NWG ENVIRONMENTAL SOLUTIONS

1181

Report for the Periodic Monitoring of Emissions to Air

Permit Number: BR96851X
Dow Corning Ltd
Barry Plant
22-May-2017
Dioxin & Furan Retest 3

Part 1: Executive Summary

Contract Reference:	Dow_Corn-03811
Client:	Dow Corning
Client Address:	Cardiff Road, Barry South Glamorgan, CF63 2YL
Site Contact:	Andrew Martin
Site Address:	Cardiff Road, Barry South Glamorgan, CF63 2YL
Monitoring Organisation:	NWG Environmental Solutions Unit 40 Court Road Industrial Estate Cwmbran, Torfaen. NP44 3AS Telephone: (01633) 862 950 Fax: (01633) 865 087 www.nwg-solutions.co.uk.

This report relates to tested items only
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Report written by	Dale Padfiled	Date:	29/06/2017
Designation	Air Quality Test Engineer		
Report Approved by	Darren Price	Date:	29/06/2017
Designation	Air Quality Senior Project Manager		
MCERTS Registration Number	MM03 176		
MCERTS Certification Level	Level 2	T.E.s Held	1, 2, 3 & 4

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1.1 Monitoring Objectives

The scope of work shown in the table below was required to demonstrate emission concentrations.

Location	Determinand	Number of Sampling Runs	Duration of Sampling Run
ERU	Dioxins & Furans	One plus Blank	4 Hours
	Oxygen	One (Continuous monitoring)	4 Hours

1.2 Monitoring Results

Job Type	Monitoring emissions to atmosphere
Company	Dow Corning
Site	Barry
Location	ERU Stack
Process Status During Monitoring	Operating as Normal
Reference Conditions	273k, 101.3 kPa, Without correction for moisture or oxygen

Determinand	Run	Units	Emission Limit Value	Date of Sampling	Start and End Times	Periodic Monitoring Result	Uncertainty (±)	Vol. Flow (Nm^3/min)	Moisture ($\%H_2O$)	Monitoring Method Reference	Accreditation for use of Method
Dioxins and Furans	1	ITEQ(1)ng/Nm^3	0.1	22-May-17	12:18-16:18	0.016	0.0019	141	15.4	BS EN 1948	MCERTS
		ITEQ(2)ng/Nm^3				0.016					
	Blank	ITEQ(1)ng/Nm^3			11:00-11:05	0.0000010	0.00071	-	-		
		ITEQ(2)ng/Nm^3				0.0010					
Oxygen	1	%	N/A	22-May-17	12:18-16:18	7.1	-	-	-	BS EN 14789	MCERTS

Note 1 ITEQ (1) values assume that dioxin and furan none detects as a zero value and ITEQ (2) values assume that dioxin and furan none detects are at limit of detection

Uncertainties expressed at 95% confidence level

Where the periodic monitoring result is shown as a "<" value, the uncertainty is calculated at the limit of detection.

1.3 Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results			
						Substance	CEMS Results	Periodic Monitoring Results	Units
ERU	22-May-17	Energy Recovery Unit	Continuous	Scrubber	Dependant on other plant processes.	No CEMs installed			

1.4 Monitoring Deviations

Emission Point Reference	Substance	Substance Deviations	Monitoring Deviations	Other Relevant Issues
ERU	Dioxins & Furans	None	Due to an obstruction on the sampling platform, only one sample port is available for the velocity traverse and sampling.	None
	Oxygen	None	Due to an obstruction on the sampling platform, only one sample port is available for the velocity traverse.	

Appendix 1: General Information

Monitoring Organisation Staff Details

Monitoring Organisation Method Details

Monitoring Organisation Equipment Checklist Reference

Manual Monitoring Method Results Calculations

2.1.1 Monitoring organisation staff details

Name	Position	MCERTS Level	TE1	TE2	TE3	TE4	MCERTS registration No.
Sampling Team							
Darren Price	Senior Air Quality Project Manager	II	✔	✔	✔	✔	MM03 176
Dale Padfield	Air Quality Technician	II	✔	✔	✔	✔	MM13 1224
Report Writing							
Dale Padfield	Air Quality Technician	II	✔	✔	✔	✔	MM13 1224
Report Authorisation							
Darren Price	Senior Air Quality Project Manager	II	✔	✔	✔	✔	MM03 176

2.1.2 Monitoring organisation method details

Determinand	In House Method ID	Reference Standard	Analytical Laboratory
Dioxins & Furans	A47	BS EN 1948	NWG SS
Oxygen	A44	BS EN 14789	N/A

2.1.3 Monitoring organisation equipment check list references

Equipment Checklist Ref: DOW_CORN-03811, May 2017

Appendix 2: Stack - ERU

Diagrams

Flow Criteria Measurements

Extractive Results Sheets

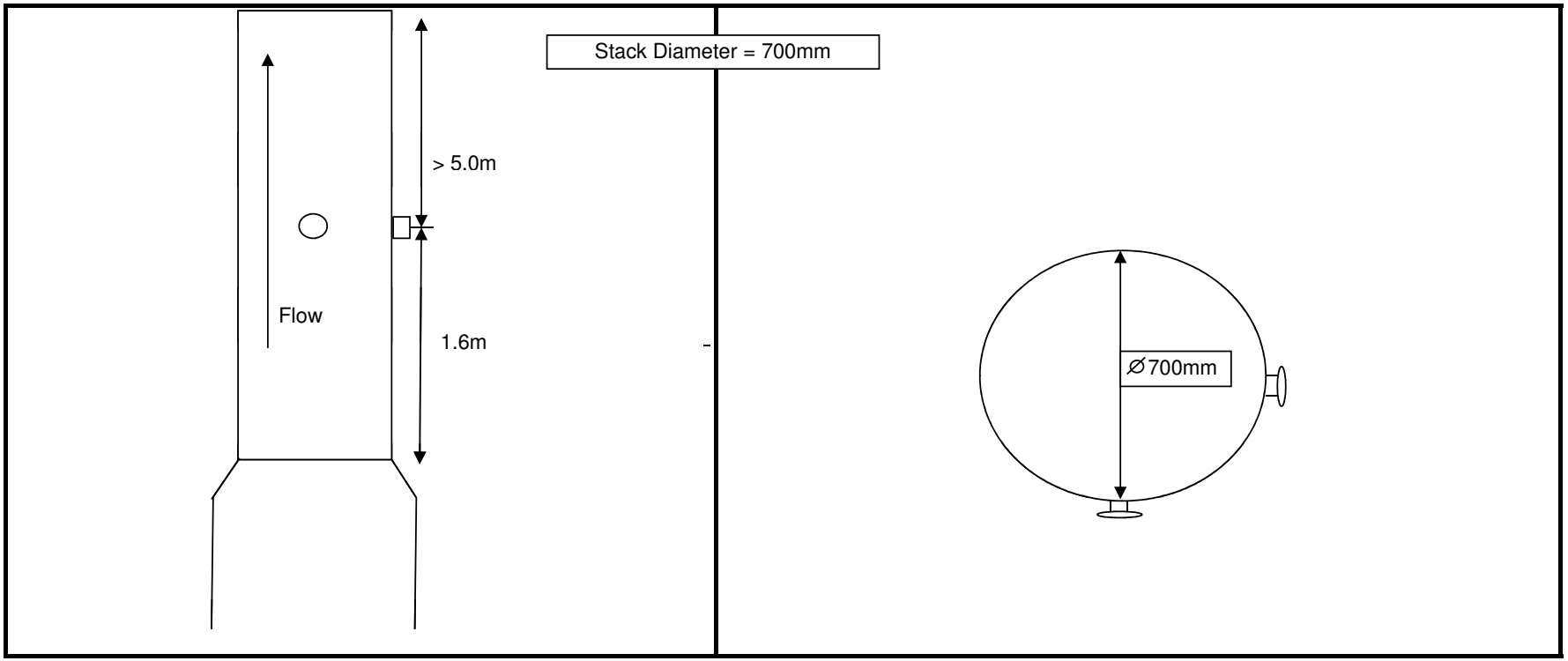
Instrumental Gas Analyser Calibration Tables

Instrumental Gas Analyser Results Tables

Analytical Results

Permit Number	Operator Name	Installation Name	Installation Address
BR96851X	Dow Corning Ltd	Barry	Cardiff Road, Barry, Vale of Glamorgan, CF63 2YL

