Ministry for the Environment
Manatū Mō Te Taiao

Dioxin and Furan Emissions to Air from Secondary Metallurgical Processes in New Zealand

Volume II Testing Results

Sinclair Knight Merz
SKM

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1 Introduction

Emission sampling for particulate matter and polychlorinated dibenzo-p-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) was conducted at 12 sites (Site A to Site L) as part of a study of emissions to air from secondary metals processes in New Zealand. The purpose and design of the sampling programme are discussed detail in Volume I.

K2 Environmental Ltd conducted the sampling for this study between September 2002 and May 2003.

This report summarises the information provided by K2 Environmental Ltd in particular, the details of the sampling including: sampling locations, sampling times, gas volumes and stack conditions.

The PCDD and PCDF results are reported as a concentration in ng/m^3, as an emission rate in ng per hour and as an emission rate in ng per tonne of metal.

Production data used to calculate the emission factors in ng per tonne of metal is held by the Ministry for the Environment and can be made available on request. Similarly, as the laboratory sheets for the 30 PCDD and PCDF analyses (S1 to S30) conducted for this study, and comprising Appendix A, are not available in electronic form, a copy can be provided on request.

2 Test Methods

2.1 Stack test methods

2.1.1 PCDD and PCDF

PCDD and PCDF were sampled and analysed as per US EPA Method 23, Determination of Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans from Stationary Sources. Figure 1 is a diagram of the sample train used for Method 23.

The sample media used was soxhlet, which was extracted in the lab for up to 16 hours to remove possible contamination prior to sampling. An internal standard spike was added to the resin. This spike was used to calculate the recovery efficiencies and can also be used as an indicator of lost sample.

At the sites, samples were withdrawn from the gas stream and drawn through the sample probe on a glass fibre filter where the particulate matter was collected. The gaseous fraction passes through a packed column of absorbent material (XAD-2 resin) where all aromatic compounds are absorbed. The sample could not be separated into a particle vapour fraction as this separation is defined by the operation of the sampling train.

After sampling the train was removed to a clean location and rinsed with acetone, methylene chloride and toluene. These washings were added to the sample for analysis.

The PCDD and PCDF were extracted from the sample, separated by high-resolution gas chromatography, and measured by high-resolution mass spectrometry.

2.1.2 Combustion gases

Figure 2 is a diagram of the combustion gas analyser used. K2 Environmental Ltd's combustion gas analyser meets the requirements of the US EPA and can measure the following gases.

- Carbon Monoxide – US EPA CTM 034 Test Method – Determination of Oxygen, Carbon Monoxide and Oxides of Nitrogen from Stationary Sources for Periodic Monitoring (Portable Electrochemical Analyzer Procedure).
- Carbon Dioxide – US EPA Method 3A CO_2 and O_2 Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure, UV, NDIR, or fluorescence).
- Oxides of Nitrogen (NO, NO_2 and NO_X) – Method 7E NO_X Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure). CTM 022 NO_X Determination of Nitric Oxide, Nitrogen Dioxide and NO Emissions from Stationary Combustion Sources by Electrochemical Analyser.
- Sulphur dioxide – US EPA Method 6C Determination of Sulphur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure), and Approved Alternative Method ALT004 Alternative Analytical Technology for Instrumental Methods 3A and 6C.

- Oxygen – US EPA Method 3A CO_2 and O_2 Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure, UV, NDIR, or fluorescence).
- Combustible gases – Combustion gases are determined using a catalytic sensor, range 0–6.00% with resolution 0.01%. The accuracy is 10% of the reading in CH_4.

Gas samples were drawn from the stack filtered and the moisture removed by a permeation drying system. The gas then passed to the analyser where a portion of the gas was analysed. The analyser used Infrared to measure the concentration of carbon dioxide. All other measurements were made with advanced chemical cells. All gasses were logged and reported.

The analyser was calibrated before and after sampling. However, it was calibrated using span gas and zero gas only. Due to supply difficulties the stack emission testers were not able to calibrate the analyser with a mid range gas. This is a minor deviation from the standard.

2.2 Ambient sampling

2.2.1 PCDD and PCDF

PCDD and PCDF were analysed as per US EPA Method TO-9A. Determination of Polychlorinated, Polybrominated and Brominated/Chlorinated Dibenzo-p-dioxins and Dibenzofurans in Ambient Air. Figure 3 is a diagram of the high-volume sampler arrangement.

The sample media used was soxhlet extracted in the lab for up to 16 hours to remove possible contamination prior to sampling. An internal standard spike was added to the resin. This spike was used to calculate the recovery efficiencies and also used as an indicator of lost sample.

At the site, samples were withdrawn from the ambient air and drawn through the dual chamber sampling module. Particulate matter was collected on a glass fibre filter; the gaseous fraction passed through a packed column of absorbent material (XAD-2 resin) where all aromatic compounds are absorbed.

After sampling the filter and trap were removed for analysis. PCDD and PCDF were extracted from the sample, separated by high-resolution gas chromatography, and measured by high-resolution mass spectrometry.

Figure 1: US EPA Method 23 sampling train

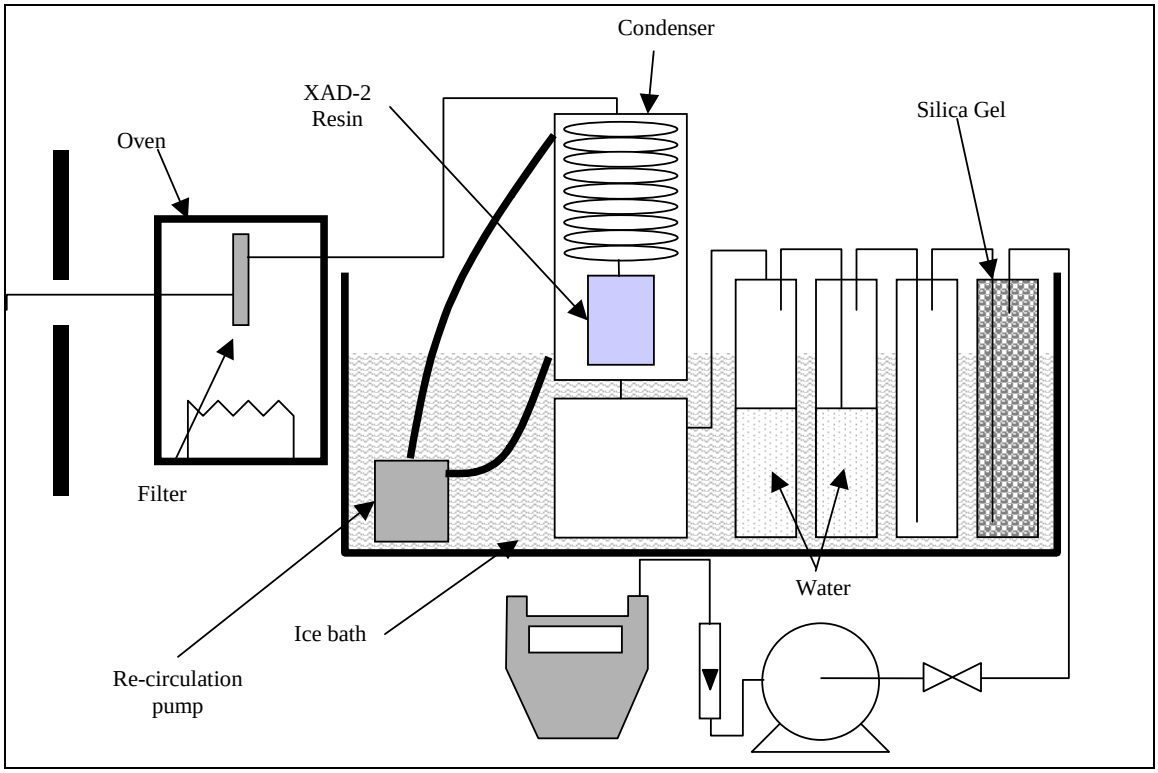


Figure 2: Combustion gas analyser

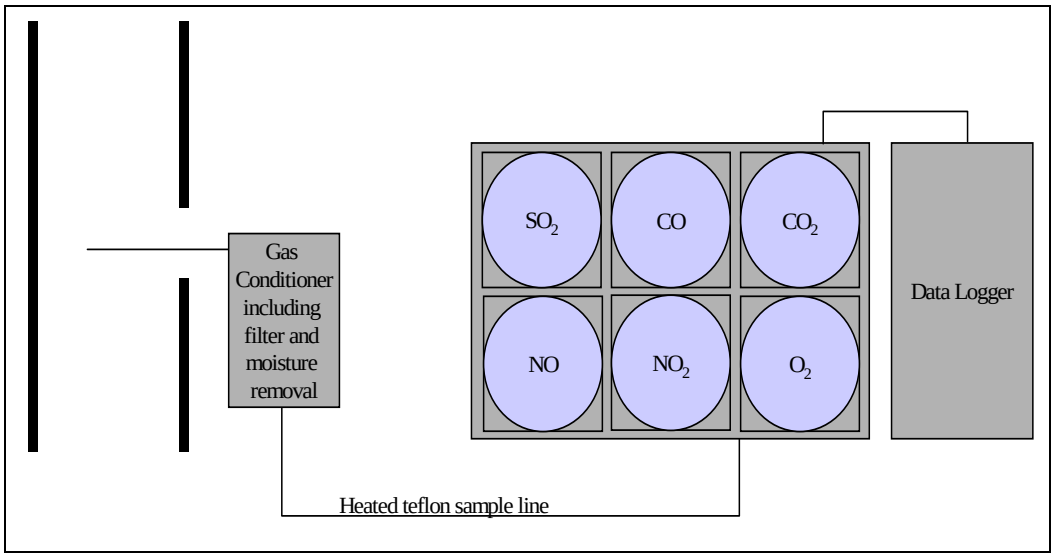
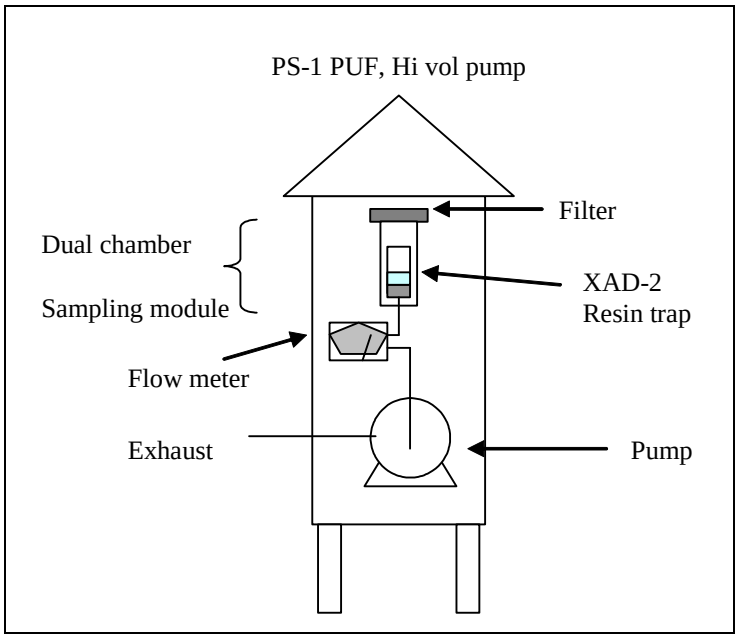


Figure 3: High-volume sampler with PUF arrangement



3 Site A

3.1 Introduction

Sampling was carried out at Site A on 19 September 2002. Samples were collected from the arc furnace discharge to determine the concentration of PCDD and PCDF present in the gases discharged to the atmosphere.

There were two sample ports on the duct exiting the arc furnace. The sample ports were approximately five diameters down stream from any disturbance to the flow and approximately one diameter upstream from the exit to the flow. As such the ports were not ideal for sampling particulate matter.

Each duplicate was sampled from one port.

Details of the sampling times and stack dimensions are:

- sampling times: Samples 1 and 2 (duplicate sampling): 11:58–15:10
- stack dimensions: 0.57 x 0.53 metre rectangular duct.

3.2 Results

Table 3.1: Particulate emissions from arc furnace

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
1	0.0451	17.8	0.42
2	0.0281	7.3	0.20
Average		12.6	0.31

Table 3.2: Average stack gas conditions at the arc furnace sampling point 1 (small hot box)

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
<0.5	<0.5	25.8	1.3	24.1	7.3	6.6

Table 3.3: Average stack gas conditions at the arc furnace sampling point 2 (large hot box)

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
<0.5	<0.5	25.8	1.2	27.6	8.3	7.5

Table 3.4: Results of isokinicity for arc furnace

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	2.5333	2.7918	91%
2	3.8386	4.1972	91%

All samples are within the required isokinicity range of 100 ± 10%.

Table 3.5: Average combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
54.5	< 25	24.7	21.1	<9

The weight of scrap metal melted during the sampling was 3.45 tonnes. This number was used for both samples as sampling occurred at the same time.

Table 3.6: Summary results from arc furnace sample 1 trap, rinses and filter

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.609	14,381	13,339
	Including half LOD values	0.649	15,313	14,203
	Including LOD values	0.688	16,245	15,068
Total I-TEQ	Excluding LOD values	0.0118	279	259
	Including half LOD values	0.0136	322	298
	Including LOD values	0.0154	365	338
Total WHO-TEQ	Excluding LOD values	0.0140	330	306
	Including half LOD values	0.0158	372	345
	Including LOD values	0.0175	414	384

Table 3.7: Results from arc furnace (individual congeners sample 1 trap, rinses and filter)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	***0.0039***	***0.00039***	***0.001***	***0.0004***	***0.001***
Total TCDF	0.13	0	0	0	0
2378 TCDD	***0.002***	***0.0020***	***0.005***	***0.0020***	***0.005***
Total TCDD	0.022	0	0	0	0
12378 PeCDF	0.0051	0.00026	0.00065	0.00026	0.00065
23478 PeCDF	0.0079	0.0039	0.01	0.0039	0.01
Total PeCDF	0.103	0	0	0	0
12378 PeCDD	0.0043	0.0022	0.0055	0.0043	0.011
Total PeCDD	0.043	0	0	0	0
123478 HxCDF	0.0095	0.00095	0.0024	0.00095	0.0024
123678 HxCDF	0.0095	0.00095	0.0024	0.00095	0.0024
234678 HxCDF	0.013	0.0013	0.0032	0.0013	0.0032
123789 HxCDF	***0.0039***	***0.0004***	***0.001***	***0.00039***	***0.001***
Total HxCDF	0.091	0	0	0	0
123478 HxCDD	0.0071	0.00071	0.0018	0.00071	0.0018
123678 HxCDD	0.0075	0.00075	0.0019	0.00075	0.0019
123789 HxCDD	***0.0079***	***0.00079***	***0.002***	***0.00079***	***0.002***
Total HxCDD	0.079	0	0	0	0
1234678 HpCDF	0.043	0.00043	0.0011	0.00043	0.0011
1234789 HpCDF	0.0047	0.000047	0.00012	0.000047	0.00012
Total HpCDF	0.059	0	0	0	0
1234678 HpCDD	0.032	0.00032	0.00082	0.00032	0.00082
Total HpCDD	0.063	0	0	0	0
OCDF	0.015	0.000015	0.000038	0.0000015	0.000004
OCDD	***0.079***	***0.000079***	***0.0002***	***0.0000079***	***0.00002***

NB. Where results are less than the detection limit they have been reported in bold.

