	2.2	< 1.0	< 0.7	< 1.0	2.7	9.9	15.4	22.0	5.0
1,2,3,4,6,7,8-HpCDD	38.9	23.4	< 13	38.4	24.9	11.3	14.6	37.7	141.3	143.8	193.3	58.8
OCDD	409.6	321.7	279.7	383.5	383.4	131.1	112.9	200.6	505.9	468.5	< 677	337.6
PCDF Congeners												
2,3,7,8-TCDF	6.0	< 5.9	8.8	2.7	1.5	< 1.4	11.9	67.9	11.2	32.1	30.9	11.8
1,2,3,7,8-PeCDF	3.9	3.1	1.5	1.9	1.0	1.0	1.8	6.2	9.1	22.2	21.0	7.3
2,3,4,7,8-PeCDF	5.6	3.7	2.0	2.9	1.2	1.4	3.1	6.3	16.0	37.1	34.7	11.8
1,2,3,4,7,8-HxCDF	6.2	< 0.7	1.1	2.7	1.1	< 1.4	2.9	3.9	13.7	27.5	26.0	7.7
1,2,3,6,7,8-HxCDF	4.3	2.2	1.3	2.4	1.0	1.2	2.4	3.8	10.6	21.6	21.8	7.4
2,3,4,6,7,8-HxCDF	4.9	2.2	< 1.2	2.1	0.3	1.1	2.6	4.2	13.7	16.5	19.0	5.8
1,2,3,7,8,9-HxCDF	< 0.2	0.2	< 0.3	0.2	< 0.07	< 0.1	< 0.1	0.3	1.0	1.6	< 2.0	< 0.5
1,2,3,4,6,7,8-HpCDF	16.3	7.5	5.7	8.6	5.4	6.2	9.3	12.7	29.6	40.3	44.3	16.6
1,2,3,4,7,8,9-HpCDF	1.8	0.7	0.5	0.7	0.4	< 0.4	1.1	1.7	4.6	8.0	< 5.8	1.9
OCDF	12.0	6.4	5.5	4.5	3.4	< 2.8	6.3	7.2	23.9	18.9	< 26	7.5
PCDD Homologue Groups												
TCDD	23.0	20.5	14.6	17.6	18.7	10.5	9.3	16.6	39.9	64.0	71.1	28.1
PeCDD	7.3	10.1	2.4	13.4	12.4	2.2	< 1.5	6.3	54.7	80.1	103.3	29.4
HxCDD	53.7	32.2	18.6	49.5	21.8	9.2	12.7	45.3	135.6	222.2	296.7	60.1
HpCDD	79.5	51.2	29.3	84.7	57.0	26.2	29.0	73.9	252.9	272.3	351.2	111.3
PCDF Homologue Groups												
TCDF	121.2	102.4	20.0	89.5	40.4	34.5	108.3	617.0	265.5	617.9	654.6	260.9
PeCDF	59.3	33.6	4.9	35.2	21.8	16.6	38.1	63.4	151.5	351.8	314.7	101.0
HxCDF	44.1	30.7	5.3	24.0	14.5	13.8	25.9	37.7	106.0	170.2	208.9	63.9
HpCDF	27.3	11.4	9.6	14.2	8.6	7.7	16.8	22.6	57.0	88.0	77.0	25.6
Non-Ortho PCBs												
PCB 77	299.2	248.6	319.6	319.6	342.0	331.3	274.6	215.7	222.2	146.2	192.3	106.1
PCB 81	15.5	12.4	16.0	17.6	18.7	15.2	14.2	11.3	13.7	10.5	13.9	7.2
PCB 126	17.0	16.1	16.0	14.4	14.5	12.7	12.1	9.1	12.5	13.8	14.1	8.1
PCB 169	< 0.6	< 0.6	< 0.3	< 0.6	< 0.5	< 0.4	< 0.6	< 0.3	1.1	1.7	1.9	< 0.4
Mono-Ortho PCBs												
PCB 105	1761.6	1345.4	1331.7	1757.9	1139.9	1352.8	1174.7	1138.9	1033.4	527.5	1568.9	479.6
PCB 114	107.7	86.3	90.6	116.7	88.1	100.8	< 76	70.9	68.4	36.3	93.6	29.4
PCB 118	4338.7	3509.6	3595.6	4314.9	3108.7	3865.2	3051.2	2971.8	2871.2	1325.6	3603.3	1195.7
PCB 123	178.8	114.1	130.5	159.8	134.7	151.8	103.7	87.5	109.4	< 49	100.8	38.4
PCB 156	265.6	204.7	159.8	239.7	155.4	165.7	141.9	126.7	128.7	90.1	247.9	83.1
PCB 157	< 56	49.7	33.3	54.3	44.6	30.4	35.1	36.2	34.2	< 12	60.5	17.9
PCB 167	480.6	380.2	306.3	< 128	< 83	< 97	< 61	< 75	< 11	< 18	< 63	< 38
PCB 189	3.4	6.9	4.3	6.9	4.8	< 2.8	< 4.6	4.1	6.2	< 5.0	< 3.3	3.2
Sum of PCDD/Fs (exc)[1]	838	614	386	719	580	248	360	1091	1595	2639	2499	1026
WHO_{98} TEQ_{DF} (inc)[2]	9.40	4.92	3.20	5.01	2.45	1.68	4.48	13.77	23.11	48.27	47.41	15.12
WHO_{98} TEQ_{DF} (exc)[1]	9.02	4.09	2.28	4.95	2.24	1.16	4.00	12.78	23.11	48.27	47.41	14.77
WHO_{98} TEQ_{PCB} (inc)[2]	2.57	2.31	2.28	2.31	2.07	1.99	1.78	1.47	1.81	1.67	2.18	1.06
WHO_{98} TEQ_{PCB} (exc)[1]	2.55	2.31	2.28	2.30	2.07	1.99	1.76	1.46	1.81	1.67	2.18	1.05

1= excluding LOD values

2= including half LOD values

Table E7 Concentrations of PCDD/Fs and dioxin-like PCBs at Boorolite, Vic (fg m^{-3}).