ERU



NWG ENVIRONMENTAL SOLUTIONS

Page	of	Job No.	3811	Date:	22/05/2017	Operators	D Padfield, D Price	A70 - ISO 16911-1 Traverse Sheet

Client	Dow Corning	Probe ID	3179
Plant	Barry	Pitot ID	3179
Stack	ERU	Pitot type	S
Diameter	700 mm	Pitot Cp	0.84
Port Length	80 mm	Barometer	1378
Bar. Pressure (kPa)	102.1	T/C ID	1125
Ambient Temp.	14	Meter ID	2526

Pitot checks			
Pyhsical checks		ok	
Leak Checks			
	0 mins	15s / 5m	
Side A	0.9	0.9	
Side B	0.8	0.8	
Pass/Fail	Pass	Pass	

Gas Composition in Stack		
O_2	7	% wet
CO_2	0	% wet
H_2O	5	% wet
If unknown:		
Combustion use 10, 10, 5		
Non-comb. use 20.9, 0, 0		

Static Pressure		
Side A	0.6	cmH_2O
Side B	0.6	cmH_2O
Pass/Fail	PASS	
Average	0.6	
Minimum Velocity	49	
Velocity Variation	1.2	
Use 1 Probe		

Repeatability of velocity @ single point					
Mins	1	2	3	4	5
cm H_2O	0.60	0.60	0.60	0.60	0.60
Pa	58.8	58.8	58.8	58.8	58.8
m/s	8.90	8.90	8.90	8.90	8.90
Average velocity	8.90	Std Dev as % of average			
Std Dev velocity	0	0.00			

Port 1

Point - mm	Temp (℃)	Δp (cmH_2O) 1	2	3	Ave	Pa	Angle	v_{meas}	v_c
102	52	0.50	0.50	0.50	0.50	49	0.0	8.12	8.12
598	53	0.60	0.60	0.60	0.60	58.8	0.0	8.90	8.90
NA									
NA									
NA									
NA									
NA									
NA									
NA									
NA									
Averages	52.5				0.55	53.90		8.5	8.5
Std Dev					0.071	6.93			

Port 2

Point - mm	Temp (℃)	Δp (cmH_2O) 1	2	3	Ave	Pa	Angle	v_{meas}	v_c
102									
598									
NA									
NA									
NA									
NA									
NA									
NA									
NA									
NA									
NA									

Only One Port Available

Signed	D Padfield, D Price	A		NTA

CLIENT:	**Dow Corning**	**SAMPLE DATE:**	**22-May-17**
		BLANK DATE:	**22-May-17**
LOCATION:	**Barry**		
		TIME OF SAMPLING:	**12:18-16:18**
STACK:	**ERU**	**TIME OF BLANK:**	**11:00-11:05**

SAMPLING DATA		**Reference Conditions**			**Dioxins and Furans Run 1**
Run Time (min)	**240**	**Temperature (K)**	**273**	**Emission Limit Value (ng/Nm3)**	**0.1**
Total mass H_2O collected (g)	**365.7**	**Pressure (kPa)**	**101.3**	**As a wet gas**	
Pitot tube constant,Cp	**0.84**				
Dry gas meter (DGM) volume (litres)	**2773.3**	**Flow Data**			
Temperature DGM (°C)	**29**	**Velocity, actual (m/s)**	**7.4**		
Temperature stack (°C)	**55**	**Velocity, ntp (m/s)**	**6.1**		
Mean pitot tube pressure drop (traverse), delta P(cm H_2O)	**0.55**	**Vol.Flow, actual (m^3/min)**	**170**		
Mean pitot tube pressure drop at sample point (traverse), delta P(cm H_2O)	**0.42**	**Vol.Flow, ntp wet gas**	**141**		
Mean pitot tube pressure drop(sample run) , delta P(cm H_2O)	**0.42**				
Mean orifice pressure drop,delta H(cm H_2O)	**0.88**	**Volume sampled, ntp, dry gas (Nm^3)**	**2.5**		
Barometric Pressure (kPa)	**101.2**	**Volume sampled, ntp, wet gas (Nm^3)**	**3.0**		
X-sectional area of stack (m^2)	**0.38**				
Nozzle Size (cm)	**0.62**	**Correction Data**			
% Isokinetic	**113**	**O_2(% vol)dry**	**7.1**		
Field Blank concentration (ng/Nm3 ITEQ 2)	**0.00104** **As a % of ELV** **1.04**	**H_2O (% vol)**	**15.4**		

Analytical Data (pg TEQ collected)	**Sample Run**								**Blank Run**							
	ITEQ (1)	**ITEQ (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**ITEQ (1)**	**ITEQ (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**
	NATO	**NATO**	**Humans/Mammals**	**Humans/Mammals**	**Birds**	**Birds**	**Fish**	**Fish**	**NATO**	**NATO**	**Humans/Mammals**	**Humans/Mammals**	**Birds**	**Birds**	**Fish**	**Fish**
2,3,7,8-TCDF	**2.10**	**2.10**	**2.10**	**2.10**	**21.0**	**21.0**	**1.051**	**1.05**	**ND**	**0.0571**	**ND**	**0.0571**	**ND**	**0.571**	**ND**	**0.02855**
2,3,7,8-TCDD	**ND**	**1.54**	**ND**	**1.54**	**ND**	**1.54**	**ND**	**1.54**	**ND**	**0.71**	**ND**	**0.71**	**ND**	**0.71**	**ND**	**0.71**
1,2,3,7,8-PeCDF	**2.41**	**2.41**	**1.44**	**1.44**	**4.81**	**4.81**	**2.41**	**2.41**	**ND**	**0.04875**	**ND**	**0.02925**	**ND**	**0.0975**	**ND**	**0.04875**
2,3,4,7,8-PeCDF	**18.3**	**18.3**	**11.0**	**11.0**	**36.7**	**36.7**	**18.3**	**18.3**	**ND**	**0.4775**	**ND**	**0.2865**	**ND**	**0.955**	**ND**	**0.4775**
1,2,3,7,8-PeCDD	**7.0**	**7.0**	**14.0**	**14.0**	**14.0**	**14.0**	**14.0**	**14.0**	**ND**	**0.562**	**ND**	**1.124**	**ND**	**1.124**	**ND**	**1.124**
1,2,3,4,7,8-HxCDF	**6.0**	**6.02**	**6.0**	**6.02**	**6.0**	**6.02**	**6.0**	**6.02**	**ND**	**0.2483**	**ND**	**0.2483**	**ND**	**0.2483**	**ND**	**0.2483**
1,2,3,6,7,8-HxCDF	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**2.57**	**ND**	**0.2216**	**ND**	**0.2216**	**ND**	**0.2216**	**ND**	**0.2216**
2,3,4,6,7,8-HxCDF	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**1.49**	**ND**	**0.2484**	**ND**	**0.2484**	**ND**	**0.2484**	**ND**	**0.2484**
1,2,3,7,8,9-HxCDF	**0.9**	**0.95**	**0.9**	**0.95**	**0.9**	**0.95**	**0.9**	**0.95**	**ND**	**0.2522**	**ND**	**0.2522**	**ND**	**0.2522**	**ND**	**0.2522**
1,2,3,4,7,8-HxCDD	**0.6**	**0.64**	**0.6**	**0.64**	**0.3**	**0.32**	**3.2**	**3.2**	**ND**	**0.073**	**ND**	**0.073**	**ND**	**0.0365**	**ND**	**0.365**
1,2,3,6,7,8-HxCDD	**2.1**	**2.1**	**2.1**	**2.1**	**0.21**	**0.21**	**0.21**	**0.21**	**ND**	**0.088**	**ND**	**0.088**	**ND**	**0.0088**	**ND**	**0.0088**
1,2,3,7,8,9-HxCDD	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**	**0.119**	**0.119**	**ND**	**0.08**	**ND**	**0.08**	**ND**	**0.08**	**ND**	**0.008**
1,2,3,4,6,7,8-HpCDF	**0.44**	**0.44**	**0.44**	**0.44**	**0.44**	**0.44**	**0.44**	**0.44**	**ND**	**0.00157**	**ND**	**0.00157**	**ND**	**0.00157**	**ND**	**0.00157**
1,2,3,4,7,8,9-HpCDF	**0.1**	**0.125**	**0.1**	**0.125**	**0.1**	**0.125**	**0.1**	**0.125**	**ND**	**0.00175**	**ND**	**0.00175**	**ND**	**0.00175**	**ND**	**0.00175**
1,2,3,4,6,7,8-HpCDD	**0.55**	**0.55**	**0.55**	**0.55**	**0.055**	**0.055**	**0.055**	**0.055**	**ND**	**0.01145**	**ND**	**0.01145**	**ND**	**0.001145**	**ND**	**0.001145**
OCDF	**0.028**	**0.028**	**0.008**	**0.0084**	**0.003**	**0.0028**	**0.0028**	**0.0028**	**ND**	**0.000212**	**ND**	**0.0000636**	**ND**	**0.0000212**	**ND**	**0.0000212**
OCDD	**0.07**	**0.07**	**0.021**	**0.021**	**0.007**	**0.007**	**0.007**	**0.007**	**0.003**	**0.0030173**	**0.0009**	**0.00090519**	**0.0003**	**0.00030173**	**0.0003**	**0.00030173**
Total Dioxins / Furans	**46**	**48**	**45**	**46**	**90**	**91**	**51**	**53**	**0.003**	**3.0848493**	**0.0009**	**3.43408879**	**0.0003**	**4.55808793**	**0.0003**	**3.74588793**