Table 3.8: Summary results from arc furnace sample 2 trap, rinses and filter

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	1.06	28,515	26,448
	Including half LOD values	1.06	28,515	26,448
	Including LOD values	1.06	28,515	26,448
Total I-TEQ	Excluding LOD values	0.0218	590	547
	Including half LOD values	0.0235	635	589
	Including LOD values	0.0252	681	632
Total WHO-TEQ	Excluding LOD values	0.0240	648	601
	Including half LOD values	0.0257	694	644
	Including LOD values	0.0274	740	686

Table 3.9: Results from arc furnace (individual congeners sample 2 trap, rinses and filter)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0086	0.00086	0.0033	0.00086	0.0033
Total TCDF	0.29	0	0	0	0
2378 TCDD	***0.0026***	***0.0026***	***0.01***	***0.0026***	***0.01***
Total TCDD	0.029	0	0	0	0
12378 PeCDF	0.0091	0.00046	0.0018	0.00046	0.0018
23478 PeCDF	0.020	0.010	0.039	0.010	0.039
Total PeCDF	0.24	0	0	0	0
12378 PeCDD	0.0044	0.0022	0.0085	0.0044	0.017
Total PeCDD	0.052	0	0	0	0
123478 HxCDF	0.019	0.0019	0.0073	0.0019	0.0073
123678 HxCDF	0.019	0.0019	0.0073	0.0019	0.0073
234678 HxCDF	0.025	0.0025	0.0097	0.0025	0.0097
123789 HxCDF	***0.0026***	***0.00026***	***0.001***	***0.00026***	***0.001***
Total HxCDF	0.21	0	0	0	0
123478 HxCDD	0.0039	0.00039	0.0015	0.00039	0.0015
123678 HxCDD	0.0047	0.00047	0.0018	0.00047	0.0018
123789 HxCDD	***0.0052***	***0.00052***	***0.002***	***0.00052***	***0.002***
Total HxCDD	0.065	0	0	0	0
1234678 HpCDF	0.063	0.00063	0.0024	0.00063	0.0024
1234789 HpCDF	0.0055	0.000055	0.00021	0.000055	0.00021
Total HpCDF	0.081	0	0	0	0
1234678 HpCDD	0.021	0.00021	0.0008	0.00021	0.0008
Total HpCDD	0.044	0	0	0	0
OCDF	0.016	0.000016	0.000061	0.0000016	0.000006
OCDD	0.034	0.000034	0.00013	0.0000034	0.000013

NB. Where results are less than the detection limit they have been reported in bold.

4 Site B

4.1 Introduction

Sampling was carried out at Site B on 26–28 September 2002. Samples were collected from the swarf baghouse stack, wheel melt baghouse and furnace 2 discharges to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sample point was located in the stack exiting from the swarf baghouse stack. The sample point is more than 8 diameters downstream and approximately 3 diameters upstream from any disturbance to flow.

Two sample points had been installed for sampling particulate. However, these were not suitable for dioxin sampling due to restricted access. One additional port was added for dioxin sampling.

Details of the sampling times and stack dimensions are:

- Sampling time: 8:57–12:57
- Stack dimensions: 0.7 metre diameter circular duct.

4.2 Results

4.2.1 Swarf drier

Table 4.1: Stack gas conditions at the swarf baghouse stack sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
1.8	1.8	94.0	2.4	9.3	3.6	2.6

Table 4.2: Results of isokinicity for swarf baghouse stack

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	3.8996	3.7368	104%

All samples are within the required isokinicity range of 100 ± 10%.

Table 4.3: Average combustion gas results for swarf baghouse stack

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
< 11	< 25	17.7	18.7	<9

The weight of scrap metal melted during this sample was 4 tonnes.

Table 4.4: Summary results from swarf baghouse stack

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	1.64	15,315	15,315
	Including half LOD values	1.64	15,315	15,315
	Including LOD values	1.64	15,315	15,315
Total I-TEQ	Excluding LOD values	0.0199	186	186
	Including half LOD values	0.0210	196	196
	Including LOD values	0.0222	207	207
Total WHO-TEQ	Excluding LOD values	0.0203	189	189
	Including half LOD values	0.0214	200	200
	Including LOD values	0.0226	211	211

Table 4.5: Results from swarf baghouse stack (individual congeners)

	Concentration (ng/m^3 0°C 1 Atm dry)		I-TEQ			WHO-TEQ		
			(ng/m^3 0°C 1 Atm dry)		ng	(ng/m^3 0°C 1 Atm dry)		ng
		11% O_2		11% O_2			11% O_2	
2378 TCDF	0.00156	0.0069	0.00016	0.0007	0.00061	0.00016	0.00069	0.00061
Total TCDF	0.0641	0.28	0	0	0	0	0	0
2378 TCDD	***0.00103***	***0.0045***	***0.0010***	***0.0045***	***0.004***	***0.0010***	***0.0045***	***0.004***
Total TCDD	0.00333	0.015	0	0	0	0	0	0
12378 PeCDF	0.00615	0.027	0.0003	0.0014	0.0012	0.0003	0.0014	0.0012
23478 PeCDF	0.00872	0.039	0.0044	0.019	0.017	0.0044	0.019	0.017
Total PeCDF	0.131	0.58	0	0	0	0	0	0
12378 PeCDD	0.00169	0.0075	0.00085	0.0037	0.0033	0.0017	0.0075	0.0066
Total PeCDD	0.0154	0.068	0	0	0	0	0	0
123478 HxCDF	0.0200	0.088	0.0020	0.0088	0.0078	0.0020	0.0088	0.0078
123678 HxCDF	0.0238	0.11	0.0024	0.011	0.0093	0.0024	0.011	0.0093
234678 HxCDF	0.0436	0.19	0.0044	0.019	0.017	0.0044	0.019	0.017
123789 HxCDF	***0.00513***	***0.023***	***0.00051***	***0.0023***	***0.002***	***0.00051***	***0.0023***	***0.002***
Total HxCDF	0.308	1.4	0	0	0	0	0	0
123478 HxCDD	0.00282	0.012	0.00028	0.0012	0.0011	0.00028	0.0012	0.0011
123678 HxCDD	0.00410	0.018	0.00041	0.0018	0.0016	0.00041	0.0018	0.0016
123789 HxCDD	***0.00769***	***0.034***	***0.00077***	***0.0034***	***0.003***	***0.0008***	***0.0034***	***0.003***
Total HxCDD	0.0539	0.24	0	0	0	0	0	0
1234678HpCDF	0.359	1.6	0.0036	0.016	0.014	0.0036	0.016	0.014
1234789HpCDF	0.0144	0.064	0.00014	0.0006	0.00056	0.0001	0.00064	0.00056
Total HpCDF	0.436	1.9	0	0	0	0	0	0
1234678 HpCDD	0.0513	0.23	0.00051	0.0023	0.002	0.0005	0.0023	0.002
Total HpCDD	0.115	0.51	0	0	0	0	0	0
OCDF	0.103	0.45	0.00010	0.0005	0.0004	0.000010	0.000045	0.00004
OCDD	0.410	1.8	0.00041	0.0018	0.0016	0.000041	0.00018	0.00016

NB. Where results are less than the detection limit they have been reported in bold.

4.2.2 Wheel melt furnace

The sample point was located in the stack exiting from the wheel melt baghouse stack. The sample point is more than 8 diameters downstream and approximately 3 diameters upstream from any disturbance to flow.

Two sample points had been installed for sampling particulate. However, these were not suitable for dioxin sampling due to restricted access. One additional port was added for dioxin sampling.

Details of the sampling date, times and stack dimensions are:

- Sample date and time: 27 September 2002, 11:29–15:32
- Stack dimensions: 0.60 metre diameter circular duct.

Table 4.6: Particulate emissions from wheel melt baghouse stack

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
1	***0.0001***	***0.02***	***0.00021***

Note: The sample mass is below the limit of detection.

Table 4.7: Average stack gas conditions at the wheel melt baghouse stack sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(^oC)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
<0.5	<0.5	63.0	0.7	11.0	3.5	2.8

Table 4.8: Results of isokinicity for wheel melt baghouse stack

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	4.7979	5.0816	94

All samples are within the required isokinicity range of 100 ± 10%.

Table 4.9: Combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
< 11	< 25	< 12	21.1	<9

The weight of scrap metal melted during this sample was 5.487 tonnes.

Table 4.10: Summary results from wheel melt baghouse stack

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.00188	19.2	14.0
	Including half LOD values	0.0132	136	99.0
	Including LOD values	0.0246	252	184
Total I-TEQ	Excluding LOD values	0	0	0
	Including half LOD values	0.000491	5.03	3.67
	Including LOD values	0.000981	10.1	7.34
Total WHO-TEQ	Excluding LOD values	0	0	0
	Including half LOD values	0.000588	6.04	4.40
	Including LOD values	0.00118	12.1	8.80

Table 4.11: Results from wheel melt baghouse stack (individual congeners)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	***0.00042***	***0.000042***	***0.0002***	***0.000042***	***0.0002***
Total TCDF	0.0019	0	0	0	0
2378 TCDD	***0.00021***	***0.00021***	***0.001***	***0.00021***	***0.001***
Total TCDD	***0.00021***	0	0	0	0
12378 PeCDF	***0.00021***	***0.0000104***	***0.00005***	***0.000010***	***0.00005***
23478 PeCDF	***0.00021***	***0.000104***	***0.0005***	***0.00010***	***0.0005***
Total PeCDF	***0.0015***	0	0	0	0
12378 PeCDD	***0.00042***	***0.00021***	***0.001***	***0.00042***	***0.002***
Total PeCDD	***0.00042***	0	0	0	0
123478 HxCDF	***0.00042***	***0.000042***	***0.0002***	***0.000042***	***0.0002***
123678 HxCDF	***0.00042***	***0.000042***	***0.0002***	***0.000042***	***0.0002***
234678 HxCDF	***0.00042***	***0.000042***	***0.0002***	***0.000042***	***0.0002***
123789 HxCDF	***0.00063***	***0.000063***	***0.0003***	***0.000063***	***0.0003***
Total HxCDF	***0.00063***	0	0	0	0
123478 HxCDD	***0.00063***	***0.000063***	***0.0003***	***0.000063***	***0.0003***
123678 HxCDD	***0.00042***	***0.000042***	***0.0002***	***0.000042***	***0.0002***
123789 HxCDD	***0.00063***	***0.000063***	***0.0003***	***0.000063***	***0.0003***
Total HxCDD	***0.00063***	0	0	0	0
1234678 HpCDF	***0.00063***	***0.0000063***	***0.00003***	***0.0000063***	***0.00003***
1234789 HpCDF	***0.0013***	***0.000013***	***0.00006***	***0.000013***	***0.00006***
Total HpCDF	***0.0013***	0	0	0	0
1234678 HpCDD	***0.0021***	***0.000021***	***0.0001***	***0.000021***	***0.0001***
Total HpCDD	***0.0042***	0	0	0	0
OCDF	***0.0015***	***0.0000015***	***0.000007***	***0.00000015***	***0.0000007***
OCDD	***0.013***	***0.000013***	***0.00006***	***0.0000013***	***0.000006***

NB. Where results are less than the detection limit they have been reported in bold.

4.2.3 Furnace 2

One sample point was located in a vertical section of stack approximately 4 diameters downstream and more than 4 diameters upstream from a disturbance to flow.

Details of the sampling date, times and stack dimensions are:

- Sample date and time: 26 September 2002, 11:04–15:58
- Stack dimensions: 1.43 metre diameter circular duct.

Table 4.12: Particulate emissions from furnace 2

Sample	Sample mass (g)	Particulate emissions		
		(mg/m^3, dry, 0°C, 1 Atm)	mg/m^3 (dry, 0°C, 12% CO_2)	(kg/h)
1	0.0020	0.67	5.7	0.017

Table 4.13: Average stack gas conditions at the furnace 2 sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
1.4	1.4	255	2.9	8.7	14.1	7.1

Table 4.14: Results of isokinicity for furnace 2

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	2.9946	3.2262	93

All samples are within the required isokinicity range of 100 ± 10%.

Table 4.15: Average combustion gas results for furnace 2

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
< 11	< 25	23.9	19.0	<9

The weight of scrap metal melted during this sample was 1.952 tonnes.