Boorolite	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 0.6	< 0.09	< 0.4	< 0.2	< 0.5	< 0.07	< 0.1	< 0.5	< 0.2	< 0.7	< 0.1	< 0.2
1,2,3,7,8-PeCDD	1.5	0.5	< 0.5	0.1	< 0.3	< 0.1	< 0.3	< 0.4	0.1	< 0.4	< 0.3	< 0.3
1,2,3,4,7,8-HxCDD	1.6	< 0.3	< 0.5	< 0.1	< 0.7	< 0.2	< 0.09	< 0.06	< 0.1	< 0.1	< 0.2	< 0.3
1,2,3,6,7,8-HxCDD	1.7	< 0.6	< 0.9	0.2	< 0.3	0.3	< 0.1	< 0.1	< 0.3	< 0.3	< 0.2	< 0.2
1,2,3,7,8,9-HxCDD	1.3	< 0.9	< 0.1	0.2	< 0.8	< 0.5	< 0.3	< 0.1	< 0.2	< 0.7	< 0.3	< 0.2
1,2,3,4,6,7,8-HpCDD	5.8	< 3.1	< 5.2	< 1.6	< 5.0	6.2	3.3	2.2	6.2	3.3	< 1.2	< 1.4
OCDD	49.2	< 31.2	79.9	33.7	82.8	81.4	50.7	30.9	27.9	< 11.6	16.8	< 9.3
PCDF Congeners												
2,3,7,8-TCDF	0.8	< 0.05	< 0.1	< 0.3	< 0.2	0.2	< 0.7	< 0.3	< 0.1	2.6	150.3	0.6
1,2,3,7,8-PeCDF	1.5	0.2	< 0.1	< 0.08	< 0.2	< 0.09	< 0.3	< 0.1	0.2	0.4	1.7	< 0.2
2,3,4,7,8-PeCDF	1.6	< 0.2	0.2	< 0.08	< 0.1	< 0.09	0.3	0.2	< 0.2	0.4	1.1	0.3
1,2,3,4,7,8-HxCDF	2.4	< 0.2	< 0.1	0.1	< 0.2	< 0.2	< 0.3	< 0.05	< 0.2	0.4	0.2	0.3
1,2,3,6,7,8-HxCDF	1.4	0.1	0.1	< 0.06	< 0.2	< 0.05	< 0.1	< 0.09	0.3	< 0.1	< 0.2	< 0.3
2,3,4,6,7,8-HxCDF	1.4	< 0.1	0.2	0.0	< 0.2	< 0.07	< 0.1	0.1	0.4	< 0.4	< 0.2	< 0.2
1,2,3,7,8,9-HxCDF	< 1.0	< 0.06	< 0.02	< 0.05	< 0.2	< 0.04	< 0.04	< 0.05	< 0.05	< 0.07	< 0.08	< 0.3
1,2,3,4,6,7,8-HpCDF	< 2.0	< 0.8	0.8	0.3	< 0.7	< 0.7	1.0	0.5	2.0	< 1.0	0.5	1.1
1,2,3,4,7,8,9-HpCDF	< 1.2	< 0.1	< 0.2	< 0.1	< 0.2	< 0.07	< 0.07	< 0.05	0.4	< 0.3	< 0.08	< 0.08
OCDF	3.8	< 0.6	< 0.5	< 0.03	< 0.8	< 0.2	1.1	< 0.4	3.1	< 1.5	0.6	< 0.6
PCDD Homologue Groups												
TCDD	1.0	< 1.6	< 1.7	0.5	1.4	4.6	0.6	< 1.3	< 1.1	1.1	0.3	< 1.1
PeCDD	1.9	< 1.6	< 1.7	0.3	< 1.0	1.8	0.4	< 2.6	< 0.8	< 1.5	0.3	< 1.4
HxCDD	8.8	3.3	7.3	1.5	5.6	2.1	4.2	1.0	1.9	1.9	0.5	1.0
HpCDD	9.0	6.9	11.5	4.2	7.9	15.0	10.0	2.2	11.5	5.8	2.5	1.7
PCDF Homologue Groups												
TCDF	12.2	5.0	4.3	2.4	2.5	2.7	5.8	1.2	4.3	14.5	437.1	8.4
PeCDF	7.0	< 1.6	< 1.7	0.9	< 1.2	0.6	1.3	0.4	1.1	4.6	5.6	3.7
HxCDF	6.0	< 1.6	< 1.7	< 0.6	< 1.0	< 0.4	1.1	0.6	0.8	2.9	0.4	< 1.2
HpCDF	< 6.0	< 0.6	3.1	0.3	< 1.3	< 1.1	2.2	0.6	3.4	< 2.9	0.4	1.2
Non-Ortho PCBs												
PCB 77	82.3	39.0	92.1	73.8	48.0	81.4	52.2	29.6	17.0	29.0	11.4	18.6
PCB 81	5.2	2.7	6.1	4.5	2.6	3.9	3.2	1.4	0.9	1.4	0.7	0.7
PCB 126	5.0	< 1.4	3.0	1.9	< 0.7	< 1.8	< 1.5	0.9	0.8	< 1.0	< 0.3	< 0.8
PCB 169	1.2	< 0.1	0.1	< 0.03	< 0.05	< 0.07	< 0.09	< 0.08	< 0.09	< 0.1	< 0.06	< 0.2
Mono-Ortho PCBs												
PCB 105	1010.1	296.2	625.5	449.3	331.2	583.7	308.6	< 257	227.8	686.4	167.7	208.8
PCB 114	59.4	20.3	50.4	35.3	23.2	40.7	21.7	19.3	13.2	39.1	11.6	12.2
PCB 118	2968.4	670.5	1563.8	1075.2	728.7	1308.9	737.5	< 643	540.9	1210.7	439.5	416.0
PCB 123	80.3	20.3	48.7	38.5	< 17	40.7	18.8	20.6	14.3	33.3	18.5	11.3
PCB 156	< 139	54.6	78.2	51.4	39.7	60.1	29.0	< 26	32.5	98.5	20.8	24.7
PCB 157	12.8	< 9.4	14.1	10.6	< 8.3	12.6	6.5	6.7	6.8	24.6	< 4.6	< 6.2
PCB 167	539.9	99.8	130.3	< 16	< 17	< 18	< 8.7	<26	< 9.3	< 29	13.9	< 11
PCB 189	< 3.0	1.5	2.1	1.6	0.7	< 1.2	< 2.9	< 0.4	< 0.8	< 0.7	< 0.3	< 0.5
Sum of PCDD/Fs (exc)[1]	99	15	106	43	101	108	77	37	54	30	465	15
WHO$_{98}$ TEQ$_{DF}$ (inc)[2]	3.89	0.74	0.70	0.33	0.61	0.31	0.52	0.64	0.46	1.22	16.01	0.58
WHO$_{98}$ TEQ$_{DF}$ (exc)[1]	3.52	0.52	0.15	0.19	0.01	0.13	0.21	0.15	0.30	0.54	15.70	0.26
WHO$_{98}$ TEQ$_{PCB}$ (inc)[2]	1.00	0.22	0.60	0.41	0.18	0.35	0.21	0.16	0.19	0.33	0.10	0.13
WHO$_{98}$ TEQ$_{PCB}$ (exc)[1]	0.97	0.14	0.60	0.41	0.14	0.26	0.14	0.11	0.19	0.28	0.08	0.08

1= excluding LOD values
2= including half LOD values

Table E8 Concentrations of PCDD/Fs and dioxin-like PCBs at Alphington, Vic (fg m^{-3}).