Concentration Data	**Blank Run wet gas**							
(ng/Nm3 TEQ unless otherwise stated)	**ITEQ (1)**	**ITEQ (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**
	NATO	**NATO**	**Humans/Mammals**	**Humans/Mammals**	**Birds**	**Birds**	**Fish**	**Fish**
2,3,7,8-TCDF	**ND**	**0.000019**	**ND**	**0.000019**	**ND**	**0.00019**	**ND**	**0.000010**
2,3,7,8-TCDD	**ND**	**0.00024**	**ND**	**0.00024**	**ND**	**0.00024**	**ND**	**0.00024**
1,2,3,7,8-PeCDF	**ND**	**0.000016**	**ND**	**0.000010**	**ND**	**0.000033**	**ND**	**0.000016**
2,3,4,7,8-PeCDF	**ND**	**0.00016**	**ND**	**0.000097**	**ND**	**0.00032**	**ND**	**0.00016**
1,2,3,7,8-PeCDD	**ND**	**0.00019**	**ND**	**0.00038**	**ND**	**0.00038**	**ND**	**0.00038**
1,2,3,4,7,8-HxCDF	**ND**	**0.000084**	**ND**	**0.000084**	**ND**	**0.000084**	**ND**	**0.000084**
1,2,3,6,7,8-HxCDF	**ND**	**0.000075**	**ND**	**0.000075**	**ND**	**0.000075**	**ND**	**0.000075**
2,3,4,6,7,8-HxCDF	**ND**	**0.000084**	**ND**	**0.000084**	**ND**	**0.000084**	**ND**	**0.000084**
1,2,3,7,8,9-HxCDF	**ND**	**0.000085**	**ND**	**0.000085**	**ND**	**0.000085**	**ND**	**0.000085**
1,2,3,4,7,8-HxCDD	**ND**	**0.000025**	**ND**	**0.000025**	**ND**	**0.000012**	**ND**	**0.00012**
1,2,3,6,7,8-HxCDD	**ND**	**0.000030**	**ND**	**0.000030**	**ND**	**0.0000030**	**ND**	**0.0000030**
1,2,3,7,8,9-HxCDD	**ND**	**0.000027**	**ND**	**0.000027**	**ND**	**0.000027**	**ND**	**0.0000027**
1,2,3,4,6,7,8-HpCDF	**ND**	**0.00000053**	**ND**	**0.00000053**	**ND**	**0.00000053**	**ND**	**0.00000053**
1,2,3,4,7,8,9-HpCDF	**ND**	**0.00000059**	**ND**	**0.00000059**	**ND**	**0.00000059**	**ND**	**0.00000059**
1,2,3,4,6,7,8-HpCDD	**ND**	**0.0000039**	**ND**	**0.0000039**	**ND**	**0.00000039**	**ND**	**0.00000039**
OCDF	**ND**	**0.000000072**	**ND**	**0.000000022**	**ND**	**0.0000000072**	**ND**	**0.0000000072**
OCDD	**0.0000010**	**0.0000010**	**0.000000**	**0.00000031**	**0.00000010**	**0.00000010**	**0.00000010**	**0.00000010**
Total Dioxins / Furans	**0.0000010**	**0.0010**	**0.00000030**	**0.0012**	**0.00000010**	**0.0015413**	**0.00000010**	**0.0013**

Concentration Data	**Sample Run wet gas**							
(ng/Nm3 TEQ unless otherwise stated)	**ITEQ (1)**	**ITEQ (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**	**TEQ WHO (1)**	**TEQ WHO (2)**
	NATO	**NATO**	**Humans/Mammals**	**Humans/Mammals**	**Birds**	**Birds**	**Fish**	**Fish**
2,3,7,8-TCDF	**0.00071**	**0.00071**	**0.00071**	**0.00071**	**0.0071**	**0.0071**	**0.00036**	**0.00036**
2,3,7,8-TCDD	**ND**	**0.00052**	**ND**	**0.0005**	**ND**	**0.00052**	**ND**	**0.00052**
1,2,3,7,8-PeCDF	**0.00081**	**0.00081**	**0.00049**	**0.00049**	**0.0016**	**0.0016**	**0.00081**	**0.00081**
2,3,4,7,8-PeCDF	**0.0062**	**0.0062**	**0.0037**	**0.0037**	**0.012**	**0.012**	**0.0062**	**0.0062**
1,2,3,7,8-PeCDD	**0.0024**	**0.0024**	**0.0047**	**0.0047**	**0.0047**	**0.0047**	**0.0047**	**0.0047**
1,2,3,4,7,8-HxCDF	**0.0020**	**0.0020**	**0.0020**	**0.0020**	**0.0020**	**0.0020**	**0.0020**	**0.0020**
1,2,3,6,7,8-HxCDF	**0.00087**	**0.00087**	**0.00087**	**0.00087**	**0.00087**	**0.00087**	**0.00087**	**0.00087**
2,3,4,6,7,8-HxCDF	**0.00050**	**0.00050**	**0.00050**	**0.00050**	**0.00050**	**0.00050**	**0.00050**	**0.00050**
1,2,3,7,8,9-HxCDF	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**
1,2,3,4,7,8-HxCDD	**0.00022**	**0.00022**	**0.00022**	**0.00022**	**0.00011**	**0.00011**	**0.0011**	**0.0011**
1,2,3,6,7,8-HxCDD	**0.00071**	**0.00071**	**0.00071**	**0.00071**	**0.00007**	**0.000071**	**0.000071**	**0.000071**
1,2,3,7,8,9-HxCDD	**0.00040**	**0.00040**	**0.00040**	**0.00040**	**0.00040**	**0.00040**	**0.000040**	**0.000040**
1,2,3,4,6,7,8-HpCDF	**0.00015**	**0.00015**	**0.00015**	**0.00015**	**0.00015**	**0.00015**	**0.00015**	**0.00015**
1,2,3,4,7,8,9-HpCDF	**0.000042**	**0.000042**	**0.000042**	**0.000042**	**0.000042**	**0.000042**	**0.000042**	**0.000042**
1,2,3,4,6,7,8-HpCDD	**0.00019**	**0.00019**	**0.00019**	**0.00019**	**0.000019**	**0.000019**	**0.000019**	**0.000019**
OCDF	**0.0000094**	**0.0000094**	**0.0000028**	**0.0000028**	**0.00000094**	**0.00000094**	**0.00000094**	**0.00000094**
OCDD	**0.000024**	**0.000023**	**0.0000071**	**0.0000070**	**0.0000024**	**0.0000023**	**0.0000024**	**0.0000023**
Total Dioxins / Furans	**0.016**	**0.016**	**0.015**	**0.016**	**0.030**	**0.031**	**0.017**	**0.018**
Mass Emissions (Kg/Hr)	**0.00013**	**0.00014**	**0.00013**	**0.00013**	**0.00026**	**0.00026**	**0.00015**	**0.00015**