Table 4.16: Summary results from induction furnace 2

		Concentration (ng/m^3)	Concentration (ng/m^3 11% O_2)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.00334	0.017	84.9	198
	Including half LOD values	0.0172	0.086	437	1019
	Including LOD values	0.0311	0.16	790	1841
Total I-TEQ	Excluding LOD values	0	0	0	0
	Including half LOD values	0.00100	0.0050	25.3	59.0
	Including LOD values	0.00199	0.010	50.7	118
Total WHO-TEQ	Excluding LOD values	0	0	0	0
	Including half LOD values	0.00107	0.0054	27.3	63.6
	Including LOD values	0.00215	0.011	54.5	127

Table 4.17: Results from induction furnace 2 (individual congeners)

	Concentration (ng/m^3 0 °C 1 Atm dry)		I-TEQ			WHO-TEQ		
			(ng/m^3 0°C 1 Atm dry)		(ng)	(ng/m^3 0°C 1 Atm dry)		(ng)
		(11%O_2)		(11%O_2)			(11%O_2)	
2378 TCDF	***0.00067***	***0.0034***	***0.00007***	***0.0003***	***0.0002***	***0.000067***	***0.00034***	***0.0002***
Total TCDF	0.0033	0.017	0	0	0	0	0	0
2378 TCDD	***0.0010***	***0.0050***	***0.0010***	***0.0050***	***0.003***	***0.0010***	***0.0050***	***0.003***
Total TCDD	***0.00067***	0.0034	0	0	0	0	0	0
12378PeCDF	***0.00027***	***0.0013***	***0.00001***	***0.0001***	***0.00004***	***0.000013***	***0.000067***	***0.00004***
23478PeCDF	***0.00033***	***0.0017***	***0.00017***	***0.0008***	***0.0005***	***0.00017***	***0.00084***	***0.0005***
Total PeCDF	***0.0013***	***0.0067***	0	0	0	0	0	0
12378PeCDD	***0.00033***	***0.0017***	***0.00017***	***0.0008***	***0.0005***	***0.00033***	***0.0017***	***0.001***
Total PeCDD	***0.00033***	***0.0017***	0	0	0	0	0	0
123478HxCDF	***0.00033***	***0.0017***	***0.00003***	***0.0002***	***0.0001***	***0.000033***	***0.00017***	***0.0001***
123678HxCDF	***0.00033***	***0.0017***	***0.00003***	***0.0002***	***0.0001***	***0.000033***	***0.00017***	***0.0001***
234678HxCDF	***0.00067***	***0.0034***	***0.00007***	***0.0003***	***0.0002***	***0.000067***	***0.00034***	***0.0002***
123789HxCDF	***0.0010***	***0.0050***	***0.00010***	***0.0005***	***0.0003***	***0.00010***	***0.00050***	***0.0003***
Total HxCDF	***0.0010***	0.0050	0	0	0	0	0	0
123478HxCDD	***0.0010***	***0.0050***	***0.00010***	***0.0005***	***0.0003***	***0.00010***	***0.00050***	***0.0003***
123678HxCDD	***0.00067***	***0.0034***	***0.00007***	***0.0003***	***0.0002***	***0.000067***	***0.00034***	***0.0002***
123789HxCDD	***0.0010***	***0.0050***	***0.00010***	***0.0005***	***0.0003***	***0.00010***	***0.00050***	***0.0003***
Total HxCDD	***0.0010***	***0.0050***	0	0	0	0	0	0
1234678HpCDF	***0.0013***	***0.0067***	***0.00003***	***0.0001***	***0.00004***	***0.000013***	***0.000067***	***0.00004***
1234789HpCDF	***0.0013***	***0.0067***	***0.00003***	***0.0001***	***0.00004***	***0.000013***	***0.000067***	***0.00004***
Total HpCDF	***0.0013***	***0.0067***	0	0	0	0	0	0
1234678HpCDD	***0.0033***	***0.017***	***0.00003***	***0.0002***	***0.0001***	***0.000033***	***0.00017***	***0.0001***
Total HpCDD	***0.0067***	0.034	0	0	0	0	0	0
OCDF	***0.0020***	***0.010***	***0.00002***	***0.000010***	***0.00001***	***0.00000020***	***0.000001***	***0.0000006***
OCDD	***0.013***	***0.067***	***0.00001***	***0.0001***	***0.00004***	***0.000001***	***0.000007***	***0.000004***

NB. Where results are less than the detection limit they have been reported in bold.

5 Site C

5.1 Introduction

On 6 March 2003, sampling was carried out at Site C. Samples were collected from the induction furnace baghouse discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sampling point was after the baghouse in a vertical section of duct and at least three duct diameters from any disturbance to the flow. The sampling point was accessed from scaffolding.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 6 March 2003, 3:40–16:42
  - Sample 2: 6 March 2003, 17:23–20:23
- Stack dimensions: 0.91 x 0.9 metre rectangular duct.

5.2 Results

Table 5.1: Particulate emissions from induction furnace

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
1	0.001	<0.6	<0.02
2	0.001	<0.6	<0.02
Average		<0.6	<0.02

Note: The sample mass was less than the limit of detection.

Table 5.2: Average stack gas conditions at the induction furnace sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(^oC)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
< 0.5	< 0.5	37.3	1.8	13.7	11.3	9.73

Table 5.3: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	1.6490	1.6434	100%
2	1.6542	1.5787	105%

All samples are within the required isokinicity range of 100 ± 10%.

Table 5.4: Average combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
11.6	<25	8.3	21.1	1.4

Table 5.5: Summary results from induction furnace sample 1 filter, rinses and trap

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.103	3,650	1,622
	Including half LOD values	0.498	17,567	7,808
	Including LOD values	0.892	31,484	13,993
Total I-TEQ	Excluding LOD values	0.000236	8.34	3.71
	Including half LOD values	0.00191	67.4	30.0
	Including LOD values	0.00358	126.5	56.2
Total WHO-TEQ	Excluding LOD values	0.000231	8.16	3.62
	Including half LOD values	0.00177	62.4	27.7
	Including LOD values	0.00331	117	51.9

Table 5.6: Results from induction furnace (individual congeners sample 1 filter, rinses and trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3 0ºC 1 Atm dry)	(ng)
2378 TCDF	***0.001***	***0.0001***	***0.0002***	***0.0001***	***0.0002***
Total TCDF	0.023	0	0	0	0
2378 TCDD	***0.001***	***0.0006***	***0.001***	***0.0006***	***0.001***
Total TCDD	0.010	0	0	0	0
12378 PeCDF	***0.001***	***0.0000***	***0.00005***	***0.0000***	***0.00005***
23478 PeCDF	***0.001***	***0.0003***	***0.0005***	***0.0003***	***0.0005***
Total PeCDF	0.012	0	0	0	0
12378 PeCDD	***0.001***	***0.0003***	***0.00045***	***0.0005***	***0.0009***
Total PeCDD	0.013	0	0	0.0000	0
123478 HxCDF	***0.002***	***0.0002***	***0.0003***	***0.0002***	***0.0003***
123678 HxCDF	***0.002***	***0.0002***	***0.0003***	***0.0002***	***0.0003***
234678 HxCDF	***0.001***	***0.0001***	***0.0001***	***0.0001***	***0.0001***
123789 HxCDF	***0.001***	***0.0001***	***0.0002***	***0.0001***	***0.0002***
Total HxCDF	0.010	0	0	0	0
123478 HxCDD	***0.001***	***0.0001***	***0.0002***	***0.0001***	***0.0002***
123678 HxCDD	0.002	0.0002	0.00032	0.0002	0.00032
123789 HxCDD	***0.001***	***0.0001***	***0.0002***	***0.0001***	***0.0002***
Total HxCDD	0.021	0	0	0	0
1234678 HpCDF	0.004	0.000036	0.00006	0.000036	0.00006
1234789 HpCDF	***0.001***	***0.000012***	***0.00002***	***0.000012***	***0.00002***
Total HpCDF	0.008	0	0	0	0
1234678 HpCDD	***0.061***	***0.0006***	***0.001***	***0.0006***	***0.001***
Total HpCDD	***0.182***	0	0	0	0
OCDF	0.006	0.000006	0.0000095	0.00000058	0.00000095
OCDD	***0.606***	***0.0006***	***0.001***	***0.0001***	***0.0001***

NB. Where results are less than the detection limit they have been reported in bold.

Table 5.7: Summary results from induction furnace sample 2 filter, rinses and trap

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	2.67	91,752	40,778
	Including half LOD values	2.67	91,752	40,778
	Including LOD values	2.67	91,752	40,778
Total I-TEQ	Excluding LOD values	0.006	195	86.6
	Including half LOD values	0.009	304	135
	Including LOD values	0.012	412	183
Total WHO-TEQ	Excluding LOD values	0.004	132	58.6
	Including half LOD values	0.007	251	111
	Including LOD values	0.011	370	164

Table 5.8: Results from induction furnace (individual congeners sample 2 filter, rinses and trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3 0ºC 1 Atm dry)	(ng)
2378 TCDF	***0.002***	***0.0002***	***0.0003***	***0.0002***	***0.0003***
Total TCDF	0.044	0	0	0	0
2378 TCDD	***0.002***	***0.0018***	***0.003***	***0.0018***	***0.003***
Total TCDD	0.005	0	0	0	0
12378 PeCDF	***0.002***	***0.0001***	***0.00015***	***0.0001***	***0.00015***
23478 PeCDF	***0.002***	***0.0012***	***0.002***	***0.0012***	***0.002***
Total PeCDF	0.015	0	0	0	0
12378 PeCDD	***0.001***	***0.0006***	***0.001***	***0.0012***	***0.002***
Total PeCDD	0.005	0	0	0	0
123478 HxCDF	***0.003***	***0.0003***	***0.0005***	***0.0003***	***0.0005***
123678 HxCDF	***0.002***	***0.0002***	***0.0004***	***0.0002***	***0.0004***
234678 HxCDF	***0.002***	***0.0002***	***0.0004***	***0.0002***	***0.0004***
123789 HxCDF	***0.005***	***0.0005***	***0.0009***	***0.0005***	***0.0009***
Total HxCDF	0.024	0	0	0	0
123478 HxCDD	***0.004***	***0.0004***	***0.0007***	***0.0004***	***0.0007***
123678 HxCDD	0.007	0.0007	0.0012	0.0007	0.0012
123789 HxCDD	***0.006***	***0.0006***	***0.001***	***0.0006***	***0.001***
Total HxCDD	0.056	0	0	0	0
1234678 HpCDF	0.019	0.0002	0.00031	0.0002	0.00031
1234789 HpCDF	***0.006***	***0.0001***	***0.0001***	***0.0001***	***0.0001***
Total HpCDF	0.042	0	0	0	0
1234678 HpCDD	0.272	0.0027	0.0045	0.0027	0.0045
Total HpCDD	0.441	0	0	0	0
OCDF	0.042	0.000042	0.00007	0.0000042	0.000007
OCDD	1.995	0.0020	0.0033	0.0002	0.00033

NB. Where results are less than the detection limit they have been reported in bold.

6 Site D

6.1 Introduction

Sampling was carried out at Site D on 12 and 13 March 2003. Samples were collected from the induction furnace discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sampling point was located in a custom built duct, which was attached to the end of the stack. 100% of the discharge from the main stack passed through this duct.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 12 March 2003, 14:51–15:55 and 13 March 2003, 09:50–12:37
  - Sample 2: 13 March 2003, 13:00–15:55
- Stack dimensions: 218 x 261 mm rectangular duct.

Note: Test 1 was stopped on 12 March and restarted on 13 March.

6.2 Results

Table 6.1: Particulate emissions from induction furnace

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
1	0.0214	4.1	0.0073
2	0.0079	2.0	0.0038
Average		3.0	0.0055

Table 6.2: Average stack gas conditions at the bag house sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(^{o}C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0^{o}C, 1 Atm, dry)
< 0.5	< 0.5	33.0	1.2	12.0	0.68	0.60

Table 6.3: Average conditions for stack

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(^{o}C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0^{o}C, 1 Atm, dry)
< 0.5	< 0.5	30.0	1.2	9.7	0.55	0.49

Note: The sample was only taken at one point and did not represent the true flows of the stack. Accurate flows were taken after this sample and used in all particulate and dioxin/furan calculations.

Table 6.4: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	5.1733	5.5539	93%
2	4.0615	4.0779	100%

All samples are within the required isokinicity range of 100 ± 10%.

Table 6.5: Average combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
0.22	<25	1.5	21.0	<9

Table 6.6: Summary results from induction furnace sample 1

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0323	57.4	129
	Including half LOD values	0.0503	89.5	201
	Including LOD values	0.0684	122	273
Total I-TEQ	Excluding LOD values	0.00011	0.217	0.49
	Including half LOD values	0.00132	2.37	5.3
	Including LOD values	0.00253	4.53	10.2
Total WHO-TEQ	Excluding LOD values	0.00010	0.200	0.45
	Including half LOD values	0.00140	2.51	5.6
	Including LOD values	0.00270	4.82	10.8

Table 6.7: Results from induction furnace (individual congeners sample 1)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3 0ºC 1 Atm dry)	(ng)
2378 TCDF	***0.00078***	***0.000078***	***0.0004***	***0.000078***	***0.00040***
Total TCDF	0.0056	0	0	0	0
2378 TCDD	***0.00020***	***0.000195***	***0.001***	***0.000195***	***0.0010***
Total TCDD	***0.00097***	0	0	0	0
12378 PeCDF	***0.00078***	***0.000039***	***0.00020***	***0.000039***	***0.00020***
23478 PeCDF	***0.0019***	***0.00098***	***0.0050***	***0.000975***	***0.0050***
Total PeCDF	0.0031	0	0	0	0
12378 PeCDD	***0.00039***	***0.00020***	***0.0010***	***0.00039***	***0.0020***
Total PeCDD	0.00070	0	0	0	0
123478 HxCDF	***0.0014***	***0.00014***	***0.00070***	***0.00014***	***0.0007***
123678 HxCDF	0.00082	0.000082	0.00042	0.000082	0.00042
234678 HxCDF	***0.0019***	***0.00020***	***0.0010***	***0.00020***	***0.001***
123789 HxCDF	***0.00039***	***0.000039***	***0.00020***	***0.000039***	***0.0002***
Total HxCDF	0.0041	0	0	0	0
123478 HxCDD	***0.0016***	***0.00016***	***0.00080***	***0.00016***	***0.00080***
123678 HxCDD	***0.0017***	***0.00018***	***0.00090***	***0.00018***	***0.00090***
123789 HxCDD	***0.0014***	***0.00014***	***0.0007***	***0.00014***	***0.0007***
Total HxCDD	0.0041	0	0	0	0
1234678 HpCDF	0.0029	0.000029	0.00015	0.000029	0.00015
1234789 HpCDF	***0.00058***	***0.0000058***	***0.000030***	***0.0000058***	***0.000030***
Total HpCDF	0.0035	0	0	0	0
1234678 HpCDD	***0.0078***	***0.000078***	***0.0004***	***0.000078***	***0.00040***
Total HpCDD	***0.016***	0	0	0	0
OCDF	0.011	0.000011	0.000057	0.0000011	0.0000057
OCDD	***0.020***	***0.000020***	***0.0001***	***0.0000020***	***0.00001***

NB. Where results are less than the detection limit they have been reported in bold.