Alphington	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 0.8	< 0.5	< 0.6	< 0.2	< 0.3	< 0.3	< 0.4	1.1	1.6	2.7	1.8	1.6
1,2,3,7,8-PeCDD	1.4	1.5	1.7	< 0.5	0.8	0.8	1.1	2.3	5.3	7.5	6.5	3.4
1,2,3,4,7,8-HxCDD	1.2	1.6	< 1.4	0.5	0.7	0.8	< 1.2	3.3	7.2	7.8	6.2	3.1
1,2,3,6,7,8-HxCDD	2.4	2.7	2.8	0.8	< 0.9	1.5	1.9	4.9	12.1	11.1	9.4	5.2
1,2,3,7,8,9-HxCDD	< 3.0	3.7	< 2.8	< 0.4	< 0.6	< 0.5	1.8	4.7	11.3	9.0	8.3	3.1
1,2,3,4,6,7,8-HpCDD	20.1	21.0	< 14	11.3	15.0	20.2	27.0	50.2	112.9	74.8	79.6	37.6
OCDD	187.9	193.4	296.4	222.1	352.3	336.1	404.0	220.8	414.8	247.2	274.3	156.1
PCDF Congeners												
2,3,7,8-TCDF	9.8	27.4	6.2	2.9	3.2	2.8	52.7	66.0	21.8	32.0	26.5	17.6
1,2,3,7,8-PeCDF	4.7	2.7	2.5	< 1.1	2.0	1.7	5.4	8.3	15.0	21.4	17.7	11.2
2,3,4,7,8-PeCDF	6.8	5.0	3.4	1.6	2.9	2.8	7.6	14.1	25.8	33.6	29.5	17.6
1,2,3,4,7,8-HxCDF	5.7	6.8	2.4	< 1.1	2.8	3.2	3.5	8.5	21.8	27.5	20.6	11.7
1,2,3,6,7,8-HxCDF	3.8	2.9	2.1	1.0	2.3	3.0	3.5	8.7	19.0	21.4	16.2	9.6
2,3,4,6,7,8-HxCDF	3.5	3.2	2.1	0.9	< 1.5	3.6	3.5	9.8	20.4	21.4	16.2	8.3
1,2,3,7,8,9-HxCDF	0.4	0.2	0.2	< 0.08	< 0.9	< 0.1	< 0.07	0.6	1.6	1.7	1.6	0.8
1,2,3,4,6,7,8-HpCDF	11.3	8.2	5.9	3.7	10.4	12.5	11.8	22.9	44.9	58.0	32.4	17.6
1,2,3,4,7,8,9-HpCDF	1.3	1.0	0.8	0.3	1.0	1.5	1.4	2.7	6.5	10.2	6.0	2.6
OCDF	11.9	5.6	5.5	4.4	15.3	9.0	12.3	12.0	25.8	27.5	16.2	10.7
PCDD Homologue Groups												
TCDD	17.3	24.2	33.9	10.5	18.4	13.4	16.2	17.2	39.4	76.3	50.1	42.3
PeCDD	11.3	12.9	15.5	4.4	6.1	7.0	6.4	30.1	70.7	112.9	67.8	41.1
HxCDD	26.0	35.5	40.9	11.7	18.4	12.6	28.4	100.4	164.6	148.0	110.6	59.9
HpCDD	39.5	38.7	43.8	23.4	32.2	45.7	55.4	96.1	212.2	143.4	144.5	70.4
PCDF Homologue Groups												
TCDF	215.0	141.8	120.0	52.6	82.7	75.3	332.4	296.8	322.3	659.3	570.7	408.5
PeCDF	70.7	51.6	73.4	23.4	41.4	39.0	85.1	134.8	235.3	383.0	303.8	185.5
HxCDF	35.8	33.8	31.1	11.1	23.0	30.9	54.0	86.0	179.5	215.2	157.8	89.2
HpCDF	14.9	13.2	13.4	6.3	13.0	20.2	20.3	25.8	83.0	106.8	63.4	31.7
Non-Ortho PCBs												
PCB 77	219.5	241.7	409.3	526.1	735.1	564.6	502.6	329.8	176.8	244.2	197.6	197.2
PCB 81	13.4	14.8	21.2	25.7	36.8	28.2	25.7	18.6	10.7	16.8	13.4	14.1
PCB 126	9.6	11.6	18.3	19.9	27.6	21.5	20.3	14.3	13.3	21.4	16.2	12.9
PCB 169	< 0.6	0.5	0.8	0.6	< 0.6	0.7	0.8	1.3	1.6	4.0	1.9	< 1.2
Mono-Ortho PCBs												
PCB 105	813.3	999.2	1552.6	1753.5	2450.5	1882.0	1972.7	1151.4	806.4	1755.0	853.8	698.4
PCB 114	57.9	74.1	115.7	128.6	183.8	147.9	139.2	91.8	50.3	111.4	63.4	49.3
PCB 118	2134.7	2578.5	3952.1	4676.0	6279.3	5511.7	5337.2	3068.4	1944.7	3571.0	2138.1	1854.6
PCB 123	69.6	87.0	155.3	198.7	275.7	201.6	177.0	126.2	69.4	117.5	64.9	58.7
PCB 156	103.9	125.7	183.5	198.7	260.4	188.2	212.1	121.9	123.8	218.2	113.5	85.7
PCB 157	< 14	27.4	40.9	43.3	56.7	41.7	43.2	28.7	25.8	64.1	38.3	21.1
PCB 167	273.6	< 32	381.1	< 117	< 153	< 94	< 81	< 43	44.9	< 92	< 103	< 35
PCB 189	< 3.0	4.5	6.2	4.8	6.4	< 5.4	6.1	4.4	7.3	7.3	7.4	3.3
Sum of PCDD/Fs (exc)[1]	630	548	678	374	597	591	1015	1019	1754	2121	1755	1095
WHO_{98} TEQ_{DF} (inc)[2]	8.54	9.58	5.76	2.06	3.86	4.39	12.59	22.29	33.81	42.72	35.61	20.95
WHO_{98} TEQ_{DF} (exc)[1]	8.02	9.26	5.20	1.61	3.51	4.16	12.32	22.29	33.81	42.72	35.61	20.94
WHO_{98} TEQ_{PCB} (inc)[2]	1.38	1.67	2.63	2.90	3.99	3.17	3.05	2.03	1.75	2.95	2.08	1.66
WHO_{98} TEQ_{PCB} (exc)[1]	1.37	1.67	2.63	2.90	3.99	3.17	3.03	2.04	1.75	2.94	2.08	1.65

1= excluding LOD values
2= including half LOD values

Table E9 Concentrations of PCDD/Fs and dioxin-like PCBs at Cape Grim, Tas (fg m^{-3}).