LOCATION: Barry

STACK: ERU

Dioxin and Furan Uncertainty Calculations	Dioxins and Furans Run 1	2,3,7,8-TCDF	2,3,7,8-TCDD	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,6,7,8-HpCDD	OCDF	OCDD	Total
Sampling Uncertainty (@ 95% confidence level)	%	10																	
Sample Volume @ Ref Conditions	m3	2.96																	
Conc. NATO ITEQ 2 @ Reference Conditions	ng/Nm3	0.00071	0.00052	0.00081	0.00620	0.00237	0.00204	0.00087	0.00050	0.00032	0.00022	0.00071	0.00040	0.00015	0.00004	0.00019	0.00001	0.00002	0.01608
Blank Conc. NATO ITEQ 2 @ Reference Conditions	ng/Nm3	0.00002	0.00024	0.00002	0.00016	0.00019	0.00008	0.00007	0.00008	0.00009	0.00002	0.00003	0.00003	0.00000	0.00000	0.00000	0.00000	0.00000	0.00104

NWSS have calculated total sampling uncertainty at a 95 % confidence level for different sampling conditions. The results were between 6 and 9 %.
NWSS have decided to quote a 'worst case' sampling uncertainty of 10% to cover all sampling procedures.
All uncertainties are quoted at a 95% confidence level

	Unit	Source	2,3,7,8-TCDF	2,3,7,8-TCDD	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	1,2,3,4,6,7,8-HpCDD	OCDF	OCDD	Total	
Analytical Uncertainty	%	From AQC data	6.5	12	6.3	2.5	7.8	3.6	4.3	7.4	14	5.2	9.0	7.9	3.7	11	5.7	8.1	2.6	_
1/2 LOD	pg ITEQ 2	From Validation data	0.055	0.18	0.036	0.25	0.71	0.14	0.12	0.17	0.049	0.10	0.10	0.097	0.016	0.010	0.021	0.0015	0.0030	_
Mass collected Sample Run	pg ITEQ 2	Lab Result	2.10	1.54	2.41	18.33	7.01	6.02	2.57	1.49	0.95	0.64	2.10	1.19	0.44	0.12	0.55	0.03	0.07	_
Mass collected Blank	pg ITEQ 2	Lab Result	0.06	0.71	0.05	0.48	0.56	0.25	0.22	0.25	0.25	0.07	0.09	0.08	0.00	0.00	0.01	0.00	0.00	
Analytical Uncertainty Sample Run	pg ITEQ 2	Calculation	0.1	0.2	0.2	0.4	0.7	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	_
Analytical Uncertainty Blank	pg ITEQ 2	Calculation	0.1	0.2	0.0	0.2	0.7	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
Sampling Uncertainty	pg ITEQ 2	Calculation	0.21	0.15	0.24	1.83	0.70	0.60	0.26	0.15	0.09	0.06	0.21	0.12	0.04	0.01	0.06	0.00	0.01	_
Blank Uncertainty	pg ITEQ 2	Calculation	0.01	0.07	0.00	0.05	0.06	0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	
Total Uncertainty Sample Run	pg ITEQ 2	Calculation	0.3	0.2	0.3	1.9	1.0	0.6	0.3	0.2	0.2	0.1	0.3	0.2	0.0	0.0	0.1	0.0	0.0	5.7
Total Uncertainty Balnk	pg ITEQ 2	Calculation	0.1	0.2	0.0	0.3	0.7	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	2.1
Total Uncert. @ Ref Cond. Sample Run	ng/Nm3	Calculation	0.000085	0.00008	0.000096	0.000638	0.000338	0.000216	0.000096	0.000077	0.000054	0.000039	0.000095	0.000052	0.000016	0.0000061	0.000022	0.0000012	0.0000026	0.0019
Total Uncert. @ Ref Cond. Blank	ng/Nm3	Calculation	0.000019	0.000066	0.000012	0.000086	0.000242	0.000047	0.000042	0.000059	0.000018	0.000033	0.000035	0.000033	0.0000054	0.0000034	0.0000069	0.00000051	0.0000010	0.00071
Total Uncertainty Sample Run	%	Calculation	12	16	12	10	14	11	11	15	17	18	13	13	11	15	12	13	11	12
Total Uncertainty Balnk	%	Calculation	97	28	75	53	127	56	56	71	22	133	118	122	1019	572	179	708	100	68

Page No.:	OF	Project No:	3811	Date:	22-May-17 to -

Client:	Dow Corning	Plant:	Barry	Location:	ERU
Operators:	DP / DPd	Test For:	Oxygen	In-house Method No.:	A44
Laptop ID:	2809	Start:	Temp (°C) 18	Pressure (kPa) 101.2	Flow Rate (l/min) 0.4
Data Logger ID:	1308	End:	Temp (°C) 18	Pressure (kPa) 101.2	Flow Rate (l/min) 0.4
Chiller ID	5451	Chiller Temp. & Time	2 - 11:21		

Action		O2	CO	SO2	NO	NOx	CO2	VOC
Analyser & Cylinder Info.	Analyser ID	2119						
	Gas Divider ID	1001						
	Span Gas Lot Number							
	Span Gas Uncertainty (±%)	1	1	1	1	1	1	1
ELVs & Ranges	Half hourly or Daily ELV (mg/m³)	N/A						
	Half hourly or Daily ELV (ppm)	N/A					N/A	
	Ideal Range [150%] to [300%] (ppm)	N/A N/A					N/A N/A	
	Range Used	25	1000	200	1000	1000	20	1000
Span & Divider Information	Span Range [50%] to [90%] (ppm)	N/A	500 900	100 180	500 900	500 900	10 18	
	Span Certified Value of Cylinder (ppm)	15.84						
	Proposed Span Value (ppm)	15.84						
	Actual Gas Divider %	100.00						
	Actual Span value to be used (ppm) (A)	15.8						
	T_{90} Value (ppm) of (A)	14.3						
Analyser Calibration	T_{90} Time Analyser (seconds)	15						
	3 x T_{90} Time Between Readings	45						
	Zero Response	0.08						
	Span Response (B)	15.68						
	Re-Zero Response	0.14						
	Analyser Repeatability	0.19				N/A		
	<2 x Repeatability	PASS				N/A		
Initial Line Checks	T_{90} Time System (seconds)	25						
	3 x T_{90} Time Between Readings	75						
	System Check: Zero (C)	0.11						
	C/B*100 =	0.70						
	C/B*100 = <2%	PASS						
	System Check: Span (D)	15.70						
	(D-B)/B*100 =	0.13						
	(D-B)/B*100 =<2% (=<5% SO_2)	PASS						
Final Line Checks	System Check: Zero (E)	0.09						
	(E-C)/D*100 =	-0.13						
	Drift: (E-C)/D*100 = <5%	PASS						
	System Check: Span (F)	15.00						
	(F-D)/B*100 =	-4.46						
	Drift: (F-D)/B*100 = <5%	PASS						

A	D Price, D Padfield	NA	

Combustion Gas Emission Data from	ERU
	Drift Corrected @ Reference Conditions (STP & Wet)
Time 22-May-17	Oxygen (%)
12:18	6.6
12:19	6.5
12:20	6.7
12:21	6.6
12:22	6.6
12:23	6.6
12:24	6.5
12:25	6.6
12:26	6.5
12:27	6.5
12:28	6.6
12:29	6.6
12:30	6.6
12:31	6.7
12:32	6.6
12:33	6.7
12:34	6.7
12:35	6.6
12:36	6.6
12:37	6.6
12:38	6.7
12:39	6.7
12:40	6.7
12:41	6.8
12:42	6.7
12:43	6.7
12:44	6.9
12:45	6.8
12:46	6.8
12:47	6.8
12:48	6.8
12:49	6.8
12:50	6.6
12:51	6.7
12:52	6.7
12:53	6.8
12:54	6.8
12:55	6.8
12:56	6.7
12:57	6.7
12:58	6.8
12:59	6.7
13:00	6.8
13:01	6.7
13:02	6.8
13:03	6.7