Table 6.8: Summary results from induction furnace sample 2

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0139	24.7	145
	Including half LOD values	0.0508	90.4	531
	Including LOD values	0.0878	156	916
Total I-TEQ	Excluding LOD values	0.00004	0.0337	0.198
	Including half LOD values	0.00160	2.81	16.5
	Including LOD values	0.00316	5.58	32.8
Total WHO-TEQ	Excluding LOD values	0.000037	0.0337	0.198
	Including half LOD values	0.00177	3.11	18.3
	Including LOD values	0.00350	6.19	36.4

Table 6.9: Results from induction furnace (individual congeners sample 2)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3 0ºC 1 Atm dry)	(ng)
2378 TCDF	***0.0074***	***0.00074***	***0.0030***	***0.00074***	***0.0030***
Total TCDF	***0.020***	0	0	0	0
2378 TCDD	***0.00050***	***0.00049***	***0.0020***	***0.00049***	***0.0020***
Total TCDD	***0.0049***	0	0	0	0
12378 PeCDF	***0.0010***	***0.000049***	***0.00020***	***0.000049***	***0.00020***
23478 PeCDF	***0.0010***	***0.00049***	***0.0020***	***0.00049***	***0.0020***
Total PeCDF	0.0049	0	0	0	0
12378 PeCDD	***0.00070***	***0.00037***	***0.0020***	***0.00074***	***0.0030***
Total PeCDD	0.0030	0	0	0	0
123478 HxCDF	***0.0025***	***0.00025***	***0.0010***	***0.00025***	***0.0010***
123678 HxCDF	***0.00070***	***0.000074***	***0.00030***	***0.000074***	***0.00030***
234678 HxCDF	***0.00070***	***0.000074***	***0.00030***	***0.000074***	***0.00030***
123789 HxCDF	***0.0012***	***0.00012***	***0.0010***	***0.00012***	***0.0010***
Total HxCDF	***0.0049***	0	0	0	0
123478 HxCDD	***0.0012***	***0.00012***	***0.00050***	***0.00012***	***0.00050***
123678 HxCDD	***0.0012***	***0.00012***	***0.00050***	***0.00012***	***0.00050***
123789 HxCDD	***0.0012***	***0.00012***	***0.00050***	***0.00012***	***0.00050***
Total HxCDD	0.0039	0	0	0	0
1234678 HpCDF	0.0019	0.000019	0.000077	0.000019	0.000077
1234789 HpCDF	***0.0015***	***0.000015***	***0.000060***	***0.000015***	***0.000060***
Total HpCDF	0.0021	0	0	0	0
1234678 HpCDD	***0.0049***	***0.000049***	***0.00020***	***0.000049***	***0.00020***
Total HpCDD	***0.015***	0	0	0	0
OCDF	***0.0049***	***0.0000049***	***0.00002***	***0.00000049***	***0.000002***
OCDD	***0.025***	***0.000025***	***0.0001***	***0.0000025***	***0.000010***

NB. Where results are less than the detection limit they have been reported in bold.

7 Site E

7.1 Introduction

Sampling was carried out at Site E on 17 March 2003. Samples were collected from the induction furnace baghouse discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sampling point was in a vertical section of duct. Access was difficult and limited which prevented doing a full traverse of the stack.

Details of the sampling date, times and stack dimensions are:

- Sample date and time: 17 March 2003, 13:55–18:05
- Stack dimensions: 0.5 metre diameter circular duct.

7.2 Results

Table 7.1: Particulate emission from induction furnace

Sample	Sample mass (g)	Particulate emissions		
		(mg/m^3, dry, 0°C, 1 Atm)	(mg/m^3, dry, 0 °C, 1 Atm, 12% CO_2)	(kg/h)
1	0.0188	5.2	44.7	0.02

Table 7.2: Average stack gas conditions at the induction furnace sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
1.3	1.4	41.6	5.4	6.6	1.3	1.1

Table 7.3: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	3.605	3.8389	93.9%

All samples are within the required isokinicity range of 100 ± 10 %.

Table 7.4: Combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
7.5	< 25	23	19.6	3.8

The weight of scrap metal melted during the sampling period was 6.319 tonnes.

Table 7.5: Summary results from induction furnace sample 1 filters, rinses and trap

		Concentration (ng/m^3)	Concentration (ng/m^3 11% O_2)	Emission ng/hr	Emission ng/tonne
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0127	0.093	48	31.3
	Including half LOD values	0.046	0.337	174	113
	Including LOD values	0.079	0.58	300	194
Total I-TEQ	Excluding LOD values	0.00007	0.0005	0.25	0.164
	Including half LOD values	0.00111	0.0082	4.2	2.74
	Including LOD values	0.00215	0.0159	8.2	5.31
Total WHO-TEQ	Excluding LOD values	0.00007	0.0005	0.25	0.164
	Including half LOD values	0.00123	0.0091	4.7	3.04
	Including LOD values	0.00240	0.0177	9.2	5.92

Table 7.6: Results from induction furnace (individual congeners sample 1 filters, rinses and trap)

	Concentration (ng/m^3, 0^oC, 1 Atm dry)		I-TEQ			WHO-TEQ		
			(ng/m^3 0^oC 1 Atm dry)		(ng)	(ng/m^3 0^oC 1 Atm dry)		(ng)
		(11% O_2)		(11% O_2)			(11% O_2)	
2378 TCDF	***0.0006***	***0.0041***	***0.0001***	***0.0004***	***0.0002***	***0.000055***	***0.00041***	***0.0002***
Total TCDF	***0.0014***	***0.0102***	0	0	0	0	0	0
2378 TCDD	***0.0006***	***0.0041***	***0.0006***	***0.0041***	***0.002***	***0.00055***	***0.0041***	***0.002***
Total TCDD	***0.0008***	***0.0061***	0	0	0	0	0	0
12378PeCDF	***0.0003***	***0.0020***	***0.000014***	***0.00010***	***0.00005***	***0.000014***	***0.00010***	***0.00005***
23478PeCDF	***0.0008***	***0.0061***	***0.0004***	***0.0031***	***0.0015***	***0.00042***	***0.0031***	***0.0015***
Total PeCDF	***0.0028***	***0.020***	0	0	0	0	0	0
12378PeCDD	***0.0006***	***0.0041***	***0.0003***	***0.0020***	***0.001***	***0.00055***	***0.0041***	***0.002***
Total PeCDD	0.0013	0.01	0	0	0	0	0	0
123478HxCDF	***0.0011***	***0.0082***	***0.00011***	***0.0008***	***0.0004***	***0.00011***	***0.00082***	***0.0004***
123678HxCDF	***0.0006***	***0.0041***	***0.00006***	***0.0004***	***0.0002***	***0.000055***	***0.00041***	***0.0002***
234678HxCDF	***0.0008***	***0.0061***	***0.00008***	***0.0006***	***0.0003***	***0.000083***	***0.00061***	***0.0003***
123789HxCDF	***0.0011***	***0.0082***	***0.00011***	***0.0008***	***0.0004***	***0.00011***	***0.00082***	***0.0004***
Total HxCDF	0.0036	0.027	0	0	0	0	0	0
123478HxCDD	***0.0011***	***0.0082***	***0.00011***	***0.0008***	***0.0004***	***0.00011***	***0.00082***	***0.0004***
123678HxCDD	***0.0011***	***0.0082***	***0.00011***	***0.0008***	***0.0004***	***0.00011***	***0.00082***	***0.0004***
123789HxCDD	***0.0011***	***0.0082***	***0.00011***	***0.0008***	***0.0004***	***0.00011***	***0.00082***	***0.0004***
Total HxCDD	0.0078	0.0572	0	0	0	0	0	0
1234678HpCDF	***0.0028***	***0.0204***	***0.000028***	***0.00020***	***0.0001***	***0.000028***	***0.00020***	***0.0001***
1234789 HpCDF	***0.0017***	***0.0123***	***0.000017***	***0.00012***	***0.00006***	***0.000017***	***0.00012***	***0.00006***
Total HpCDF	***0.0028***	***0.0204***	0	0	0	0	0	0
1234678 HpCDD	0.0067	0.049	0.000067	0.00049	0.00024	0.000067	0.00049	0.00024
Total HpCDD	***0.0277***	***0.2044***	0	0	0	0	0	0
OCDF	***0.0028***	***0.0204***	***0.0000028***	***0.000020***	***0.00001***	***0.00000028***	***0.0000020***	***0.000001***
OCDD	***0.0277***	***0.2044***	***0.000028***	***0.00020***	***0.0001***	***0.0000028***	***0.000020***	***0.00001***

NB. Where results are less than the detection limit they have been reported in bold.

8 Site F

8.1 Introduction

Sampling was carried out at Site F on 18 March 2003. Samples were collected from the induction furnace baghouse discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sampling point was on the main stack after a bag house. The sample port was at least five diameters from a disturbance to the flow.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 18 March 2003, 10:03–14:02
  - Sample 2: 18 March 2003, 14:59–19:00
- Stack dimensions: 1.5 metre diameter circular duct.

Flows were measured the day before sampling. On the day of sampling the flows had changed significantly. The flow rate was measured while the samples were being gathered and if there was any change the sample rate was adjusted accordingly. At the end of sampling flows were measured across the entire diameter of the stack.

8.2 Results

Table 8.1: Particulate emissions from induction furnace

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
1	0.0297	7.2	0.494
2	< 0.0155	< 4.2	< 0.259

Table 8.2: Average stack gas conditions at the induction furnace sampling point

CO_2		Temperature	Moisture	Velocity	Flow fate	
(%, wet)	(%, dry)	(^oC)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
<0.5	<0.5	73.9	2.3	12.2	21.6	16.6

Table 8.3: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	4.1198	4.3630	94
2	3.6999	3.9731	93

All samples are within the required isokinicity range of 100 ± 10%.

Table 8.4: Summary results from induction furnace sample 1 filter, rinses and trap

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	4.72	282,958	232,204
	Including half LOD values	4.76	285,139	233,994
	Including LOD values	4.80	287,321	235,784
Total I-TEQ	Excluding LOD values	0.100	6017	4938
	Including half LOD values	0.101	6026	4945
	Including LOD values	0.101	6036	4953
Total WHO-TEQ	Excluding LOD values	0.110	6605	5421
	Including half LOD values	0.110	6613	5427
	Including LOD values	0.111	6620	5433

Table 8.5: Results from induction furnace (individual congeners sample 1 filter, rinses and trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0^oC, 1 Atm dry)	(ng/m^3 0^oC 1 Atm dry)	(ng)	(ng/m^3 0^oC 1 Atm dry)	(ng)
2378 TCDF	0.114	0.0114	0.047	0.0114	0.047
Total TCDF	0.922	0	0	0	0
2378 TCDD	0.008	0.0083	0.034	0.0083	0.034
Total TCDD	0.107	0	0	0	0
12378 PeCDF	0.073	0.0036	0.015	0.0036	0.015
23478 PeCDF	0.095	0.0473	0.195	0.0473	0.195
Total PeCDF	1.893	0	0	0	0
12378 PeCDD	0.020	0.0098	0.0405	0.0197	0.081
Total PeCDD	0.607	0	0	0	0
123478 HxCDF	0.056	0.0056	0.023	0.0056	0.023
123678 HxCDF	0.053	0.0053	0.022	0.0053	0.022
234678 HxCDF	0.049	0.0049	0.02	0.0049	0.02
123789 HxCDF	***0.0024***	***0.00024***	***0.001***	***0.00024***	***0.001***
Total HxCDF	0.704	0	0	0	0
123478 HxCDD	0.007	0.0007	0.003	0.0007	0.003
123678 HxCDD	0.017	0.0017	0.0071	0.0017	0.0071
123789 HxCDD	0.009	0.0009	0.0036	0.0009	0.0036
Total HxCDD	0.340	0	0	0	0
1234678 HpCDF	0.056	0.0006	0.0023	0.0006	0.0023
1234789 HpCDF	0.004	0.00004	0.00017	0.00004	0.00017
Total HpCDF	0.085	0	0	0	0
1234678 HpCDD	0.027	0.0003	0.0011	0.0003	0.0011
Total HpCDD	0.058	0	0	0	0
OCDF	0.007	0.00001	0.00003	0.000001	0.000003
OCDD	***0.073***	***0.000073***	***0.0003***	***0.0000073***	***0.00003***

NB. Where results are less than the detection limit they have been reported in bold.

Table 8.6: Summary results from induction furnace sample 2 filter, rinses and trap

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	24.1	1,446,089	734,133
	Including half LOD values	24.2	1,448,518	735,366
	Including LOD values	24.2	1,450,946	736,599
Total I-TEQ	Excluding LOD values	0.567	33,969	17,245
	Including half LOD values	0.567	33,971	17,246
	Including LOD values	0.567	33,974	17,247
Total WHO-TEQ	Excluding LOD values	0.614	36,801	18,683
	Including half LOD values	0.614	36,802	18,683
	Including LOD values	0.614	36,802	18,683

Table 8.7: Results from induction furnace (individual congeners sample 2 filter, rinses and trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0^oC, 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.757	0.0757	0.28	0.0757	0.28
Total TCDF	2.973	0	0	0	0
2378 TCDD	0.046	0.0459	0.17	0.0459	0.17
Total TCDD	0.186	0	0	0	0
12378 PeCDF	0.486	0.0243	0.09	0.0243	0.09
23478 PeCDF	0.541	0.2703	1	0.2703	1
Total PeCDF	11.352		0	0	0
12378 PeCDD	0.095	0.0473	0.175	0.0946	0.35
Total PeCDD	3.243	0	0	0	0
123478 HxCDF	0.297	0.0297	0.11	0.0297	0.11
123678 HxCDF	0.270	0.0270	0.1	0.0270	0.1
234678 HxCDF	0.251	0.0251	0.093	0.0251	0.093
123789 HxCDF	0.017	0.0017	0.0062	0.0017	0.0062
Total HxCDF	4.054	0	0	0	0
123478 HxCDD	0.038	0.0038	0.014	0.0038	0.014
123678 HxCDD	0.078	0.0078	0.029	0.0078	0.029
123789 HxCDD	0.041	0.0041	0.015	0.0041	0.015
Total HxCDD	1.649	0	0	0	0
1234678 HpCDF	0.324	0.0032	0.012	0.0032	0.012
1234789 HpCDF	0.021	0.0002	0.00078	0.0002	0.00078
Total HpCDF	0.459	0	0	0	0
1234678 HpCDD	0.081	0.0008	0.003	0.0008	0.003
Total HpCDD	0.203	0	0	0	0
OCDF	0.021	0.000021	0.000076	0.0000021	0.0000076
OCDD	***0.081***	***0.000081***	***0.0003***	***0.0000081***	***0.00003***

NB. Where results are less than the detection limit they have been reported in bold.

9 Site G

9.1 Introduction

Sampling was carried out at Site G on 26 and 27 March 2003. Samples were collected from the induction furnace baghouse discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sampling ports were after the baghouse and were at least 5 stack diameters from any disturbance to the flow.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 26 March 2003, 9:42–14:46
  - Sample 2: 27 March 2003, 6:32–10:00
- Stack dimensions: 0.575 metre diameter circular duct.

9.2 Results

Table 9.1: Particulate emissions from induction furnace

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0^oC, 1 Atm)	(kg/h)
1	0.0017	0.6	0.0017
2	0.0003	0.1	0.00044
Average		0.3	0.0010

Table 9.2: Average stack gas conditions at the induction furnace sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(^oC)	(%)	(m/s)	(m^3/s)	(m^3/s, 0^oC, 1 Atm, dry)
<0.5	<0.5	29.1	1.5	3.7	1.0	0.9

Table 9.3: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0^oC, 1 Atm, dry)	Calculated sample volume (m^3, 0^oC, 1 Atm, dry)	Isokinicity (%)
1	3.0647	3.0638	100%
2	2.1362	2.1003	102%

All samples are within the required isokinicity range of 100 ± 10%.