Cape Grim	Sep-02	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03
PCDD Congeners												
2,3,7,8-TCDD	< 0.7	< 0.3	< 0.2	< 0.2	< 0.4	< 0.2	< 0.07	< 0.2	< 1.3	< 0.3	< 0.1	1.4
1,2,3,7,8-PeCDD	< 1	0.8	< 0.7	< 0.2	< 0.2	< 0.1	< 0.2	< 0.2	29.1	1.6	< 0.1	1.0
1,2,3,4,7,8-HxCDD	< 0.7	< 0.5	< 0.7	< 0.1	< 0.1	< 0.2	< 0.03	< 0.03	106.5	4.5	< 0.2	0.8
1,2,3,6,7,8-HxCDD	< 1.3	< 0.8	< 0.9	< 0.1	< 0.1	< 0.2	0.1	< 0.03	263.2	9.8	1.6	1.8
1,2,3,7,8,9-HxCDD	< 1.7	< 1.8	< 0.2	0.4	< 0.1	< 0.1	< 0.05	< 0.08	219.3	9.1	0.8	1.6
1,2,3,4,6,7,8-HpCDD	7.9	< 2.6	< 4.5	< 1.7	< 0.6	1.1	1.0	1.5	3020.1	83.7	8.6	8.0
OCDD	26.7	< 10.4	< 11.3	< 7.1	< 2	11.7	9.0	< 9.1	5263.3	126.2	4.6	< 6.6
PCDF Congeners												
2,3,7,8-TCDF	< 0.3	< 0.08	< 0.07	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1	1.5	0.3	< 0.06	1.5
1,2,3,7,8-PeCDF	< 0.1	< 0.08	< 0.02	< 0.07	< 0.2	< 0.06	0.1	0.1	13.2	1.0	< 0.2	1.4
2,3,4,7,8-PeCDF	< 0.2	< 0.05	< 0.05	0.1	< 0.1	< 0.1	< 0.1	0.1	37.6	2.6	0.4	1.4
1,2,3,4,7,8-HxCDF	< 0.7	< 0.1	< 0.1	0.1	< 0.2	< 0.1	< 0.1	0.1	103.4	10.5	< 0.4	2.1
1,2,3,6,7,8-HxCDF	< 0.1	< 0.3	< 0.05	< 0.1	< 0.06	< 0.1	< 0.04	< 0.05	103.4	7.7	1.1	1.7
2,3,4,6,7,8-HxCDF	< 0.03	< 0.3	< 0.05	< 0.09	< 0.1	< 0.1	< 0.05	< 0.03	200.5	12.6	1.5	1.7
1,2,3,7,8,9-HxCDF	< 0.3	< 0.1	< 0.02	< 0.09	< 0.06	< 0.1	0.0	< 0.02	17.2	0.6	< 0.08	< 0.08
1,2,3,4,6,7,8-HpCDF	< 0.7	< 0.2	< 0.2	< 0.2	< 0.6	< 0.3	0.2	< 0.2	842.8	59.3	6.0	5.5
1,2,3,4,7,8,9-HpCDF	< 0.3	< 0.1	< 0.4	< 0.1	< 0.1	< 0.2	< 0.05	< 0.1	153.5	7.7	< 0.4	0.5
OCDF	< 1	< 0.5	< 0.2	< 0.2	1.6	< 0.3	< 0.2	< 0.6	698.6	39.1	0.5	0.8
PCDD Homologue Groups												
TCDD	< 9.9	< 0.3	1.0	0.1	0.8	< 0.8	0.5	0.8	4.1	2.7	0.5	21.5
PeCDD	< 13.2	< 1.0	1.4	< 1.2	< 1.2	0.3	0.5	0.2	285.1	12.6	1.2	9.9
HxCDD	< 6.6	4.7	6.3	1.9	< 1.4	< 0.8	0.7	0.5	2130.4	116.5	16.3	19.8
HpCDD	12.2	7.0	7.5	1.4	< 0.6	1.8	1.2	2.6	4699.4	161.8	18.7	15.7
PCDF Homologue Groups												
TCDF	< 2.6	0.0	0.4	0.1	0.5	0.6	1.5	< 0.9	15.7	6.3	4.1	100.8
PeCDF	< 2.3	0.1	< 0.2	< 0.9	< 1.4	< 0.8	0.5	0.3	213.0	18.1	0.8	32.2
HxCDF	< 2.0	< 1.6	0.3	< 1.2	< 1.6	< 0.6	0.6	0.2	751.9	85.8	8.6	12.4
HpCDF	< 1.7	< 0.5	< 2.3	< 0.5	< 1.6	< 0.8	0.3	< 0.5	1206.2	94.2	7.5	7.4
Non-Ortho PCBs												
PCB 77	6.9	5.2	5.4	5.4	5.9	20.1	61.7	< 10.2	13.5	7.7	2.6	13.2
PCB 81	< 0.7	0.5	< 0.2	0.3	< 0.4	0.8	3.0	< 0.6	1.2	0.4	< 0.2	1.7
PCB 126	< 0.7	< 0.2	< 0.1		< 0.4	< 0.6	2.1	< 0.5	3.8	0.9	< 0.2	1.3
PCB 169	< 0.7	< 0.2	< 0.2	< 0.05	< 0.02	< 0.2	< 0.1	< 0.2	7.2	0.9	< 0.03	< 0.2
Mono-Ortho PCBs												
PCB 105	41.5	146.1	90.4	75.3	89.6	114.7	389.5	226.8	307.0	319.4	42.0	251.2
PCB 114	< 1.7	7.0	4.7	4.5	5.3	6.7	22.2	11.3	14.1	13.9	3.1	10.7
PCB 118	135.1	313.0	196.7	160.1	244.2	268.5	852.4	453.6	554.5	458.9	97.9	466.9
PCB 123	< 3.0	8.3	< 13.6	< 7.1	< 6.1	< 6.6	20.8	13.6	15.0	10.5	2.4	12.4
PCB 156	7.3	19.3	12.7	17.4	< 14.3	13.7	77.6	< 34.0	75.2	47.4	< 7.8	47.9
PCB 157	< 0.03	4.7	<2.3	< 2.4	< 1.8	< 1.4	15.9	< 7.9	26.6	14.6	< 2.3	14.0
PCB 167	< 16.5	<5.2	24.9	< 4.7	< 6.1	< 8.4	< 27.7	< 9.1	< 18.8	< 20.9	< 3.1	< 16.5
PCB 189	< 0.7	< 0.5	0.6	< 0.7	< 0.2	0.6	2.3	< 0.6	40.7	4.2	< 0.7	< 0.7
Sum of PCDD/Fs (exc)[1]	39	12	17	4	3	15	15	5	15257	663	63	221
WHO$_{98}$ TEQ$_{DF}$ (inc)[2]	1.22	1.17	0.56	0.34	0.40	0.27	0.23	0.31	191.4	10.1	1.08	4.43
WHO$_{98}$ TEQ$_{DF}$ (exc)[1]	0.08	0.81	0.00	0.10	0.00	0.01	0.03	0.06	190.9	10.0	0.85	4.43
WHO$_{98}$ TEQ$_{PCB}$ (inc)[2]	0.06	0.07	0.05	0.04	0.06	0.08	0.40	0.08	0.60	0.22	0.03	0.24
WHO$_{98}$ TEQ$_{PCB}$ (exc)[1]	0.02	0.06	0.04	0.04	0.04	0.05	0.41	0.01	0.60	0.22	0.01	0.24