Combustion Gas Emission Data from	ERU
	Drift Corrected @ Reference Conditions (STP & Wet)
Time 22-May-17	Oxygen (%)
13:04	6.7
13:05	6.7
13:06	6.8
13:07	6.7
13:08	6.7
13:09	6.6
13:10	6.7
13:11	6.6
13:12	6.7
13:13	6.6
13:14	7.0
13:15	7.2
13:16	7.2
13:17	7.3
13:18	7.2
13:19	7.1
13:20	7.1
13:21	7.1
13:22	7.3
13:23	7.4
13:24	7.4
13:25	7.4
13:26	7.5
13:27	7.3
13:28	7.4
13:29	7.3
13:30	7.3
13:31	7.1
13:32	7.1
13:33	7.2
13:34	7.3
13:35	7.3
13:36	7.2
13:37	7.2
13:38	7.2
13:39	7.1
13:40	6.8
13:41	6.9
13:42	6.9
13:43	6.9
13:44	6.9
13:45	6.8
13:46	6.9
13:47	6.9
13:48	6.9
13:49	6.9

Combustion Gas Emission Data from	ERU
	Drift Corrected @ Reference Conditions (STP & Wet)
Time 22-May-17	Oxygen (%)
13:50	7.2
13:51	7.5
13:52	7.6
13:53	7.5
13:54	7.5
13:55	7.4
13:56	7.5
13:57	7.3
13:58	7.4
13:59	7.4
14:00	7.3
14:01	7.1
14:02	7.0
14:03	6.9
14:04	6.8
14:05	6.8
14:06	6.9
14:07	6.9
14:08	7.2
14:09	7.1
14:10	7.3
14:11	7.4
14:12	7.5
14:13	7.5
14:14	7.4
14:15	7.4
14:16	7.4
14:17	7.5
14:18	7.5
14:19	7.4
14:20	7.4
14:21	7.4
14:22	7.4
14:23	7.3
14:24	7.2
14:25	7.1
14:26	6.9
14:27	6.8
14:28	6.9
14:29	7.0
14:30	7.2
14:31	7.3
14:32	7.3
14:33	7.4
14:34	7.5
14:35	7.6

Combustion Gas Emission Data from	ERU
	Drift Corrected @ Reference Conditions (STP & Wet)
Time 22-May-17	Oxygen (%)
14:36	7.6
14:37	7.8
14:38	7.8
14:39	7.8
14:40	7.7
14:41	7.7
14:42	7.7
14:43	7.7
14:44	7.6
14:45	7.5
14:46	7.4
14:47	7.3
14:48	7.3
14:49	7.3
14:50	7.2
14:51	7.2
14:52	7.2
14:53	7.0
14:54	6.8
14:55	6.7
14:56	7.3
14:57	7.2
14:58	7.3
14:59	7.2
15:00	7.3
15:01	7.2
15:02	7.3
15:03	7.2
15:04	7.3
15:05	7.2
15:06	7.3
15:07	7.2
15:08	7.3
15:09	7.3
15:10	7.2
15:11	7.2
15:12	7.2
15:13	7.2
15:14	7.0
15:15	6.9
15:16	7.0
15:17	7.1

Combustion Gas Emission Data from	ERU
	Drift Corrected @ Reference Conditions (STP & Wet)
Time 22-May-17	Oxygen (%)
15:18	7.1
15:19	7.1
15:20	7.1
15:21	7.1
15:22	7.0
15:23	7.3
15:24	7.2
15:25	7.3
15:26	7.5
15:27	7.8
15:28	7.8
15:29	7.8
15:30	7.7
15:31	7.6
15:32	7.5
15:33	7.6
15:34	7.5
15:35	7.4
15:36	7.3
15:37	7.3
15:38	7.1
15:39	7.2
15:40	7.1
15:41	7.1
15:42	7.2
15:43	7.2
15:44	7.3
15:45	7.3
15:46	7.5
15:47	7.3
15:48	7.4
15:49	7.3
15:50	7.3
15:51	7.4
15:52	7.5
15:53	7.5
15:54	7.6
15:55	7.6
15:56	7.6
15:57	7.5
15:58	7.5
15:59	7.4

Combustion Gas Emission Data from	ERU
	Drift Corrected @ Reference Conditions (STP & Wet)
Time 22-May-17	Oxygen (%)
16:00	7.4
16:01	7.3
16:02	7.3
16:03	7.3
16:04	7.2
16:05	7.2
16:06	7.2
16:07	7.2
16:08	7.3
16:09	7.2
16:10	7.5
16:11	7.5
16:12	7.5
16:13	7.6
16:14	7.7
16:15	7.6
16:16	7.3
16:17	7.4
16:18	7.3
Average	**7.1**

DIOXIN/FURAN

ANALYSIS REPORT

NUMBER D8208-8209

1181

This analysis is based on Northumbrian Water Scientific Services Organics Laboratory method O-55 which is accredited under the **UKAS** accreditation scheme.
This analysis was performed in accordance with BS EN 1948-2: 2006 and BS EN 1948-3:2006.

DIOXIN/FURAN

ANALYSIS REPORT

NUMBER D8208-8209

Laboratory Address:

Northumbrian Water Scientific Services
Northumberland Dock Road
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Wallsend
Tyne & Wear
NE28 0QD

Report Ref: D8208-8209

Client Address:

Mark Elliott
Air Emissions Manager
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Prepared by: Sophie Wright **Signed:** **Date:** 28/06/17

Issued under the authority of Steve Wilson– Laboratory Manager (Howdon Organics)

CONTENTS

SECTION 1

SUMMARY

Two samples taken on behalf of Dow Corning were analysed for dioxin and furan contamination. Analysis of the samples gave the following TEQ values (to 2 significant figures). Two values are quoted, the first taking any non-detects as zero and the second taking any non-detects as at the detection limit level

	Toxic Equivalent Results pg/sample				
Sample	**NATO/CCMS ITEQ**	**WHO (1998) HUMANS TEQ**	**WHO (2005) HUMANS TEQ**	**WHO (1998) FISH TEQ**	**WHO (1998) BIRDS TEQ**
ERU BLANK	0.003 (3.1)	0.0003 (3.6)	0.00091 (3.4)	0.0003 (3.7)	0.0003 (4.6)
ERU RUN 1	46 (48)	53 (54)	45 (46)	51 (53)	90 (91)

Full results for individual congeners and recoveries, together with information on any deviations from methodology/quality systems is shown in section 2.

INTRODUCTION

Two samples were submitted to Northumbrian Water Scientific Services by Dow Corning for analysis to determine the levels of polychlorinated dibenzo-p-dioxins (PCDD's) and polychlorinated dibenzofurans (PCDF's) present.

The analysis covered the 17 PCDD and PCDF congeners containing chlorine substitution at the 2,3,7 and 8 positions so that Toxicity Equivalents could be calculated based on the NATO/CCMS and WHO systems.

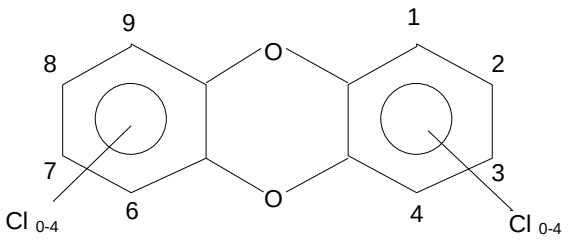
The samples were received on 25/05/17. Details of the samples are shown below.

CONTRACT - DOW_CORN-03811

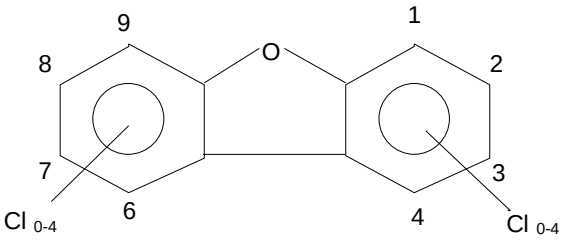
DATE REC'D	SAMPLE	LAB Nº	REF
25/05/17	ERU BLANK	1449868	D8208
25/05/17	ERU RUN 1	1449867	D8209

DIOXINS AND FURANS

PCDDs and PCDFs form a group of 210 closely related substances. The structural formulae are shown below. A dioxin or furan molecule can have as few as one or as many as eight chlorine atoms attached to the molecule at any of eight locations. The combination of number and position of the chlorine atoms gives rise to 75 possible dioxins and 135 furans.