Table 9.4: Combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
<11	<25	<12	21.1	<9

Table 9.5: Summary results from induction furnace sample 1 particulate and rinses

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.139	423	875
	Including half LOD values	0.322	978	2022
	Including LOD values	0.505	1532	3169
Total I-TEQ	Excluding LOD values	0.0033	10.1	20.9
	Including half LOD values	0.0046	14.0	28.9
	Including LOD values	0.0059	17.8	36.8
Total WHO-TEQ	Excluding LOD values	0.0033	10.1	20.9
	Including half LOD values	0.0048	14.6	30.1
	Including LOD values	0.00628	19.1	39.4

Table 9.6: Results from induction furnace (individual congeners sample 1 particulate and rinses)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0028	0.00028	0.00087	0.00028	0.00087
Total TCDF	0.024	0	0	0	0
2378 TCDD	***0.0010***	***0.0010***	***0.0030***	***0.0010***	***0.003***
Total TCDD	0.0042	0	0	0	0
12378 PeCDF	0.0033	0.00016	0.0005	0.00016	0.0005
23478 PeCDF	0.0036	0.0018	0.0055	0.0018	0.0055
Total PeCDF	0.055	0	0	0	0
12378 PeCDD	***0.0013***	***0.0007***	***0.00200***	***0.0013***	***0.004***
Total PeCDD	0.0085	0	0	0	0
123478 HxCDF	0.0036	0.00036	0.0011	0.00036	0.0011
123678 HxCDF	0.0033	0.00033	0.001	0.00033	0.001
234678 HxCDF	0.0033	0.00033	0.001	0.00033	0.001
123789 HxCDF	***0.0010***	***0.00010***	***0.00030***	***0.00010***	***0.0003***
Total HxCDF	0.036	0	0	0	0
123478 HxCDD	***0.0010***	***0.00010***	***0.00030***	***0.00010***	***0.0003***
123678 HxCDD	***0.0010***	***0.00010***	***0.00030***	***0.00010***	***0.0003***
123789 HxCDD	***0.0007***	***0.00007***	***0.00020***	***0.00007***	***0.0002***
Total HxCDD	0.011	0	0	0	0
1234678 HpCDF	0.0075	0.000075	0.00023	0.000075	0.00023
1234789 HpCDF	***0.0016***	***0.000016***	***0.000050***	***0.000016***	0
Total HpCDF	***0.0261***	***0***	0	***0***	***0.00005***
1234678 HpCDD	***0.0261***	***0.00026***	***0.00080***	***0.00026***	0
Total HpCDD	***0.0653***	***0***	0	***0***	***0.0008***
OCDF	***0.0131***	***0.000013***	***0.000040***	***0.0000013***	***0.000004***
OCDD	***0.2610***	***0.00026***	***0.00080***	***0.00003***	***0.00008***

NB. Where results are less than the detection limit they have been reported in bold.

Table 9.7: Summary results from induction furnace sample 1 gaseous (trap)

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.12	354	732
	Including half LOD values	0.13	397	821
	Including LOD values	0.14	440	910
Total I-TEQ	Excluding LOD values	0.00031	0.941	1.95
	Including half LOD values	0.0020	5.94	12.3
	Including LOD values	0.0036	10.9	22.6
Total WHO-TEQ	Excluding LOD values	0.00031	0.941	1.95
	Including half LOD values	0.0021	6.41	13.3
	Including LOD values	0.0039	11.9	24.6

Table 9.8: Results from induction furnace (individual congeners sample 1 gaseous (trap))

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0024	0.0002	0.00073	0.00024	0.00073
Total TCDF	0.075	0	0	0	0
2378 TCDD	***0.00065***	***0.00065***	***0.002***	***0.00065***	***0.002***
Total TCDD	0.0046	0	0	0	0
12378 PeCDF	0.001	0.000072	0.00022	0.000072	0.00022
23478 PeCDF	***0.0033***	***0.0016***	***0.005***	***0.00163***	***0.005***
Total PeCDF	0.025	0	0	0	0
12378 PeCDD	***0.00065***	***0.00033***	***0.001***	***0.00065***	***0.002***
Total PeCDD	0.004	0	0	0	0
123478 HxCDF	***0.0013***	***0.00013***	***0.0004***	***0.00013***	***0.0004***
123678 HxCDF	***0.00065***	***0.000065***	***0.0002***	***0.000065***	***0.0002***
234678 HxCDF	***0.00065***	***0.000065***	***0.0002***	***0.000065***	***0.0002***
123789 HxCDF	***0.00065***	***0.000065***	***0.0002***	***0.000065***	***0.0002***
Total HxCDF	0.007	0	0	0	0
123478 HxCDD	***0.00098***	***0.00010***	***0.0003***	***0.00010***	***0.0003***
123678 HxCDD	***0.00098***	***0.00010***	***0.0003***	***0.00010***	***0.0003***
123789 HxCDD	***0.00098***	***0.00010***	***0.0003***	***0.00010***	***0.0003***
Total HxCDD	0.001	0	0	0	0
1234678 HpCDF	***0.00065***	***0.0000065***	***0.00002***	***0.000007***	***0.00002***
1234789 HpCDF	***0.00098***	***0.000010***	***0.00003***	***0.000010***	***0.00003***
Total HpCDF	***0.00098***	0	0	***0***	0
1234678 HpCDD	***0.0029***	***0.000029***	***0.00009***	***0.000029***	***0.00009***
Total HpCDD	***0.0065***	***0***	0	***0***	0
OCDF	***0.001***	***0.0000013***	***0.000004***	***0.00000013***	***0.0000004***
OCDD	***0.020***	***0.000020***	***0.00006***	***0.0000020***	***0.000006***

NB. Where results are less than the detection limit they have been reported in bold.

Table 9.9: Summary results from induction furnace sample 2 particulate and gaseous

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0585	183	523
	Including half LOD values	0.0945	295	846
	Including LOD values	0.131	408	1168
Total I-TEQ	Excluding LOD values	0.000238	0.744	2.13
	Including half LOD values	0.00194	6.07	17.4
	Including LOD values	0.00365	11.4	32.7
Total WHO-TEQ	Excluding LOD values	0.000238	0.744	2.13
	Including half LOD values	0.00216	6.74	19.3
	Including LOD values	0.00408	12.7	36.5

Table 9.10: Results from induction furnace (individual congeners sample 2 particulate and gaseous)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0021	0.00021	0.00044	0.0002	0.00044
Total TCDF	0.019	0	0	0	0
2378 TCDD	***0.00047***	***0.00047***	***0.001***	***0.0005***	***0.001***
Total TCDD	***0.0019***	***0***	0	0	0
12378 PeCDF	***0.0023***	***0.00012***	***0.00025***	***0.00012***	***0.00025***
23478 PeCDF	***0.0023***	***0.0012***	***0.0025***	***0.0012***	***0.0025***
Total PeCDF	0.011	0	0	0	0
12378 PeCDD	***0.0009***	***0.0005***	***0.001***	***0.00094***	***0.002***
Total PeCDD	0.0084	0	0	0	0
123478 HxCDF	***0.0023***	***0.00023***	***0.0005***	***0.00023***	***0.0005***
123678 HxCDF	***0.0014***	***0.00014***	***0.0003***	***0.00014***	***0.0003***
234678 HxCDF	***0.0014***	***0.00014***	***0.0003***	***0.00014***	***0.0003***
123789 HxCDF	***0.0023***	***0.00023***	***0.0005***	***0.00023***	***0.0005***
Total HxCDF	0.0089	0	0	0	0
123478 HxCDD	***0.00094***	***0.000094***	***0.0002***	***0.000094***	***0.0002***
123678 HxCDD	***0.00094***	***0.000094***	***0.0002***	***0.000094***	***0.0002***
123789 HxCDD	***0.00094***	***0.000094***	***0.0002***	***0.000094***	***0.0002***
Total HxCDD	0.0084	0	0	0	0
1234678 HpCDF	0.0032	0	0.000069	0.000032	0.000069
1234789 HpCDF	***0.0019***	***0.000019***	***0.00004***	***0.000019***	***0.00004***
Total HpCDF	0.0032	0	0	0	0
1234678 HpCDD	***0.0094***	***0.000094***	***0.0002***	***0.000094***	***0.0002***
Total HpCDD	***0.023***	***0***	0	0	0
OCDF	***0.0047***	***0.0000047***	***0.00001***	0.00000047	***0.000001***
OCDD	***0.042***	***0.000042***	***0.00009***	0.0000042	***0.000009***

NB. Where results are less than the detection limit they have been reported in bold.

10 Site H

10.1 Introduction

Sampling was carried out at Site H on 27 and 28 March 2003. Samples were collected from the induction furnace baghouse discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sample port was approximately 2 stack diameters from any disturbance to the flow as shown in the photo. The sample port is in the middle of the first straight section of the vertical duct.

The furnace contained molten metal at the start of the test. Extra metal was added during the test.

Metal was added to the furnace cold and the sample represents a complete cycle of melting and pouring the metal. It is noted that the greatest visible fumes occur during the initial melt, pouring, alloying and degassing.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 27 March 2003, 13:22–16:04
  - Sample 2: 28 March 2003, 7:04–11:10
- Stack dimensions: 0.67 metre diameter circular duct.

10.2 Results

Table 10.1: Particulate emission from induction furnace

Sample	Sample mass (g)	Particulate	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
1	0.0984	34	0.20
2	0.0617	14	0.08
Average		24	0.14

Table 10.2: Average stack gas conditions at the induction furnace sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(^{o}C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0^{o}C, 1 Atm, dry)
<0.5	<0.5	27.4	1.2	5.0	1.8	1.6

Table 10.3: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0^oC, 1 Atm, dry)	Calculated sample volume (m^3, 0^oC, 1 Atm, dry)	Isokinicity (%)
1	2.9313	2.9098	101%
2	4.3677	4.1947	104%

All samples are within the required isokinicity range of 100 ± 10%.

Table 10.4: Average combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
1.2	<25	2.8	21	<9

Table 10.5: Summary results from induction furnace sample 1 particulate and rinses

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.408	2387	1989
	Including half LOD values	0.495	2897	2414
	Including LOD values	0.582	3406	2838
Total I-TEQ	Excluding LOD values	0.00829	48.6	40.5
	Including half LOD values	0.0117	68.3	57.0
	Including LOD values	0.0150	88.1	73.4
Total WHO-TEQ	Excluding LOD values	0.00826	48.4	40.3
	Including half LOD values	0.0122	71.4	59.5
	Including LOD values	0.0161	94.4	78.6

Table 10.6: Results from induction furnace (individual congeners sample 1 particulate and rinses)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0027	0.00027	0.0008	0.00027	0.0008
Total TCDF	0.051	0	0	0	0
2378 TCDD	***0.0010***	***0.0010***	***0.003***	***0.0010***	***0.003***
Total TCDD	***0.0034***	***0***	0	***0***	0
12378 PeCDF	0.0051	0.00026	0.00075	0.00026	0.00075
23478 PeCDF	0.0089	0.0044	0.013	0.0044	0.013
Total PeCDF	0.11	0	0	0	0
12378 PeCDD	***0.0024***	***0.0012***	***0.0035***	***0.0024***	***0.007***
Total PeCDD	0.011	0	0	***0***	0
123478 HxCDF	0.015	0.0015	0.0045	0.0015	0.0045
123678 HxCDF	0.012	0.0012	0.0034	0.0012	0.0034
234678 HxCDF	***0.010***	***0.0010***	***0.003***	***0.0010***	***0.003***
123789 HxCDF	***0.017***	***0.0017***	***0.005***	***0.0017***	***0.005***
Total HxCDF	0.089	0	0	0	0
123478 HxCDD	***0.0034***	***0.00034***	***0.001***	***0.00034***	***0.001***
123678 HxCDD	***0.0034***	***0.00034***	***0.001***	***0.00034***	***0.001***
123789 HxCDD	***0.0068***	***0.00068***	***0.002***	***0.00068***	***0.002***
Total HxCDD	0.025	0	0	0	0
1234678 HpCDF	0.048	0.00048	0.0014	0.00048	0.0014
1234789 HpCDF	0.012	0.00012	0.00035	0.00012	0.00035
Total HpCDF	0.085	0	0	0	0
1234678 HpCDD	***0.034***	***0.00034***	***0.001***	***0.00034***	***0.001***
Total HpCDD	***0.068***	0	0	***0***	0
OCDF	0.038	0.000038	0.00011	0.0000	0.000011
OCDD	***0.102***	***0.00010***	***0.0003***	***0.000010***	***0.00003***

NB. Where results are less than the detection limit they have been reported in bold.

Table 10.7: Summary results from induction furnace sample 1 gaseous (trap)

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.187	1096	913
	Including half LOD values	0.211	1236	1030
	Including LOD values	0.235	1376	1146
Total I-TEQ	Excluding LOD values	0.00205	12.0	10.0
	Including half LOD values	0.00302	17.7	14.8
	Including LOD values	0.00400	23.4	19.5
Total WHO-TEQ	Excluding LOD values	0.00204	12.0	10.0
	Including half LOD values	0.00335	19.6	16.3
	Including LOD values	0.00465	27.2	22.7

Table 10.8: Results from induction furnace (individual congeners sample 1 gaseous (trap))

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0031	0.00031	0.00091	0.00031	0.00091
Total TCDF	0.089	0	0	0	0
2378 TCDD	***0.0007***	***0.00068***	***0.002***	***0.00068***	***0.002***
Total TCDD	0.0092	0	0	0	0
12378 PeCDF	0.0027	0.00014	0.0004	0.00014	0.0004
23478 PeCDF	0.0024	0.0012	0.00355	0.0012	0.00355
Total PeCDF	0.061	0	0	0	0
12378 PeCDD	***0.0014***	***0.00068***	***0.002***	***0.0014***	***0.004***
Total PeCDD	0.0034	0	0	0	0
123478 HxCDF	0.0022	0.00022	0.00064	0.00022	0.00064
123678 HxCDF	0.0012	0.00012	0.00034	0.00012	0.00034
234678 HxCDF	***0.0010***	***0.00010***	***0.0003***	***0.00010***	***0.0003***
123789 HxCDF	***0.0014***	***0.00014***	***0.0004***	***0.00014***	***0.0004***
Total HxCDF	0.016	0	0	0	0
123478 HxCDD	***0.0010***	***0.00010***	***0.0003***	***0.00010***	***0.0003***
123678 HxCDD	***0.0010***	***0.00010***	***0.0003***	***0.00010***	***0.0003***
123789 HxCDD	***0.00068***	***0.000068***	***0.0002***	***0.000068***	***0.0002***
Total HxCDD	***0.00682***	0	0	0	0
1234678 HpCDF	0.0051	0.000051	0.00015	0.000051	0.00015
1234789 HpCDF	***0.0014***	***0.000014***	***0.00004***	***0.000014***	***0.00004***
Total HpCDF	0.0051	0	0	0	0
1234678 HpCDD	***0.0034***	***0.000034***	***0.0001***	***0.000034***	***0.0001***
Total HpCDD	***0.010***	0	0	0	0
OCDF	0.0033	0.0000033	0.0000096	0.00000033	0.00000096
OCDD	***0.031***	***0.000031***	***0.00009***	***0.000003***	***0.000009***

NB. Where results are less than the detection limit they have been reported in bold.