1= excluding LOD values
2= including half LOD values

Table E10 Concentrations of PCDD/Fs and dioxin-like PCBs at Netley, SA (fg m^{-3}).

Netley PCDD Congeners	Jan-03	Mar-Apr 2003	May-Jun 2003	Jul-Aug 2003	Sep-Oct 2003	Nov-Dec 2003
2,3,7,8-TCDD	< 0.3	< 0.2	3.2	3.2	0.8	< 0.1
1,2,3,7,8-PeCDD	0.3	0.7	4.2	7.9	2.4	0.5
1,2,3,4,7,8-HxCDD	< 0.4	0.8	1.1	9.6	2.8	0.6
1,2,3,6,7,8-HxCDD	1.5	2.2	< 1.4	14.1	5.3	1.4
1,2,3,7,8,9-HxCDD	< 0.4	1.5	0.8	10.7	4.8	1.1
1,2,3,4,6,7,8-HpCDD	29.8	31.0	1.3	185.6	72.0	22.3
OCDD	223.8	151.3	< 2.1	575.3	230.1	152.5
PCDF Congeners						
2,3,7,8-TCDF	1.4	32.4	32.9	29.9	7.1	2.3
1,2,3,7,8-PeCDF	0.6	2.6	18.6	15.2	4.5	1.1
2,3,4,7,8-PeCDF	0.9	3.8	17.2	23.7	7.1	1.5
1,2,3,4,7,8-HxCDF	0.9	< 2.1	4.9	19.2	4.8	1.5
1,2,3,6,7,8-HxCDF	1.0	2.6	4.2	10.7	4.1	1.1
2,3,4,6,7,8-HxCDF	< 0.9	2.3	1.2	7.3	3.9	1.0
1,2,3,7,8,9-HxCDF	0.1	0.2	0.2	0.8	0.3	0.1
1,2,3,4,6,7,8-HpCDF	10.3	13.0	1.0	20.3	12.2	7.7
1,2,3,4,7,8,9-HpCDF	< 0.6	1.2	< 0.1	3.0	2.0	0.5
OCDF	22.4	15.1	< 0.5	15.8	12.2	12.8
PCDD Homologue Groups						
TCDD	7.2	15.9	161.1	130.9	52.7	44.0
PeCDD	2.2	10.1	115.3	109.4	27.0	14.7
HxCDD	19.4	33.1	24.4	192.9	77.8	21.7
HpCDD	64.2	62.7	2.5	372.3	125.3	5.3
PCDF Homologue Groups						
TCDF	23.9	196.0	766.3	727.6	177.4	14.7
PeCDF	10.9	48.3	278.6	245.4	81.6	19.8
HxCDF	17.9	32.4	43.0	112.8	43.1	16.0
HpCDF	23.9	27.4	1.4	42.3	22.5	44.0
Non-Ortho PCBs						
PCB 77	1491.9	879.1	628.8	308.0	293.0	829.5
PCB 81	70.1	37.5	32.2	17.5	14.1	35.7
PCB 126	95.5	69.9	65.2	32.1	23.8	62.5
PCB 169	< 0.6	1.1	2.1	1.7	0.7	0.9
Mono-Ortho PCBs						
PCB 105	5371	4273	2514	1371	1497	3656
PCB 114	328.2	301.9	159.0	75.0	87.4	229.1
PCB 118	14621	11457	7878	3768	4338	12379
PCB 123	552.0	541.9	325.2	120.7	128.5	370.1
PCB 156	611.7	382.6	262.1	195.7	189.6	460.7
PCB 157	164.1	142.0	85.9	51.3	50.8	115.5
PCB 167	< 597	< 144	< 143	< 113	< 129	< 255
PCB 189	12.1	7.1	7.9	6.2	5.7	10.2
Sum of PCDD/Fs (exc)[1]	418	592	1389	2527	848	345
WHO$_{98}$ TEQ$_{DF}$ (inc)[2]	2.0	7.7	21.6	36.1	11.1	2.7
WHO$_{98}$ TEQ$_{DF}$ (exc)[1]	1.7	7.4	21.5	36.0	11.1	2.6
WHO$_{98}$ TEQ$_{PCB}$ (inc)[2]	12.3	9.1	7.9	4.0	3.2	8.4
WHO$_{98}$ TEQ$_{PCB}$ (exc)[1]	12.3	9.1	7.9	4.0	3.2	8.4

1= excluding LOD values
2= including half LOD values

Appendix F Summary of published dioxin concentrations

This appendix comprises two parts; the first (Table F1) gives a summary of concentrations of dioxins and dioxin-like compounds in Australia and New Zealand. Table F1 was prepared by Melanie Shaw and Michael Bartkow, National Research Centre for Environmental Toxicology. Appendix F, Part 2, gives a summary of atmospheric levels of PCDD/PCDFs from various geographical locations and was prepared by Michael Bartkow, National Research Centre for Environmental Toxicology.

Appendix F – Part 1: Background Levels of Dioxins and Dioxin-like Compounds in Air in Australia, New Zealand, Europe and the US.