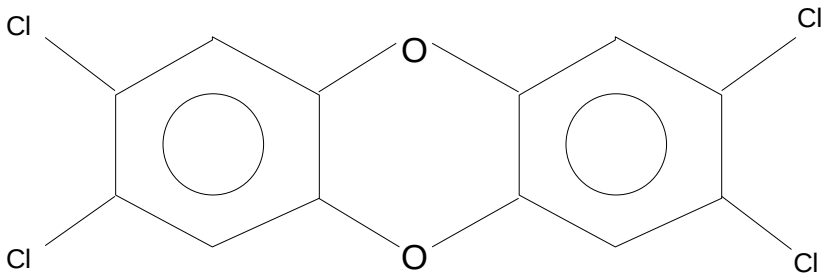


A Dioxin Molecule



A Furan Molecule

It is both the number of chlorine atoms and position in the molecule that determines the physical and chemical properties, as well as the toxicity of a given dioxin or furan. The most hazardous dioxin has chlorine substitution at the 2,3,7 and 8 positions and is therefore called 2,3,7,8-tetrachlorodibenzo-p-dioxin.



2,3,7,8-Tetrachlorodibenzo-p-dioxin

TOXIC EQUIVALENTS

In order to assess the toxicity of complex mixtures of PCDDs, PCDFs and PCBs the concept of toxic equivalents was devised. Toxic Equivalent Factors (TEF) are assigned to individual dioxins, furans and PCBs on the basis of how toxic they are in comparison with 2,3,7,8-TCDD, the most potent dioxin which has been assigned a value of 1.0. By comparison, animal and cell tests show that 2,3,7,8-TCDF is approximately one-tenth as toxic as 2,3,7,8-TCDD. Consequently its toxic equivalent factor is 0.1.

Of the 210 dioxins and furans, 17 contribute most to the toxicity of a complex mixture and are of most concern. Of the 209 PCBs 12 contribute most to the toxicity of a complex mixture and are of most concern. `Therefore it is these 29 compounds that have TEFs assigned shown in the table below for various schemes.

TEF tables	**NATO/CCMS**	**WHO (1998)**	**WHO (2005)**	**WHO (1998)**	**WHO (1998)**
Congener		**Humans/ mammals**	**Humans/ mammals**	**Fish**	**Birds**
2,3,7,8-TCDF	0.1	0.1	0.1	0.05	1
2,3,7,8-TCDD	1.0	1	1	1	1
1,2,3,7,8-PeCDF	0.05	0.05	0.03	0.05	0.1
2,3,4,7,8-PeCDF	0.5	0.5	0.3	0.5	1
1,2,3,7,8-PeCDD	0.5	1	1	1	1
1,2,3,4,7,8-HxCDF	0.1	0.1	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1	0.1	0.1	0.1
1,2,3,4,7,8-HxCDD	0.1	0.1	0.1	0.5	0.05
1,2,3,6,7,8-HxCDD	0.1	0.1	0.1	0.01	0.01
1,2,3,7,8,9-HxCDD	0.1	0.1	0.1	0.01	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.01	0.01	0.01
1,2,3,4,6,7,8-HpCDD	0.01	0.01	0.01	0.001	<0.001*
OCDF	0.001	0.0001	0.0003	0.0001	0.0001
OCDD	0.001	0.0001	0.0003	<0.0001*	0.0001
PCB BZ 81	-	0.0001	0.0003	0.0005	0.1
PCB BZ 77	-	0.0001	0.0001	0.0001	0.05
PCB BZ 123	-	0.0001	0.00003	<0.000005*	0.00001
PCB BZ 118	-	0.0001	0.00003	<0.000005*	0.00001
PCB BZ 114	-	0.0005	0.00003	<0.000005*	0.0001
PCB BZ 105	-	0.0001	0.00003	<0.000005*	0.0001
PCB BZ 126	-	0.1	0.1	0.005	0.1
PCB BZ 167	-	0.00001	0.00003	<0.000005*	0.00001
PCB BZ 156	-	0.0005	0.00003	<0.000005*	0.0001
PCB BZ 157	-	0.0005	0.00003	<0.000005*	0.0001
PCB BZ 169	-	0.01	0.03	0.00005	0.001
PCB BZ 189	-	0.0001	0.00003	<0.000005*	0.00001

*** NB** Where < figure is quoted for TEF the actual figure is used in all calculations in this report giving a worst case scenario.

METHOD

The analytical method used for this analysis is based on BS EN1948-2 & BS EN1948-3 2006.

The sample is withdrawn isokinetically from the gas stream and collected in the sample probe, on a glass fibre filter and on a packed column of XAD-2 resin. The resin is spiked with a mixture of three stable isotopically labelled standards before sampling to give an indication of sampling efficiency and breakthrough. The filter is treated with 1ml of concentrated hydrochloric acid and dried. The resin/filter is spiked with 13 stable isotopically labelled standards before extraction to give an indication of extraction and clean-up efficiency. (The spiking scheme is illustrated on page 10). The filter and resin (after mixing with sodium sulphate for drying) are then combined with the solvent washes (after solvent exchange in to toluene) and Soxhlet extracted for a minimum of 20 hours with toluene.

Impurities are removed from the extracts by column chromatography using silica and alumina absorbents.

The resulting extracts are concentrated and solvent exchanged to give a final volume of 10 µl in nonane.

Two isotopically labelled internal standards are added before analysis by high resolution gas chromatography- high resolution mass spectrometry (HRGC-HRMS) using a DB5-MS column. If any limiting value is exceeded for the sample then a confirmatory analysis may be performed on an RTX 2330 column.

Identification of the dioxins and furans is based on comparison of GC retention times and the ion abundance ratios of the monitored mass signals with the corresponding retention times of authentic standards and the theoretical ion abundance ratios.

If results for individual targeted dioxins/furans (i.e. 2,3,7,8 substituted) exceed the calibration range of the instrument then these results are flagged in the analytical report. The mass spectrometer is operated at a resolution in excess of 10000 to minimize the potential for interference. Selected ions characteristic of the dioxins and furans are monitored together with ions characteristic of polychlorinated diphenyl ethers, which may interfere with the furans. The mass spectrometer is continuously calibrated during acquisition to correct for any mass drift using mass signals from a reference compound FC43 (heptacosafluorotributylamine).

CEN 1948 Labelled Standard Spiking Scheme
Sampling Standards
$^{13}C_{12}$ 1,2,3,7,8-PeCDF
$^{13}C_{12}$ 1,2,3,7,8,9-HxCDF
$^{13}C_{12}$ 1,2,3,4,7,8,9-HpCDF
Extraction Standards
$^{13}C_{12}$ 2,3,7,8-TCDF
$^{13}C_{12}$ 2,3,7,8-TCDD
$^{13}C_{12}$ 2,3,4,7,8-PeCDF
$^{13}C_{12}$ 1,2,3,7,8-PeCDD
$^{13}C_{12}$ 1,2,3,4,7,8-HxCDF
$^{13}C_{12}$ 1,2,3,6,7,8-HxCDF
$^{13}C_{12}$ 2,3,4,6,7,8-HxCDF
$^{13}C_{12}$ 1,2,3,4,7,8-HxCDD
$^{13}C_{12}$ 1,2,3,6,7,8-HxCDD
$^{13}C_{12}$ 1,2,3,4,6,7,8-HpCDF
$^{13}C_{12}$ 1,2,3,4,6,7,8-HpCDD
$^{13}C_{12}$ OCDF
$^{13}C_{12}$ OCDD
Syringe Standards
$^{13}C_{12}$ 1,2,3,4-TCDD
$^{13}C_{12}$ 1,2,3,7,8,9-HxCDD
Resin Trap and/or Filter
Sampling
Resin Trap, Filter, Washings & Condensate
Extraction
Crude Extract
Cleanup
Final Extract

SECTION 2

RESULTS

The following pages contain the detailed analytical results for the isomer specific analysis for each sample and blank along with recovery information for the labelled standards.

A matrix blank is analysed alongside the samples to show any possible contamination. This consists of a filter and a sample of XAD-2 resin

The following points should be noted:-

Results have not been blank corrected. Results have not been rounded. This is to permit further processing if necessary and does not imply the level of accuracy. Summary results on page 5 have been rounded to two significant figures.

n.d. - not detected – Quantitation limits (LOQ) for the analysis are calculated on a sample specific basis by the GCMS software, and are based on a signal to noise value of 10 to 1, as directed by BSEN1948

Results marked * are over the normal calibration limit of the method.