Table 10.9: Summary results from induction furnace sample 2 particulate and rinses

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	225	1,260,100	2,545,030
	Including half LOD values	225	1,260,100	2,545,030
	Including LOD values	225	1,260,100	2,545,030
Total I-TEQ	Excluding LOD values	7.30	40,805	82,413
	Including half LOD values	7.30	40,805	82,413
	Including LOD values	7.30	40,805	82,413
Total WHO-TEQ	Excluding LOD values	7.73	43,228	87,308
	Including half LOD values	7.73	43,228	87,308
	Including LOD values	7.73	43,228	87,308

Table 10.10: Results from induction furnace (individual congeners sample 2 particulate and rinses)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	1.076	0.1076	0.47	0.1076	0.47
Total TCDF	5.724	0	0	0	0
2378 TCDD	0.085	0.0847	0.37	0.0847	0.37
Total TCDD	0.458	0	0	0	0
12378 PeCDF	3.663	0.1832	0.8	0.1832	0.8
23478 PeCDF	5.724	2.8619	12.5	2.8619	12.5
Total PeCDF	48.080	0	0	0	0
12378 PeCDD	0.893	0.4465	1.95	0.8929	3.9
Total PeCDD	6.869	0	0	0	0
123478 HxCDF	11.906	1.1906	5.2	1.1906	5.2
123678 HxCDF	8.471	0.8471	3.7	0.8471	3.7
234678 HxCDF	7.784	0.7784	3.4	0.7784	3.4
123789 HxCDF	0.687	0.0687	0.3	0.0687	0.3
Total HxCDF	84.713	0	0	0	0
123478 HxCDD	1.030	0.1030	0.45	0.1030	0.45
123678 HxCDD	1.099	0.1099	0.48	0.1099	0.48
123789 HxCDD	1.282	0.1282	0.56	0.1282	0.56
Total HxCDD	12.135	0	0	0	0
1234678 HpCDF	27.474	0.2747	1.2	0.2747	1.2
1234789 HpCDF	4.808	0.0481	0.21	0.0481	0.21
Total HpCDF	43.501	0	0	0	0
1234678 HpCDD	4.808	0.0481	0.21	0.0481	0.21
Total HpCDD	9.158	0	0	0	0
OCDF	10.532	0.0105	0.046	0.0011	0.0046
OCDD	4.121	0.0041	0.018	0.0004	0.0018

NB. Where results are less than the detection limit they have been reported in bold.

Table 10.11: Summary results from induction furnace sample 2 gaseous (trap)

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	21.3	119,114	240,575
	Including half LOD values	21.3	119,178	240,705
	Including LOD values	21.3	119,242	240,834
Total I-TEQ	Excluding LOD values	0.594	3,322	6,710
	Including half LOD values	0.594	3,322	6,710
	Including LOD values	0.594	3,322	6,710
Total WHO-TEQ	Excluding LOD values	0.639	3,572	7,214
	Including half LOD values	0.639	3,572	7,214
	Including LOD values	0.639	3,572	7,214

Table 10.12: Results from induction furnace (individual congeners sample 2 gaseous (trap))

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.756	0.0756	0.33	0.0756	0.33
Total TCDF	4.579	0	0	0	0
2378 TCDD	0.055	0.0549	0.24	0.0549	0.24
Total TCDD	0.343	0	0	0	0
12378 PeCDF	0.710	0.0355	0.155	0.0355	0.155
23478 PeCDF	0.549	0.2747	1.2	0.2747	1.2
Total PeCDF	10.532	0	0	0	0
12378 PeCDD	0.089	0.0446	0.195	0.0893	0.39
Total PeCDD	0.847	0	0	0	0
123478 HxCDF	0.412	0.0412	0.18	0.0412	0.18
123678 HxCDF	0.366	0.0366	0.16	0.0366	0.16
234678 HxCDF	0.188	0.0188	0.082	0.0188	0.082
123789 HxCDF	0.014	0.0014	0.006	0.0014	0.006
Total HxCDF	4.121	0	0	0	0
123478 HxCDD	0.023	0.0023	0.01	0.0023	0.01
123678 HxCDD	0.025	0.0025	0.011	0.0025	0.011
123789 HxCDD	0.020	0.0020	0.0089	0.0020	0.0089
Total HxCDD	0.321	0	0	0	0
1234678 HpCDF	0.321	0.0032	0.014	0.0032	0.014
1234789 HpCDF	0.027	0.0003	0.0012	0.0003	0.0012
Total HpCDF	0.458	0	0	0	0
1234678 HpCDD	0.027	0.0003	0.0012	0.0003	0.0012
Total HpCDD	0.078	0	0	0	0
OCDF	0.017	0	0.000075	0	0.0000075
OCDD	***0.023***	***0.000023***	***0.0001***	***0.0000023***	***0.00046***

NB. Where results are less than the detection limit they have been reported in bold.

11 Site I

11.1 Introduction

Sampling was carried out at Site I on 21 March 2003. Samples were collected from the Pillar and Whiting stacks to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sample port was at least five diameters from a flow disturbance after the fan.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 21 March 2003, Pillar Stack: 11:32–14:33
  - Sample 2: 21 March 2003, Whiting Stack: 11:49–14:25
- Stack dimensions:
  - Whiting – 700 mm diameter circular duct.
  - Pillar – 400 mm x 400 mm metre rectangular duct.

11.2 Results

Table 11.1: Particulate emissions from pillar stack

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
Pillar stack	0.0007	0.2	0.002

Table 11.2: Particulate from whiting stack

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
Whiting stack	0.0004	0.1	0.001

Table 11.3: Average stack gas conditions at the pillar stack sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
<0.5	<0.5	21.6	1.4	21.8	3.5	3.2

Table 11.4: Average stack gas conditions at the whiting stack sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
<0.5	<0.5	23.4	2.0	17.4	6.7	6.0

Table 11.5: Results of isokinicity for pillar stack

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
Pillar stack	4.2261	4.1749	101%

Table 11.6: Results of isokinicity for whiting stack

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
Whiting stack	2.7826	2.8551	97%

All samples are within the required isokinicity range of 100 ± 10%.

Table 11.7: Average of combustion gas results (sampled during melting)

Stack	CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
Pillar	3	<25	0.3	20.9	3.2
Whiting	59	<25	13	20.8	<9

Table 11.8: Summary results from pillar stack

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.256	2931	5497
	Including half LOD values	0.269	3080	5777
	Including LOD values	0.282	3229	6057
Total I-TEQ	Excluding LOD values	0.00328	37.6	70.6
	Including half LOD values	0.00373	42.7	80.2
	Including LOD values	0.00417	47.8	89.7
Total WHO-TEQ	Excluding LOD values	0.00357	40.9	76.7
	Including half LOD values	0.00400	45.9	86.0
	Including LOD values	0.00443	50.8	95.3

Table 11.9: Summary results from whiting stack

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.357	7750	7786
	Including half LOD values	0.396	8609	8649
	Including LOD values	0.436	9469	9513
Total I-TEQ	Excluding LOD values	0.00652	142	142
	Including half LOD values	0.00760	165	166
	Including LOD values	0.00868	189	190
Total WHO-TEQ	Excluding LOD values	0.00652	142	142
	Including half LOD values	0.00793	172	173
	Including LOD values	0.00933	203	204

Table 11.10: Results from pillar stack (individual congeners)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.006	0.0006	0.00270	0.0006	0.0027
Total TCDF	0.104	0	0	0	0
2378 TCDD	***0.00047***	***0.00047***	***0.0020***	***0.00047***	***0.0020***
Total TCDD	0.009	0	0	0	0
12378 PeCDF	0.004	0.0002	0.0008	0.0002	0.0008
23478 PeCDF	0.003	0.0014	0.006	0.0014	0.006
Total PeCDF	0.071	0	0	0	0
12378 PeCDD	0.001	0.0003	0.0012	0.0006	0.0024
Total PeCDD	0.011	0	0	0	0
123478 HxCDF	0.003	0.0003	0.0011	0.0003	0.0011
123678 HxCDF	0.002	0.0002	0.00082	0.0002	0.00082
234678 HxCDF	0.002	0.0002	0.00073	0.0002	0.00073
123789 HxCDF	***0.00118***	***0.00012***	***0.00050***	***0.00012***	***0.00050***
Total HxCDF	0.024	0	0	0	0
123478 HxCDD	***0.00071***	***0.00007***	***0.00030***	***0.00007***	***0.00030***
123678 HxCDD	***0.00071***	***0.00007***	***0.00030***	***0.00007***	***0.00030***
123789 HxCDD	***0.00118***	***0.00012***	***0.00050***	***0.00012***	***0.00050***
Total HxCDD	0.012	0	0	0	
1234678 HpCDF	0.004	0.000045	0.00019	0.000045	0.00019
1234789 HpCDF	***0.00118***	***0.00001***	***0.000050***	***0.00001***	***0.000050***
Total HpCDF	0.007	0	0	0	0
1234678 HpCDD	0.008	0.0001	0.00033	0.0001	0.00033
Total HpCDD	0.017	0	0	0	0
OCDF	***0.00237***	***0***	***0.000010***	***0.00000***	***0.000010***
OCDD	***0.02366***	***0.00002***	***0.000100***	***0.00000***	***0.000100***

NB. Where results are less than the detection limit they have been reported in bold.

Table 11.11: Results from whiting stack (individual congeners)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.006	0.0006	0.0018	0.0006	0.0018
Total TCDF	0.061	0	0	0	0
2378 TCDD	***0.00072***	***0.00072***	***0.002***	***0.00072***	***0.002***
Total TCDD	0.008	0	0	0	0
12378 PeCDF	0.007	0.0003	0.00095	0.0003	0.00095
23478 PeCDF	0.007	0.0036	0.01	0.0036	0.01
Total PeCDF	0.111	0	0	0	0
12378 PeCDD	***0.00144***	***0.00072***	***0.002***	***0.00144***	***0.004***
Total PeCDD	0.023	0	0	0	0
123478 HxCDF	0.007	0.0007	0.002	0.0007	0.002
123678 HxCDF	0.005	0.0005	0.0015	0.0005	0.0015
234678 HxCDF	0.004	0.0004	0.0012	0.0004	0.0012
123789 HxCDF	***0.00180***	***0.00018***	***0.0005***	***0.00018***	***0.0005***
Total HxCDF	0.068	0	0	0	0
123478 HxCDD	***0.00144***	***0.00014***	***0.0004***	***0.00014***	***0.0004***
123678 HxCDD	***0.00144***	***0.00014***	***0.0004***	***0.00014***	***0.0004***
123789 HxCDD	***0.00144***	***0.00014***	***0.0004***	***0.00014***	***0.0004***
Total HxCDD	0.036	0	0	0	0
1234678 HpCDF	0.008	0.0001	0.00023	0.0001	0.00023
1234789 HpCDF	***0.00323***	***0.00003***	***0.00009***	***0.00003***	***0.00009***
Total HpCDF	0.010	0	0	0	0
1234678 HpCDD	0.017	0.0002	0.00047	0.0002	0.00047
Total HpCDD	0.040	0	0	0	0
OCDF	***0.00719***	***0.00001***	***0.00002***	***0.00000***	***0.00002***
OCDD	***0.07188***	***0.00007***	***0.0002***	***0.00001***	***0.0002***

NB. Where results are less than the detection limit they have been reported in bold.

12 Site J

12.1 Introduction

Sampling was carried out at Site J on 1 April 2003. Samples were collected from the induction furnace discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sample point was in a vertical section of duct at least five diameters from a disturbance to the flow.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 1 April 2003, 9:10–13:19
  - Sample 2: 1 April 2003, 14:16–18:16
- Stack dimensions: 0.702 metre diameter circular duct.

12.2 Results

Table 12.1: Particulate emissions from induction furnace

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0^oC, 1 Atm)	(kg/h)
1	0.0018	0.38	0.0079
2	0.0045	1.09	0.023
Average		0.74	0.015

Table 12.2: Average stack gas conditions at the induction furnace sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(^oC)	(%)	(m/s)	(m^3/s)	(m^3/s, 0^oC, 1 Atm, dry)
< 0.5	< 0.5	48	1.4	17.8	6.9	5.8

Table 12.3: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0^oC, 1 Atm, dry)	Calculated sample volume (m^3, 0^oC, 1 Atm, dry)	Isokinicity (%)
1	4.6801	4.6200	101
2	4.1430	4.2227	98

All samples are within the required isokinicity range of 100 ± 10%.

Table 12.4: Combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
1.4	<25	4.7	21.1	<9

Table 12.5: Summary results from gas melting furnace sample 1

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	2.2	45,217	19,815
	Including half LOD values	2.2	45,483	19,932
	Including LOD values	2.2	45,749	20,048
Total I-TEQ	Excluding LOD values	0.059	1220	535
	Including half LOD values	0.059	1225	537
	Including LOD values	0.059	1229	539
Total WHO-TEQ	Excluding LOD values	0.067	1388	608
	Including half LOD values	0.067	1393	610
	Including LOD values	0.067	1397	612

Table 12.6: Results from induction furnace (individual congeners sample 1)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0556	0.00556	0.026	0.00556	0.026
Total TCDF	0.449	0	0	0	0
2378 TCDD	0.00705	0.00705	0.033	0.00705	0.033
Total TCDD	0.0962	0	0	0	0
12378 PeCDF	0.0385	0.00192	0.009	0.00192	0.009
23478 PeCDF	0.0491	0.0246	0.115	0.0246	0.115
Total PeCDF	0.748	0	0	0	0
12378 PeCDD	0.0162	0.00812	0.038	0.0162	0.076
Total PeCDD	0.256	0	0	0	0
123478 HxCDF	0.0299	0.00299	0.014	0.00299	0.014
123678 HxCDF	0.0342	0.00342	0.016	0.00342	0.016
234678 HxCDF	0.0256	0.00256	0.012	0.00256	0.012
123789 HxCDF	***0.00427***	***0.00043***	***0.002***	***0.00043***	***0.002***
Total HxCDF	0.3846	0	0	0	0
123478 HxCDD	0.00556	0.000556	0.0026	0.000556	0.0026
123678 HxCDD	0.00855	0.000855	0.004	0.000855	0.004
123789 HxCDD	0.00726	0.000726	0.0034	0.000726	0.0034
Total HxCDD	0.160	0	0	0	0
1234678 HpCDF	0.0342	0.000342	0.0016	0.000342	0.0016
1234789 HpCDF	0.00299	0.0000299	0.00014	0.0000299	0.00014
Total HpCDF	0.0513	0	0	0	0
1234678 HpCDD	0.0154	0.000154	0.00072	0.000154	0.00072
Total HpCDD	0.0363	0	0	0	0
OCDF	***0.00427***	***0.00000427***	***0.00002***	***0.000000427***	***0.000002***
OCDD	***0.0214***	***0.0000214***	***0.0001***	***0.00000214***	***0.00001***

NB. Where results are less than the detection limit they have been reported in bold.