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National Research Centre for Environmental Toxicology

Location	**Compounds**				**Notes**	**Reference**
	Dioxins and Furans		**PCBs**			
	Σ 17 PCDD/F ($fg\ m^{-3}$)	**I TEQ PCDD/F ($fg\ m^{-3}$)**	**Various PCBs ($pg\ m^{-3}$)**	**TEQ PCBs ($fg\ m^{-3}$)**		
Queensland						
Brisbane	1040 (600-1230)	12 (4.7-17)	(34-120) [b]		High volume air samplers	Müller 1997
Gladstone	340	8.1	120[b]			Australian Magnesium Corporation, 2002
Mutdapilly					Preliminary work for this study	Müller et al., 2003
- June	(7.5)	(0.8)	-	-		
- July	(67)	(0.3)	-	-		
- August	(67)	(0.4)	(0.4)[c]	(0.2)[d]		
Eagle Farm					Preliminary work for this study	
- June	(600)	(42)	-	-		
- July	(350)	(6.1)	-	-		
- August	(270)	(9.2)	(3.6)[c]	(2.0)[d]		
New South Wales						
Sydney	(3670 – 14800)	16-62			High volume air samplers	Taucher et al. 1992
Siding Spring	17 (3-43)	0.64 (0.2-2.4)			15 samples, 24 days	NSW EPA, 2002
Warrawong	160 (40-320)	10 (3-20)			33 samples, 12 days	
Westmead	480 (83-1500)	14 (2.3-53)			34 samples, 12 days	
New Zealand[e]						
Reference Baring Head Nelson Lakes				1.87 0.58	High volume air samplers, consistent with EPA approach	Buckland et al.1999

Rural Te Wera Culverden		16.0 (1.66- 31.7) 3.77 (0.94- 9.88)	14.8 (5.09-30) 10.3 (4.99- 14.5)	0.94 0.64		
Urban Hamilton Auckland		53.6 (6.99-234) 28.1 (16.5-40.8)	69.7 (41.6- 102) 112 (102- 129)	5.13 2.56		
Industrial Auckland South		317 (40.3– 1170)	304 (210- 471)	15.5		
Summary European Union						
Rural Belgium Luxembourg The Netherl. UK		70-125 30-64 9-63 6-12				Fiedler et al 1999
Urban Belgium Italy Luxembourg Sweden UK		86-129 47-277 54-77 0.2-54 17-103				
Unspecified Austria Germany Italy The Netherl		1.3-587 1-705 85 4-99				
United States[f]						
Suburban Rural National Parks				2.0 1.1 0.2		Cleverly et al. 2002
Suburban Rural National Parks				3.0 0.6 0.3		Cleverly et al. 2001

[a] Mean values are generally presented unless otherwise stated. Values in parentheses represent the range or single measurements.
[b] Σ 6 PCBs: TrCBi (PCB 28), TeCBi (PCB 52), PeCBi (PCB 101), HxCBi1 (PCB 138), HxCBi2 (PCB 153), HpCBi (PCB 180).
[c] Σ 12 dioxin-like PCBs (#77, #81, #126, #169, #123, #118, #114, #105, #167, #156, #157, #189) including half LOD values.
[d] Total PCB TEQs includes half LOD values for non-detected congeners.
[e] Σ 25 PCBs: #77, #126, #169, #28, #31, #52, #101, #99, #123, #118, #114, #105, #153, #138, #167, #156, #157, #187, #183, #180, #170, #189, #202, #194, #206.
[f] Σ 7 PCBs: #77, #105, #118, #126, #156, #157, #169.

Appendix F, Part 2: Summary of atmospheric levels of PCDD/PCDFs from various geographical locations.

Michael Bartkow
National Research Centre for Environmental Toxicology

Studies on concentrations of PCDD/PCDFs in ambient air have been conducted in many countries since the mid 1980s. Many published studies have reported levels in Europe and the USA and only a few studies have been published from Asia and Australia. The following tables are an expansion on data collated by Müller (1997) and Lohmann and Jones (1998).

Atmospheric concentrations of PCDD/PCDFs can be reported in different ways. Data can be collated by summing all PCDD and PCDFs separately (ΣPCDD, ΣPCDF) or as a combined total (ΣPCDD/F). Toxicity equivalents are commonly reported, usually according to internationally agreed protocol (such as I-TE or more recently WMO-TEQ). Data may be discussed in terms of individual congeners and homologues that have been used to distinguish between source-related levels and background levels (Smith et al. 1990; Tysklind et al. 1993). Detecting specific congeners and homologue profiles can also be used to examine the behaviour of PCDD/Fs under changing atmospheric conditions, such as temperature. The data presented in the following tables are listed as ΣPCDD, ΣPCDF, ΣPCDD/F and I-TE.

Mean I-TE values (fg m^{-3}) for selected countries (remote, rural, urban and industrial sites combined) are also presented in Figure F1 and F2. Studies of atmospheric concentrations of PCDD/Fs from Germany (Table F1) and elsewhere in Europe (Table F2) are followed by work done in North America (Table F3). Studies from Asia are listed in Table F4, followed by atmospheric concentrations measured in the southern hemisphere (Table F5).

The highest levels from all studies reviewed were measured at a site of heavy traffic in Cracow, Poland. The authors attributed the high levels to domestic heating, domestic waste incineration and the continued use of leaded fuel in cars (Grochowalski et al. 1995). Some of the highest I-TE were measured in Japan and have been attributed to the large number of municipal and waste incinerators throughout the country (Miyata et al. 2000). Studies in North America and Asia have show that levels measured in industrial areas and highly populated cities tend to be higher than those found in urban areas (Eitzer and Hites 1989; Kim et al. 2001). Other studies have found that air samples from rural and remote sites tend to have lower loadings of dioxins and furans than urban sites, although the range in values can overlap (Bobet et al. 1990; Lugar et al. 1996; Baker and Hites 1999; Lohmann et al. 2000a). The lowest levels of PCDD/Fs were reported for remote regions in the southern hemisphere from New Zealand, the Falkland Islands and areas near Antarctica (Buckland et al. 1999; Lohmann et al. 2000b). However, low values were not restricted to the southern hemisphere, with comparable values measured for a remote site in Ireland. The higher levels measured in industrial and urban centres was associated with more numerous and stronger sources of PCDD/Fs (e.g. Eitzer and Hites 1989).

Atmospheric concentrations of PCDD/Fs can show considerable variability even in the same area during the same season. The range in concentrations measured at various sites has been attributed to various factors influencing the distribution and fate of PCDD/Fs in the atmosphere (Lohmann et al. 2000a). Lohmann et al. considered that PCDD/F levels were strongly dependent on the origin of the sampled air mass. When the wind direction was consistently from the sea, PCDD/F levels were lower than when the air mass originated from over land where stronger sources of these chemicals were situated. Miyata et al. (2000) found no correlation between large variations in weekly-surveyed concentrations and wind velocity or humidity and attributed the variation to changes in emissions from sources (e.g. incinerators). In another study, Lee et al. (1999) found increases in PCDD/Fs by a factor of 10 were linked to festival celebrations that coincided with the lighting of fireworks.