As part of the method validation the precision of the standard was assessed (including sampling and analysis) with the following results:-

The internal variability (corresponding to the repeatability in accordance with ISO 5725-2: 1994) is determined as the maximum difference to be expected with a 95 % statistical confidence between the results of one measurement institute measuring, and using the same laboratory facilities, in accordance with the requirements of this standard with two identical sampling trains and the same sample gas. The internal variability is expressed as the internal confidence interval with a 95 % statistical confidence.

The internal confidence interval for the filter/cooler method at a mean concentration of 0.040 ng I-TEQ/m3 was ± 0.060 ng I-TEQ /m^3 and on a mean concentration of 0.030 ng I-TEQ/m^3 ± 0.014 ng I-TEQ /m^3.

The external variability (corresponding to the reproducibility according to ISO 5725-2: 1994) is determined as the maximum difference to be expected with a 95 % statistical confidence between the results of several institutes measuring the same sample gas, each using their own individual sampling train and laboratory facilities and fulfilling the requirements of this standard.

The external confidence interval (with 95 % statistical confidence) at a mean concentration of 0.035 ng I-TEQ/m3 was ± 0.05 ng I-TEQ/m3.

All quality criteria in the method O55 have been met with any deviations outlined below.

Deviations from methodology/quality criteria/comments: None.

DIOXIN-FURAN RESULTS

CLIENT DOW CORNING **CONTRACT** DOW_CORN-03811

SAMPLE LABORATORY BLANK

LAB NO N/A **REF** D8208-8209

		NATO	WHO TEQ			
CONGENER	**pg/sample**	**I-TEQ**	**Humans[a]**	**Humans[b]**	**Fish[a]**	**Birds[a]**
2,3,7,8-TCDF	<1.138	n.d.	n.d.	n.d.	n.d.	n.d.
2,3,7,8-TCDD	<0.815	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8-PeCDF	<1.295	n.d.	n.d.	n.d.	n.d.	n.d.
2,3,4,7,8-PeCDF	<1.268	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8-PeCDD	<0.43	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,7,8-HxCDF	<2.495	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,6,7,8-HxCDF	<2.601	n.d.	n.d.	n.d.	n.d.	n.d.
2,3,4,6,7,8-HxCDF	<2.707	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8,9-HxCDF	<2.748	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,7,8-HxCDD	<0.746	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,6,7,8-HxCDD	<0.771	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8,9-HxCDD	<0.7	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,6,7,8-HpCDF	3.0646	0.0306	0.0306	0.0306	0.0306	0.0306
1,2,3,4,7,8,9-HpCDF	<0.555	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,6,7,8-HpCDD	<1.266	n.d.	n.d.	n.d.	n.d.	n.d.
OCDF	<0.179	n.d.	n.d.	n.d.	n.d.	n.d.
OCDD	<0.414	n.d.	n.d.	n.d.	n.d.	n.d.
	TEQ TOTAL (1)	**0.0306**	**0.0306**	**0.0306**	**0.0306**	**0.0306**
	TEQ TOTAL (2)	**3.1688**	**3.3833**	**3.1039**	**3.4810**	**4.9881**

[a] WHO 1998 TEQ values, [b] WHO 2005 TEQ values

TEQ TOTAL (1) taking n.d.=0 and TEQ TOTAL (2) taking n.d.=LOQ

LABELLED STANDARD RECOVERIES

CLIENT DOW CORNING **CONTRACT** DOW_CORN-03811

SAMPLE LABORATORY BLANK

LAB NO N/A **REF** D8208-8209

EXTRACTION STANDARDS	RECOVERY %
$^{13}C_{12}$ 2378 TCDF	86
$^{13}C_{12}$ 2378 TCDD	72
$^{13}C_{12}$ 23478 PeCDF	85
$^{13}C_{12}$ 12378 PeCDD	93
$^{13}C_{12}$ 123478 HxCDF	89
$^{13}C_{12}$ 123678 HxCDF	80
$^{13}C_{12}$ 234678 HxCDF	81
$^{13}C_{12}$ 123478 HxCDD	83
$^{13}C_{12}$ 123678 HxCDD	87
$^{13}C_{12}$ 1234678 HpCDF	96
$^{13}C_{12}$ 1234678 HpCDD	90
$^{13}C_{12}$ OCDF	88
$^{13}C_{12}$ OCDD	83

All of the recoveries quoted above are within the acceptance limits of method O55.

DIOXIN-FURAN RESULTS

CLIENT DOW CORNING **CONTRACT** DOW_CORN-03811

SAMPLE ERU BLANK

LAB NO 1449868 **REF** D8208

		NATO	WHO TEQ			
CONGENER	**pg/sample**	**I-TEQ**	**Humans[a]**	**Humans[b]**	**Fish[a]**	**Birds[a]**
2,3,7,8-TCDF	<0.571	n.d.	n.d.	n.d.	n.d.	n.d.
2,3,7,8-TCDD	<0.71	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8-PeCDF	<0.975	n.d.	n.d.	n.d.	n.d.	n.d.
2,3,4,7,8-PeCDF	<0.955	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8-PeCDD	<1.124	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,7,8-HxCDF	<2.483	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,6,7,8-HxCDF	<2.216	n.d.	n.d.	n.d.	n.d.	n.d.
2,3,4,6,7,8-HxCDF	<2.484	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8,9-HxCDF	<2.522	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,7,8-HxCDD	<0.73	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,6,7,8-HxCDD	<0.88	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8,9-HxCDD	<0.8	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,6,7,8-HpCDF	<0.157	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,7,8,9-HpCDF	<0.175	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,4,6,7,8-HpCDD	<1.145	n.d.	n.d.	n.d.	n.d.	n.d.
OCDF	<0.212	n.d.	n.d.	n.d.	n.d.	n.d.
OCDD	3.0173	0.0030	0.0003	0.0009	0.0003	0.0003
	TEQ TOTAL (1)	**0.0030**	**0.0003**	**0.0009**	**0.0003**	**0.0003**
	TEQ TOTAL (2)	**3.0848**	**3.6439**	**3.4341**	**3.7459**	**4.5581**

[a] WHO 1998 TEQ values, [b] WHO 2005 TEQ values

TEQ TOTAL (1) taking n.d.=0 and TEQ TOTAL (2) taking n.d.=LOQ

LABELLED STANDARD RECOVERIES

CLIENT DOW CORNING **CONTRACT** DOW_CORN-03811

SAMPLE ERU BLANK

LAB NO 1449868 **REF** D8208

SURROGATE STANDARDS	RECOVERY %
$^{13}C_{12}$ 12378 PeCDF	76
$^{13}C_{12}$ 123789 HxCDF	83
$^{13}C_{12}$ 1234789 HpCDF	82

EXTRACTION STANDARDS	RECOVERY %
$^{13}C_{12}$ 2378 TCDF	80
$^{13}C_{12}$ 2378 TCDD	71
$^{13}C_{12}$ 23478 PeCDF	79
$^{13}C_{12}$ 12378 PeCDD	87
$^{13}C_{12}$ 123478 HxCDF	66
$^{13}C_{12}$ 123678 HxCDF	71
$^{13}C_{12}$ 234678 HxCDF	66
$^{13}C_{12}$ 123478 HxCDD	69
$^{13}C_{12}$ 123678 HxCDD	62
$^{13}C_{12}$ 1234678 HpCDF	77
$^{13}C_{12}$ 1234678 HpCDD	71
$^{13}C_{12}$ OCDF	67
$^{13}C_{12}$ OCDD	67

All of the recoveries quoted above are within the acceptance limits of method O55.