Table 12.7: Summary results from gas melting furnace sample 2

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.15	3121	1991
	Including half LOD values	0.17	3447	2199
	Including LOD values	0.18	3774	2408
Total I-TEQ	Excluding LOD values	0.0024	50.4	32.1
	Including half LOD values	0.0040	83.0	52.9
	Including LOD values	0.0056	116	73.7
Total WHO-TEQ	Excluding LOD values	0.0024	50.4	32.1
	Including half LOD values	0.0043	89.0	56.8
	Including LOD values	0.0061	128	81.4

Table 12.8: Results from induction furnace (individual congeners sample 2)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0123	0.00123	0.0051	0.00123	0.0051
Total TCDF	0.09172	0	0	0	0
2378 TCDD	***0.00145***	***0.00145***	***0.006***	***0.00145***	***0.006***
Total TCDD	0.00314	0	0	0	0
12378 PeCDF	0.00241	0.000121	0.0005	0.000121	0.0005
23478 PeCDF	0.00210	0.00105	0.00435	0.00105	0.00435
Total PeCDF	0.0362	0	0	0	0
12378 PeCDD	***0.00121***	***0.000603***	***0.0025***	***0.00121***	***0.005***
Total PeCDD	0.00434	0	0	0	0
123478 HxCDF	***0.00193***	***0.000193***	***0.0008***	***0.000193***	***0.0008***
123678 HxCDF	***0.00121***	***0.000121***	***0.0005***	***0.000121***	***0.0005***
234678 HxCDF	***0.00097***	***0.0000965***	***0.0004***	***0.0000965***	***0.0004***
123789 HxCDF	***0.00169***	***0.000169***	***0.0007***	***0.000169***	***0.0007***
Total HxCDF	0.00821	0	0	0	0
123478 HxCDD	***0.00145***	***0.000145***	***0.0006***	***0.000145***	***0.0006***
123678 HxCDD	***0.00145***	***0.000145***	***0.0006***	***0.000145***	***0.0006***
123789 HxCDD	***0.00121***	***0.000121***	***0.0005***	***0.000121***	***0.0005***
Total HxCDD	0.00410	0	0	0	0
1234678 HpCDF	0.00183	0.0000183	0.000076	0.0000183	0.000076
1234789 HpCDF	***0.00169***	***0.0000169***	***0.00007***	***0.0000169***	***0.00007***
Total HpCDF	0.00224	0	0	0	0
1234678 HpCDD	***0.00483***	***0.0000483***	***0.0002***	***0.0000483***	***0.0002***
Total HpCDD	0.00483	0	0	0	0
OCDF	***0.00241***	***0.00000241***	***0.00001***	***0.000000241***	***0.000001***
OCDD	***0.0241***	***0.0000241***	***0.0001***	***0.00000241***	***0.00001***

NB. Where results are less than the detection limit they have been reported in bold.

13 Site K

13.1 Introduction

Sampling was carried out at Site K on 2 and 3 April 2003. Samples were collected from the induction furnace discharge to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

The sampling point was in a vertical section of duct after the baghouse at least three diameters from any disturbance to the flow.

Details of the sampling date, times and stack dimensions are:

- Sample date and time:
  - Sample 1: 2 April 2003, 13:12–16:14
  - Sample 2: 3 April 2003, 11:16–15:16
- Stack dimensions: 0.775 x 0.25 metre rectangular duct.

13.2 Results

Table 13.1: Particulate emissions from induction furnace

Sample	Sample mass (g)	Particulate emissions	
		(mg/m^3, dry, 0°C, 1 Atm)	(kg/h)
1	<0.0023	<0.60	<0.00227
2	<0.0009	<0.19	<0.000631
Average		<0.40	<0.0015

Note: The sample mass was less than the detection limit.

Table 13.2: Average stack gas conditions at the induction furnace sampling point

CO_2		Temperature	Moisture	Velocity	Flow rate	
(%, wet)	(%, dry)	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
<0.5	<0.5	50.0	1.2	5.9	1.1	1.0

Table 13.3: Results of isokinicity for induction furnace

Sample	Actual sample volume (m^3, 0°C, 1 Atm, dry)	Calculated sample volume (m^3, 0°C, 1 Atm, dry)	Isokinicity (%)
1	3.8043	3.9191	97%
2	4.6741	4.5696	102%

All samples are within the required isokinicity range of 100 ± 10%.

Table 13.4: Combustion gas results

CO (mg/m^3)	SO_2 (mg/m^3)	NO (mg/m^3)	O_2 (%)	NO_2 (mg/m^3)
<11	<25	<12	21.1	<9

Table 13.5: Summary results from induction furnace sample 1

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.21	811	1230
	Including half LOD values	0.21	811	1230
	Including LOD values	0.21	811	1230
Total I-TEQ	Excluding LOD values	0.0079	29.9	45.3
	Including half LOD values	0.0079	29.9	45.3
	Including LOD values	0.0079	29.9	45.3
Total WHO-TEQ	Excluding LOD values	0.0093	35.2	53.4
	Including half LOD values	0.0093	35.2	53.4
	Including LOD values	0.0093	35.2	53.4

Table 13.6: Results from induction furnace (individual congeners sample 1)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0045	0.00045	0.0017	0.00045	0.0017
Total TCDF	0.063	0	0	0	0
2378 TCDD	0.0010	0.00100	0.0038	0.00100	0.0038
Total TCDD	0.0063	0	0	0	0
12378 PeCDF	0.0039	0.00020	0.00075	0.00020	0.00075
23478 PeCDF	0.0039	0.0020	0.0075	0.0020	0.0075
Total PeCDF	0.026	0	0	0	0
12378 PeCDD	0.0029	0.00145	0.0055	0.0029	0.011
Total PeCDD	0.0047	0	0	0	0
123478 HxCDF	0.0053	0.00053	0.002	0.00053	0.002
123678 HxCDF	0.0039	0.00039	0.0015	0.00039	0.0015
234678 HxCDF	0.0032	0.00032	0.0012	0.00032	0.0012
123789 HxCDF	0.0037	0.00037	0.0014	0.00037	0.0014
Total HxCDF	0.019	0	0	0	0
123478 HxCDD	0.0025	0.00025	0.00094	0.00025	0.00094
123678 HxCDD	0.0032	0.00032	0.0012	0.00032	0.0012
123789 HxCDD	0.00394	0.000394	0.0015	0.000394	0.0015
Total HxCDD	0.0139	0	0	0	0
1234678 HpCDF	0.0081	0.000081	0.00031	0.000081	0.00031
1234789 HpCDF	0.0042	0.000042	0.00016	0.000042	0.00016
Total HpCDF	0.0124	0	0	0	0
1234678 HpCDD	0.0103	0.000103	0.00039	0.000103	0.00039
Total HpCDD	0.019	0	0	0	0
OCDF	0.0103	0.0000103	0.000039	0.00000103	0.0000039
OCDD	0.039	0.000039	0.00015	0.000004	0.000015

Table 13.7: Summary results from induction furnace sample 2

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.081	269	399
	Including half LOD values	0.11	377	559
	Including LOD values	0.15	485	718
Total I-TEQ	Excluding LOD values	0.00045	1.50	2.22
	Including half LOD values	0.0012	3.93	5.82
	Including LOD values	0.0019	6.35	9.41
Total WHO-TEQ	Excluding LOD values	0.00045	1.50	2.22
	Including half LOD values	0.0013	4.39	6.50
	Including LOD values	0.0022	7.27	10.8

Table 13.8: Results from induction furnace (individual congeners sample 2)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.0013	0.00013	0.00061	0.00013	0.00061
Total TCDF	0.053	0	0	0	0
2378 TCDD	***0.0004***	***0.00043***	***0.002***	***0.00043***	***0.002***
Total TCDD	0.0043	0	0	0	0
12378 PeCDF	0.0006	0.00003	0.00015	0.00003	0.00015
23478 PeCDF	0.0005	0.0003	0.0012	0.0003	0.0012
Total PeCDF	0.015	0	0	0	0
12378 PeCDD	***0.0006***	***0.00032***	***0.0015***	***0.0006***	***0.003***
Total PeCDD	***0.0006***	0	0	0	0
123478 HxCDF	***0.0013***	***0.00013***	***0.0006***	***0.00013***	***0.0006***
123678 HxCDF	***0.0011***	***0.00011***	***0.0005***	***0.00011***	***0.0005***
234678 HxCDF	***0.0006***	***0.00006***	***0.0003***	***0.00006***	***0.0003***
123789 HxCDF	***0.0013***	***0.00013***	***0.0006***	***0.00013***	***0.0006***
Total HxCDF	0.004	0	0	0	0
123478 HxCDD	***0.0006***	***0.00006***	***0.0003***	***0.00006***	***0.0003***
123678 HxCDD	***0.0006***	***0.00006***	***0.0003***	***0.00006***	***0.0003***
123789 HxCDD	***0.00043***	***0.000043***	***0.0002***	***0.000043***	***0.0002***
Total HxCDD	***0.0021***	0	0	0	0
1234678 HpCDF	0.0032	0.000032	0.00015	0.000032	0.00015
1234789 HpCDF	***0.0021***	***0.000021***	***0.0001***	***0.000021***	***0.0001***
Total HpCDF	0.0036	0	0	0	0
1234678 HpCDD	***0.0043***	***0.000043***	***0.0002***	***0.000043***	***0.0002***
Total HpCDD	***0.013***	0	0	0	0
OCDF	***0.006***	***0.0000064***	***0.00003***	***0.00000064***	***0.000003***
OCDD	***0.043***	***0.000043***	***0.0002***	***0.000004***	***0.00002***

NB. Where results are less than the detection limit they have been reported in bold.

14 Site L

14.1 Introduction

Sampling was carried during May 2003. Samples were collected from the foundry to determine the concentration and mass emission of PCDD and PCDF present in the gases discharged to the atmosphere.

Two Ambient, PS-1 PUF sampler pumps were placed on the foundry floor as per Figure 4. One sampling pump was located next to the furnace, and the other was positioned opposite the smelter in the casting area. Two fan driven vents were located on the roof above the foundry.

Sample dates and times are provided in Table 14.1. Duct dimension were a 750 mm x 750 mm square duct.

Figure 4: Location of PUF samplers

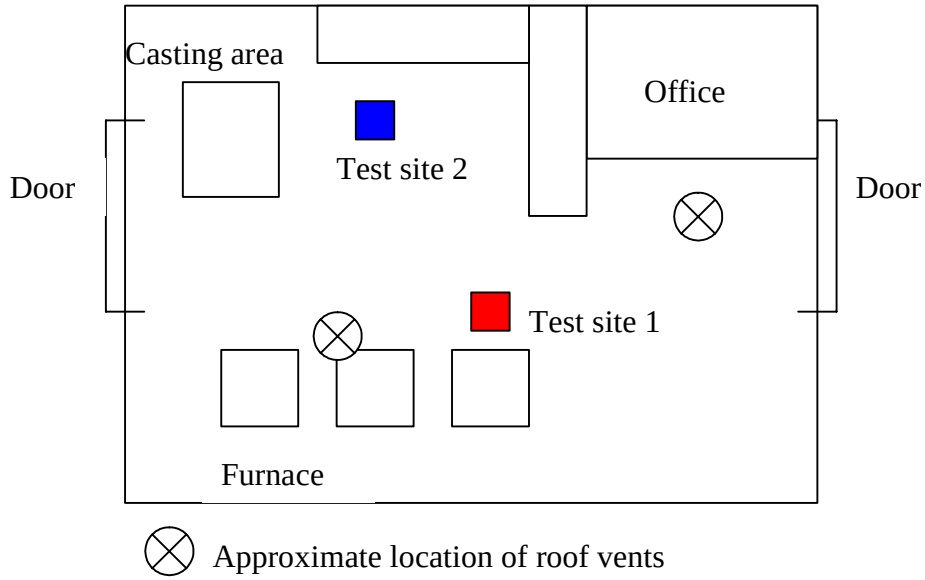


Table 14.1: Dioxin and furan sample dates and times

Sample	1 (ferrous metal)	2 (non-ferrous metal)
7 May 2003	8:51–15:37	
8 May 2003	8:30–15:30	
9 May 2003	7:30–9:30	
21 May 2003		13:10–15:15
22 May 2003		7:30–11:30

14.2 Results

The lab reported that the filters for the non-ferrous metal samples were ripped and the particulate weight gain for these filters was unable to be reported.