Hippelein et al. (1996) discussed various hypotheses regarding seasonal trends in PCDD/F levels. Numerous studies have found that the highest amounts of PCDD/Fs were measured in winter (e.g. Konig et al. 1993; Hippelein et al. 1996). Some studies suggest that reduced mixing in the atmosphere during winter months allows the build-up of these chemicals (e.g. Konig et al. 1993). However, this effect was not shown in other pollutants measured in the atmosphere, suggesting that some other factor was involved (Hippelein et al. 1996). Other studies suggest that photochemical degradation of these compounds is weaker in winter, however the presence of these compounds in remote areas suggests that such processes are very slow (Hippelein et al. 1996). Some investigations have linked higher levels of PCDD/Fs in the local atmosphere in winter to domestic heating (Hippelein et al. 1996; Lee et al. 1999). Lohmann et al. (2000) assessed the contribution of domestic burning as a source of PCDD/Fs and concluded that a combination of domestic burning and meteorological conditions influenced levels in the UK atmosphere. A study conducted in New Zealand also measured the highest PCDD/F concentrations in winter (Buckland et al. 1999). These authors found significant negative correlations between PCDD/F concentrations and nighttime temperature and positive correlations with retene (a molecular marker of wood combustion) and particulate mass concentrations. Their findings suggested that domestic emissions such as wood burning could be important sources of PCDD/Fs.

Polychlorinated dibenzodioxins and dibenzofurans have been detected from industrialised areas through to the most remote geographical regions. The highest concentrations were found at industrialised sites and urban centres, where exposure to sources of these toxic compounds is high. Studies on atmospheric concentrations in India, China, South American and African nations are necessary to determine the extent of atmospheric pollution of PCDD/Fs on a global scale.

Table F1 Comparison of atmospheric PCDD/F levels (in fg m^{-3}) measured at sites in Germany, expressed as means, range of means and range of individual measurements (in brackets) in terms of —PCDD, —PCDF, —PCDD/F and I-TE values.

Location	Period	—PCDD	—PCDF	—PCDD/F	I-TE	Study
Bavaria	June 2002-May 2003				6.2[a]	Kerst et al. 2003
Bavaria	Feb and Mar, 2002				(26-33)	Kerst et al. 2002
Bavaria	1989-1998				29 (3-343)	Fiedler et al. 2000
Hesse					58 (0-812)	
Saxony					900 (307-3648)	
Thuringia					78 (15-230)	
Koln, NRW	1987-1988				130	Hiester et al. 1995
	1993-1994				40	
Duisberg, NRW	1987-1988				332	
	1993-1994				124	
Essen, NRW	1987-1988				204	
	1993-1994				76	
Dortmund, NRW	1987-1988				224	
	1993-1994				129	
Rural, Baden-Wurttemberg	1992				18-21 (5-54)	Wallenhorst et al. 1995
Urban, Baden-Wurttemberg					56-83 (9-217)	
Augsburg	1992				52 (10-250)	Hippelein et al. 1996
Augsburg	Summer, 1992			1700	22	Hutzinger et al. 1993[b]
	Winter, 1992-1993			6100	81	
Rural, Hessen	1990				48	Konig et al. 1993
Industrial, Hessen					146	
Rural, Maulach	1992	500 (280-720)	430 (330-520)	930 (610-1200)	8.6	Hülster 1994[b]
Rheinfelden		980	1600	2500	31	
Bayreuth	1992	2100	1500	3600		Hippelein et al. 1993[b]
Urban, Hamburg		(ND-77900)	(ND-39600)			Rappe et al. 1988[b]
Urban, Hamburg				610-79000	45-1102	Päpke et al. 1989[b]
Rhine-Ruhr-District	1985-1986	3200	5500			Buck and Kirschmer 1989

NRW: North-Rhine-Westfalia, [a] median value [b] From Müller (1997), ND: not detected.

Table F2 Comparison of atmospheric PCDD/F levels (in fg m^{-3}) measured at sites in Europe, expressed as means, range of means and range of individual measurements (in brackets) in terms of ΣPCDD, ΣPCDF, ΣPCDD/F and also I-TE values.

Country	Location	Period	ΣPCDD	ΣPCDF	ΣPCDD/F	I-TE	Study
Spain	Urban, Catalonia	1994-2000				158-264 (47-405)[a]	Abad et al. 2002
	Suburban					73-362 (18-954)[a]	
	Rural					21-48 (5-125)[a]	
Greece	Urban, Thessaloniki	1999				21 (4-119)	Kouimtzis et al. 2000[b]
	Semi-rural					24 (2-178)	
England	Urban, Manchester	1998				(20-510)	Lohmann et al. 2000a
	Semirural					(6-110)	
	Semirural	Autumn			1000-20000		Lee et al. 1999
	Semirural	Summer			400-700		
Ireland	Remote, Mace Head	1997			450 (370-530)	4 (3-4)	Lohmann et al. unpublished[c]
Slovakia	Urban/Industrial	1996-1997				50-130 (30-690)[d]	Stenhouse et al. 1998
	Rural					40-70 (30-220)[d]	
Czech Republic	Remote	1995				(33-816)	Holoubek et al. 1998
Italy	Seveso					220-350	Fattore et al. 1998
Portugal	Urban, Oporto	1998				(36-490)	Coutinho et al. 1999
Poland	Cracow	1995			60000 - 1060000	950 – 12000	Grochowalski et al. 1995[e]
Netherlands	MWI deposition sites	1989				(15-125)	Bolt and de Jong 1993
	Background					(10-15)	
Sweden	Rural, Rorvik	1989-1990			1900 (300-5200)	21 (4-60)	Tysklind et al. 1993[c]
	Urban, Gothenburg	1988			1300 (1000-1800)	22 (16-30)	
	Urban, Stockholm	1986-1987			(1400)	(24)[f]	Broman et al. 1991[e]
	Rural				(420)	(4.4)[f]	
	Coastal				(220)	(2.6)[f]	

[a] Sites potentially affected by industrial activity, [b] Only particulate-bound PCDD/Fs measured, [c] From Lohmann and Jones (1998), [d] Mean of maximum I-TEQs, [e] from Müller (1997), MWI: Municipal Waste Incinerator, [f] Nordic TE.

Table F3 Comparison of atmospheric PCDD/F levels (in fg m^{-3}) measured at sites in North America, expressed as means, range of means and range of individual measurements (in brackets) in terms of —PCDD, —PCDF, —PCDD/F and also I-TE values.