Table 14.2: Foundry workplace particulate emissions (ferrous metal)

Site	Sample mass (g)	Particulate emissions (mg/m^3)
Furnace	0.3668	0.83
Casting	0.4247	0.28
Average		0.56

Table 14.3: Gas conditions at vent 1

	Temperature	Moisture	Velocity	Flow rate	
	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
Doors open					
Above fan	20.0	1.0	10.8	6.1	7.5
Below fan	20.0	1.0	7.3	4.1	3.8
1 door open 1 closed					
Above fan	20.0	1.0	10.9	6.1	5.6
Below fan	20.0	1.0	7.0	3.9	3.6
Doors closed					
Above fan	20.0	1.0	10.9	6.1	5.6
Below fan	20.0	1.0	7.1	4.0	3.7

Table 14.4: Gas conditions at vent 2

	Temperature	Moisture	Velocity	Flow rate	
	(°C)	(%)	(m/s)	(m^3/s)	(m^3/s, 0°C, 1 Atm, dry)
Doors open					
Above fan	20.0	1.0	10.9	6.1	5.7
Below fan	20.0	1.0	6.6	3.7	3.4
1 door open 1 closed					
Above fan	20.0	1.0	11.2	6.3	5.8
Below fan	20.0	1.0	7.2	4.0	3.7
Doors closed					
Above fan	20.0	1.0	10.8	6.1	5.6
Below fan	20.0	1.0	6.8	3.8	3.5

Table 14.5: Summary results from sample 1 ferrous (furnace)

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0032	64.83	475
	Including half LOD values	0.0032	64.83	475
	Including LOD values	0.0032	64.83	475
Total I-TEQ	Excluding LOD values	0.000060	1.21	8.9
	Including half LOD values	0.000076	1.34	9.8
	Including LOD values	0.000072	1.46	10.7
Total WHO-TEQ	Excluding LOD values	0.000064	1.28	9.4
	Including half LOD values	0.000070	1.41	10.3
	Including LOD values	0.000076	1.53	11.2

Table 14.6: Results from sample 1 ferrous furnace (individual congeners filter and trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3, 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.000042	0.0000042	0.0020	0.0000042	0.0020
Total TCDF	0.00055	0	0	0	0
2378 TCDD	***0.000011***	***0.000011***	***0***	***0.00011***	***0.000***
Total TCDD	0.000047	0	0	0	0
12378 PeCDF	0.000036	0.0000018	0.00085	0.0000018	0.00085
23478 PeCDF	0.000053	0.000027	0.013	0.000027	0.013
Total PeCDF	0.00081	0	0	0	0
12378 PeCDD	0.0000074	0.0000037	0.0018	0.0000074	0.0035
Total PeCDD	0.00016	0	0	0	0
123478 HxCDF	0.000072	0.0000072	0.0034	0.0000072	0.0034
123678 HxCDF	0.000051	0.0000051	0.0024	0.0000051	0.0024
234678 HxCDF	0.000053	0.0000053	0.0025	0.0000053	0.0025
123789 HxCDF	***0.0000085***	***0.00000085***	***0***	***0.00000085***	***0***
Total HxCDF	0.00066	0	0	0	0
123478 HxCDD	***0.0000064***	***0.00000064***	***0***	***0.00000064***	***0***
123678 HxCDD	0.000013	0.0000013	0.00059	0.00000013	0.00059
123789 HxCDD	0.000013	0.0000013	0.00063	0.00000013	0.00063
Total HxCDD	0.00020	0	0	0	0
1234678 HpCDF	0.00023	0.0000023	0.0011	0.0000023	0.0011
1234789 HpCDF	0.000025	0.00000025	0.00012	0.00000025	0.00012
Total HpCDF	0.00032		0	0	0
1234678 HpCDD	0.000081	0.00000081	0.00038	0.0000008	0.00038
Total HpCDD	0.00016	0	0	0	0
OCDF	0.00010	0.00000010	0.000049	0.000000010	0.0000049
OCDD	0.00021	0.00000021	0.00010	0.000000021	0.000010

NB. Where results are less than the detection limit they have been reported in bold.

Table 14.7: Summary results from sample 1 ferrous casting

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.00090	18.2	730
	Including half LOD values	0.0010	19.5	740
	Including LOD values	0.0010	20.7	149
Total I-TEQ	Excluding LOD values	0.000016	0.329	2.36
	Including half LOD values	0.000020	0.397	2.85
	Including LOD values	0.000023	0.466	3.34
Total WHO-TEQ	Excluding LOD values	0.000017	0.348	2.50
	Including half LOD values	0.000021	0.416	2.98
	Including LOD values	0.000024	0.483	3.47

Table 14.8: Results from ferrous sample 1: casting (individual congeners filter and trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3, 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.000015	0.0000015	0.0024	0.0000015	0.0024
Total TCDF	0.00019	0	0	0.	0
2378 TCDD	***0.0000051***	***0.0000051***	***0.00800***	***0.0000051***	***0.008***
Total TCDD	0.000018	0	0	0	0
12378 PeCDF	0.000011	0.00000054	0.00085	0.00000054	0.00085
23478 PeCDF	0.000015	0.0000076	0.012	0.0000076	0.012
Total PeCDF	0.00026	0	0	0	0
12378 PeCDD	0.0000020	0.0000010	0.0016	0.0000020	0.0032
Total PeCDD	0.00005	0	0	0	0
123478 HxCDF	0.000018	0.0000018	0.0029	0.0000018	0.0029
123678 HxCDF	0.000013	0.0000013	0.0020	0.0000013	0.002
234678 HxCDF	0.000015	0.0000015	0.0024	0.0000015	0.0024
123789 HxCDF	***0.0000038***	***0.00000038***	***0.0006***	***0.00000038***	***0.0006***
Total HxCDF	0.00015	0	0	0	0
123478 HxCDD	***0.0000019***	***0.00000019***	***0.0003***	***0.00000019***	***0.0003***
123678 HxCDD	***0.0000045***	***0.00000045***	***0.0007***	***0.00000045***	***0.0007***
123789 HxCDD	***0.0000057***	***0.00000057***	***0.0009***	***0.00000057***	***0.0009***
Total HxCDD	0.000062	0	0	0	0
1234678 HpCDF	0.000062	0.00000062	0.00097	0.00000062	0.0009
1234789 HpCDF	0.0000076	0.000000076	0.00012	0.000000076	0.0001
Total HpCDF	0.000089	0	0	0	0
1234678 HpCDD	0.000022	0.00000022	0.00034	0.00000022	0.0003
Total HpCDD	0.000046	0	0	0	0
OCDF	0.000031	0.000000031	0.000048	0.0000000031	0.0000048
OCDD	***0.00013***	***0.00000013***	***0.0002***	***0.000000013***	***0.00002***

NB. Where results are less than the detection limit they have been reported in bold.

Table 14.9: Summary results from sample 2 non-ferrous furnace (trap)

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0021	42.4	458
	Including half LOD values	0.0028	56.9	615
	Including LOD values	0.0035	71.4	772
Total I-TEQ	Excluding LOD values	0.000012	0.237	2.56
	Including half LOD values	0.000029	0.584	6.31
	Including LOD values	0.000046	0.93	10.1
Total WHO-TEQ	Excluding LOD values	0.000012	0.237	2.56
	Including half LOD values	0.000031	0.631	6.82
	Including LOD values	0.000051	1.02	11.1

Table 14.10: Results from sample 2 non-ferrous furnace (individual congeners trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3, 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.000020	0.0000020	0.00034	0.0000020	0.00034
Total TCDF	0.00069	0	0	0	0
2378 TCDD	***0.000017***	***0.000017***	***0.003***	***0.000017***	***0.003***
Total TCDD	0.00051	0	0	0	0
12378 PeCDF	***0.000012***	***0.00000058***	***0.0001***	***0.00000058***	***0.0001***
23478 PeCDF	0.000020	0.000010	0.0017	0.000010	0.0017
Total PeCDF	0.00035	0	0	0	0
12378 PeCDD	***0.000012***	***0.0000058***	***0.001***	***0.000012***	***0.00200***
Total PeCDD	0.00037	0	0	0	0
123478 HxCDF	***0.000023***	***0.0000023***	***0.0004***	***0.0000023***	***0.0004***
123678 HxCDF	***0.0000058***	***0.00000058***	***0.0001***	***0.00000058***	***0.0001***
234678 HxCDF	***0.0000058***	***0.00000058***	***0.0001***	***0.00000058***	***0.0001***
123789 HxCDF	***0.000012***	***0.0000012***	***0.0002***	***0.0000012***	***0.0002***
Total HxCDF	0.000092	0	0	0	0
123478 HxCDD	***0.000012***	***0.0000012***	***0.0002***	***0.0000012***	***0.0002***
123678 HxCDD	***0.000012***	***0.0000012***	***0.0002***	***0.0000012***	***0.0002***
123789 HxCDD	***0.000012***	***0.0000012***	***0.0002***	***0.0000012***	***0.0002***
Total HxCDD	0.000049	0	0	0	0
1234678 HpCDF	***0.000029***	***0.00000029***	***0.00005***	***0.00000029***	***0.00005***
1234789 HpCDF	***0.000012***	***0.00000012***	***0.00002***	***0.00000012***	***0.00002***
Total HpCDF	0.000033	0	0	0	0
1234678 HpCDD	***0.00012***	***0.0000012***	***0.0002***	***0.0000012***	***0.0002***
Total HpCDD	***0.00023***	***0***	***0***	***0***	***0***
OCDF	***0.000058***	***0.000000058***	***0.00001***	***0.000000006***	***0.000001***
OCDD	***0.0012***	***0.0000012***	***0.0002***	***0.00000012***	***0.00002***

NB. Where results are less than the detection limit they have been reported in bold.

Table 14.11: Summary results from sample 2 non-ferrous furnace (filter)

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0304	613	6624
	Including half LOD values	0.0304	613	6624
	Including LOD values	0.0304	613	6624
Total I-TEQ	Excluding LOD values	0.00076	15.4	166
	Including half LOD values	0.00077	15.6	169
	Including LOD values	0.00079	15.8	171
Total WHO-TEQ	Excluding LOD values	0.00080	16.0	173
	Including half LOD values	0.00081	16.3	176
	Including LOD values	0.00082	16.5	178

Table 14.12: Results from sample 2 non-ferrous furnace (individual congeners filter)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3, 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.00016	0.000016	0.0027	0.000016	0.0027
Total TCDF	0.0036	0	0	0	0
2378 TCDD	***0.000017***	***0.000017***	***0.003***	***0.000017***	***0.0030***
Total TCDD	0.00022	0	0	0	0
12378 PeCDF	0.00030	0.000015	0.0026	0.000015	0.0026
23478 PeCDF	0.00075	0.00037	0.065	0.00037	0.065
Total PeCDF	0.0092	0	0	0	0
12378 PeCDD	0.000069	0.000035	0.006	0.000069	0.012
Total PeCDD	0.00081	0	0	0	0
123478 HxCDF	0.00092	0.000092	0.016	0.000092	0.016
123678 HxCDF	0.00069	0.000069	0.012	0.000069	0.012
234678 HxCDF	0.0010	0.00010	0.018	0.00010	0.018
123789 HxCDF	***0.00006***	***0.0000058***	***0.001***	***0.0000058***	***0.0010***
Total HxCDF	0.0092	0	0	0	0
123478 HxCDD	0.000069	0.0000069	0.0012	0.0000069	0.0012
123678 HxCDD	0.000092	0.0000092	0.0016	0.0000092	0.0016
123789 HxCDD	0.000069	0.0000069	0.0012	0.0000069	0.0012
Total HxCDD	0.0011	0	0	0	0
1234678 HpCDF	0.0025	0.000025	0.0044	0.000025	0.0044
1234789 HpCDF	0.00027	0.0000027	0.00047	0.0000027	0.00047
Total HpCDF	0.0036	0	0	0	0
1234678 HpCDD	0.00058	0.0000058	0.0010	0.0000058	0.0010
Total HpCDD	0.0012	0	0	0	0
OCDF	0.00069	0.00000069	0.00012	0.000000069	0.000012
OCDD	0.00086	0.00000086	0.00015	0.000000086	0.000015

NB. Where results are less than the detection limit they have been reported in bold.

Table 14.13: Summary results from sample 2: casting

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0083	168	1510
	Including half LOD values	0.0083	168	1510
	Including LOD values	0.0083	168	1510
Total I-TEQ	Excluding LOD values	0.00019	3.82	34.4
	Including half LOD values	0.00019	3.90	35.1
	Including LOD values	0.00020	3.98	35.8
Total WHO-TEQ	Excluding LOD values	0.00020	4.00	36.0
	Including half LOD values	0.00020	4.08	36.7
	Including LOD values	0.00021	4.15	37.4

Table 14.14: Results from sample 2 non-ferrous casting (individual congeners filter and trap)

	Concentration	I-TEQ		WHO-TEQ	
	(ng/m^3, 0ºC 1 Atm dry)	(ng/m^3, 0ºC 1 Atm dry)	(ng)	(ng/m^3, 0ºC 1 Atm dry)	(ng)
2378 TCDF	0.000050	0.0000050	0.0025	0.0000050	0.0025
Total TCDF	0.0010	0	0	0	0
2378 TCDD	***0.0000060***	***0.0000060***	***0.0030***	***0.0000060***	***0.0030***
Total TCDD	0.00015	0	0	0	0
12378 PeCDF	0.000092	0.0000046	0.0023	0.0000046	0.0023
23478 PeCDF	0.00018	0.000091	0.046	0.000091	0.046
Total PeCDF	0.0024	0	0	0	0
12378 PeCDD	0.000019	0.0000093	0.0047	0.000019	0.0093
Total PeCDD	0.00038	0	0	0	0
123478 HxCDF	0.00024	0.000024	0.012	0.000024	0.012
123678 HxCDF	0.00016	0.000016	0.0081	0.000016	0.0081
234678 HxCDF	0.00024	0.000024	0.012	0.000024	0.012
123789 HxCDF	***0.000016***	***0.0000016***	***0.00080***	***0.0000016***	***0.0008***
Total HxCDF	0.0022	0	0	0	0
123478 HxCDD	0.000014	0.0000014	0.00072	0.0000014	0.00072
123678 HxCDD	0.000020	0.0000020	0.001	0.0000020	0.001
123789 HxCDD	0.000020	0.0000020	0.001	0.0000020	0.001
Total HxCDD	0.00032	0	0	0	0
1234678 HpCDF	0.00064	0.0000064	0.0032	0.0000064	0.0032
1234789 HpCDF	0.000074	0.00000074	0.00037	0.00000074	0.00037
Total HpCDF	0.00092	0	0	0	0
1234678 HpCDD	0.00017	0.0000017	0.00084	0.0000017	0.00084
Total HpCDD	0.00034	0	0	0	0
OCDF	0.00022	0.00000022	0.00011	0.000000022	0.000011
OCDD	0.00034	0.00000034	0.00017	0.000000034	0.000017

NB. Where results are less than the detection limit they have been reported in bold.

The following two tables the concentrations for samples from casting and furnace were averaged. A flow rate of 15 m^3/s was used to calculate out the resulting information.

Table 14.15: Average ferrous samples casting and furnace

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.00143	57.8	424
	Including half LOD values	0.00148	59.8	438
	Including LOD values	0.00153	61.8	453
Total I-TEQ	Excluding LOD values	0.0000317	1.28	9.4
	Including half LOD values	0.0000357	1.44	10.5
	Including LOD values	0.0000397	1.60	11.7
Total WHO-TEQ	Excluding LOD values	0.0000331	1.34	9.8
	Including half LOD values	0.0000371	1.50	11.0
	Including LOD values	0.0000411	1.66	12.1

Table 14.16: Average non-ferrous samples casting and furnace

		Concentration (ng/m^3)	Emission (ng/hr)	Emission (ng/tonne)
Sum of PCDD and PCDF congeners	Excluding LOD values	0.0146	587	6348
	Including half LOD values	0.0148	595	430
	Including LOD values	0.0149	602	511
Total I-TEQ	Excluding LOD values	0.000352	14.2	154
	Including half LOD values	0.000363	14.6	158
	Including LOD values	0.000373	15.0	162
Total WHO-TEQ	Excluding LOD values	0.000367	14.8	160
	Including half LOD values	0.000378	15.3	165
	Including LOD values	0.000389	15.7	170

Appendix A: Laboratory Certificates for Particulate Matter and PCDD and PCDF Analyses [1]

[1] Certificates not reproduced in the electronic version of this report but can be made available on request.