Location	Period	—PCDD	—PCDF	—PCDD/F	I-TE	Study
Rural	2000				14.6	Cleverly et al. 2002
National Parks					2.0	
Urban					15.5	
Rural, Nationwide	1998-1999				11.3	Cleverly et al. 2001
National Parks					2.1	
Urban, Washington DC					19.4	
All areas, Southern California	1987-1989				117-839 (92-2229)	Hunt and Maisel 1992
Industrial, Niagara Falls	1988			(3770-21600)		Smith et al. 1990
City, Albany				(4540-9900)		
City, Binghampton				3020		
City, Utica				(11250-13100)		
Rural, Ohio	1987			3600		Edgerton et al. 1989
Incinerators, Ohio				4600-9900		
City, Indianapolis	1987	2500	2600			Eitzer and Hites 1989
Urban, Bloomington		1100	780			
Rural, Trout Lake		240	180			
Urban, Bridgeport	1987-1988	4300 (220-11000)	2600 (20- 6200)			Hunt and Maisel 1990[a]
Urban, Windsor, Canada,	1988	2100	460			Bobet et al.1990[a]
Rural, Walpole Is., Canada,	1989	510	ND			
Remote, Bermuda, North Atlantic	1993-97			35-105		Baker and Hites 1999
Remote, Barbados, North Atlantic	1996-97			15		

[a] From Müller (1997)

Table F4 Comparison of atmospheric PCDD/F levels (in fg m^{-3}) measured at sites in Asia, expressed as means, range of means and range of individual measurements (in brackets) in terms of ΣPCDD, ΣPCDF, ΣPCDD/F and also I-TE values.

Country	Location	Period	ΣPCDD	ΣPCDF	ΣPCDD/F	I-TE	Study
Hong Kong	Urban	Dec, 2000				(54-292)	Louie and Sin 2003
Japan	Osaka	1998-1999				408-535 (33-2500)	Miyata et al. 2000
	Urban and rural	Summer, 1992. Winter, 1992.	24190[f] 20170[f]	19850[f] 23580[f]		(60-591) (303-682)	Kurokawa et al. 1996
	Urban	1990 and 1992.				790-1500	Sugita et al. 1994[a]
	Cities		5400 (<100-28000)	3300 (<100-22000)			Nakano et al. 1990[a]
Korea	Urban, Busan	1999-00				(15-27)	Ok et al. 2001
	Urban, Seoul Industrial, Incheon	1998-99.	(86-245) (386-1050)	(663-785) (1709-2647)			Kim et al. 2001
	Urban, Pusan Residential Industrial	1998-1999			2160-46960 2120-6910 2580-51530	(29-690) (24-140) (41-647)	Ok et al. 1999

[a] From Müller (1997), [f] Mean of 2 urban and 1 rural site

Table F5 Comparison of atmospheric PCDD/F levels (in fg m^{-3}) measured at sites in the southern hemisphere, expressed as means, range of means and range of individual measurements (in brackets) in terms of ΣPCDD, ΣPCDF, ΣPCDD/F and also I-TE values.

Country	Location	Period	ΣPCDD	ΣPCDF	ΣPCDD/F	I-TE	Study
Uruguay	City	1998				(40)	Lohmann et al. 2000b
Falkland Island						(2.6)	
Bird Island						(0.9)	
Halley						(0.5)	
New Zealand	Reference	1996-1997				1.4-3.4 (0.77-7.48)	Buckland et al. 1999
	Rural					4-16 (0.94-31.7)	
	Urban					28-84 (6.73-262)	
	Industrial					317 (40.3-1170)	
Antarctic	McMurdo Station	1992 -1994	440 – 610	50 – 560			Lugar et al. 1996[a]
Australia	Urban, Brisbane	1995	(400-650)	(150-650)	(600-1200)	(4.7-17)	Müller et al. 1998
	City, Sydney	1990			(3700 – 15000)	(16 – 62)	Taucher et al. 1992[a]

[a] From Müller (1997)

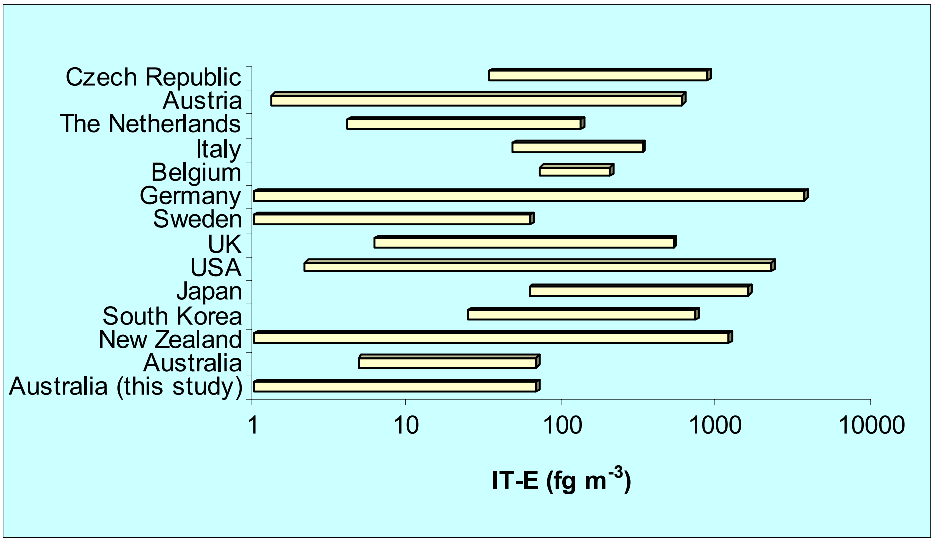
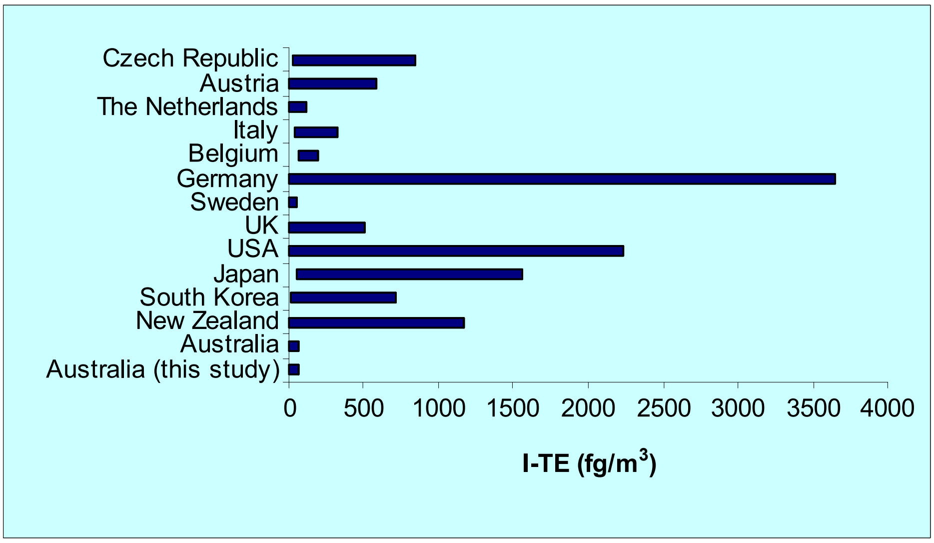


Figure F1 Concentrations of PCDD/F as fg I-TE m^{-3}.



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