DIOXIN-FURAN RESULTS

CLIENT DOW CORNING **CONTRACT** DOW_CORN-03811

SAMPLE ERU RUN 1

LAB NO 1449867 **REF** D8209

		NATO	WHO TEQ			
CONGENER	**pg/sample**	**I-TEQ**	**Humans[a]**	**Humans[b]**	**Fish[a]**	**Birds[a]**
2,3,7,8-TCDF	21.0171	2.1017	2.1017	2.1017	1.0509	21.0171
2,3,7,8-TCDD	<1.535	n.d.	n.d.	n.d.	n.d.	n.d.
1,2,3,7,8-PeCDF	48.1105	2.4055	2.4055	1.4433	2.4055	4.8111
2,3,4,7,8-PeCDF	36.6542	18.3271	18.3271	10.9963	18.3271	36.6542
1,2,3,7,8-PeCDD	14.0211	7.0106	14.0211	14.0211	14.0211	14.0211
1,2,3,4,7,8-HxCDF	60.2455	6.0246	6.0246	6.0246	6.0246	6.0246
1,2,3,6,7,8-HxCDF	25.7254	2.5725	2.5725	2.5725	2.5725	2.5725
2,3,4,6,7,8-HxCDF	14.8544	1.4854	1.4854	1.4854	1.4854	1.4854
1,2,3,7,8,9-HxCDF	9.4799	0.9480	0.9480	0.9480	0.9480	0.9480
1,2,3,4,7,8-HxCDD	6.3775	0.6378	0.6378	0.6378	3.1888	0.3189
1,2,3,6,7,8-HxCDD	20.9882	2.0988	2.0988	2.0988	0.2099	0.2099
1,2,3,7,8,9-HxCDD	11.9441	1.1944	1.1944	1.1944	0.1194	1.1944
1,2,3,4,6,7,8-HpCDF	44.2120	0.4421	0.4421	0.4421	0.4421	0.4421
1,2,3,4,7,8,9-HpCDF	12.4798	0.1248	0.1248	0.1248	0.1248	0.1248
1,2,3,4,6,7,8-HpCDD	55.4510	0.5545	0.5545	0.5545	0.0555	0.0555
OCDF	27.8837	0.0279	0.0028	0.0084	0.0028	0.0028
OCDD	69.4714	0.0695	0.0069	0.0208	0.0069	0.0069
	TEQ TOTAL (1)	**46.0252**	**52.9481**	**44.6745**	**50.9853**	**89.8892**
	TEQ TOTAL (2)	**47.5602**	**54.4831**	**46.2095**	**52.5203**	**91.4242**

[a] WHO 1998 TEQ values, [b] WHO 2005 TEQ values

TEQ TOTAL (1) taking n.d.=0 and TEQ TOTAL (2) taking n.d.=LOQ

LABELLED STANDARD RECOVERIES

CLIENT DOW CORNING **CONTRACT** DOW_CORN-03811

SAMPLE ERU RUN 1

LAB NO 1449867 **REF** D8209

SURROGATE STANDARDS	RECOVERY %
$^{13}C_{12}$ 12378 PeCDF	91
$^{13}C_{12}$ 123789 HxCDF	89
$^{13}C_{12}$ 1234789 HpCDF	99

EXTRACTION STANDARDS	RECOVERY %
$^{13}C_{12}$ 2378 TCDF	80
$^{13}C_{12}$ 2378 TCDD	80
$^{13}C_{12}$ 23478 PeCDF	88
$^{13}C_{12}$ 12378 PeCDD	79
$^{13}C_{12}$ 123478 HxCDF	120
$^{13}C_{12}$ 123678 HxCDF	121
$^{13}C_{12}$ 234678 HxCDF	108
$^{13}C_{12}$ 123478 HxCDD	82
$^{13}C_{12}$ 123678 HxCDD	83
$^{13}C_{12}$ 1234678 HpCDF	121
$^{13}C_{12}$ 1234678 HpCDD	95
$^{13}C_{12}$ OCDF	106
$^{13}C_{12}$ OCDD	81

All of the recoveries quoted above are within the acceptance limits of method O55.

SECTION 3

EXPLANATION OF APPENDICES

APPENDIX 1 CHAIN OF CUSTODY FORMS/EXTRACTION/AUTOSAMPLER LISTS

These pages show copies of forms that document the progress of the sample from the sampling stage through all analysis stages.

The chain of custody form documents the date that the sample was taken and contains sample identification information together with records of the transfer of the sample prior to analysis.

The extraction log shows the dates of all extraction and cleanup processes, including details of the spiking standards used for analysis. The final extract volume after addition of internal standards is also shown.

The autosampler list shows the run order of the samples GCMS analysis together with the datafile names under which data is stored.

APPENDIX 2 GLOSSARY

This is a list of abbreviations used in this report.

APPENDIX 1

PAGE No **NWG ENVIRONMENTAL SOLUTIONS AIR EMISSIONS SAMPLE SUBMISSION SHEET**

NWG ENVIRONMENTAL SOLUTIONS
Howdon (0191) 2968500
Cwmbran (01633) 862950

CLIENT: Dow Corning **SITE: Barry**	**NWG ES CONTRACT REF: Dow_Corn-03811**	
CLIENT PROJECT MANAGER: Andrew Martin	**NWG ES PROJECT MANAGER:** C Harley	**AGREED TURNROUND:** (No of working days): 10

AIR TEMPLATE

MATRIX			STACK, TEST & RUN NUMBER	SAMPLER	COMMENTS / SOLUTION / FILTER	ANALYSIS / TEST SCHEDULE REQUIRED	DATE SAMPLED	TIME SAMPLED	NWSS LAB NO
Liquid	Solid	Gas							
		X	ERU – RUN 1	DPd/DP	Resin Trap, Filter, Condensate, Acetone/Toluene wash and Toluene Wash	CEN Dioxins + Furans	22/5/17	12:18	149867
		X	E.R.U - Blank	DPd/DP	Resin Trap, Filter, Acetone/Toluene wash and Toluene Wash	CEN Dioxins + Furans	22/5/17	11:00	149868

CHAIN OF CUSTODY

Relinquished By D Price	Date 24/5/17	Received By
Relinquished By	Date 25/05/17	Received By
Relinquished By	Date	Received By

ADDITIONAL INFORMATION\HAZARD DATA

T/C ID - 1628 1624	T/C Max °C

ENTERED BY:		
ON (DATE):	25/05/17	
NO. OF SAMPLES CORRECT?		
IF NO THEN REPORTED TO:		
COMPLETED FORM TO BE SENT TO:	**TICK BOX**	**ACTIONED BY:**
CWMBRAN OFFICE		

Dioxin/Furan Report Number D8208-8209
Dow Corning Ltd
Barry Plant
Permit Numbe: BR9685IX
Dow_Corn-03811
Dioxins & Furans Retest 3, May 2017
Issue 1

SAMPLE EXTRACTION LOG

LAB NO	x	x	x	1449868	1450863	1450854	1450865
PCBs REQD ?	✓	✓	✓	x	✓	✓	✓
SAMPLE ID	Lab Blank. Filter	Lab Blank.	Lab Blank. Resin	DOW_CORN 03811 EXCH BLANK.	Hanson Cem Vapour Phase. Blank.	Hanson Cem Solid Phase Blank.	Hanson Cem Vapour Phase RUN 1.
WT/VOL/TRAP	NW	NW	NW	NW55002	AES101	—	AES439.
SIGN	Slee.						

$^{13}C_{12}$ STD ADDITIONS

DATE/TIME	CENEXT 16	0217					
STD	7-6-17	17:15	→	→	→	→	→
VOL	100 ml.						
SIGN	Slee.						

EXTRACTION

EXT DATES & TIMES	7-6-17 17:45	→	8-6-17 17:00	→	→	→	→
GLASSWARE N^{O}	11	13	20	14	15	16	17

ALUMINA CLEANUP

DATE	14-6-17			→	→	→	→
SIGN	[illegible]						
PCB KEEP?	✓	✓	✓	x	✓	✓	✓

MIXED SILICA CLEANUP

DATE	~~Slee~~ 9-6-17	→	→	→	→	→	→
SIGN	Slee. /	[illegible]					

OTHER CLEANUPS 1

TYPE							
DATE	N/A	→	→	→	→	→	→
SIGN							

OTHER CLEANUPS 2

TYPE							
DATE	N/A	→	→	→	→	→	→
SIGN							

CONCENTRATION INTO NONANE

DATE	14.6.17						
VOL	10ul	→	→	→	→	→	→
SIGN	[illegible]						

RECOVERY STD ADDITION

DATE/TIME	14.6.17/17:15						
STD	QNS2300317	→	→	→	→	→	→
VOL	25ul						
Final VOL	35ul						
SIGN	[illegible]						

SAMPLE EXTRACTION LOG

LAB NO	1450882	1450864	1450881	1449867	x		
PCBs REQD ?	✓	✓	✓	x	✓		
SAMPLE ID	Henson Com Vapour Phase Run 2.	Henson Com Solid Phase Run 1	Henson Com Solid Phase Run 2.	DOW_CORN 03811 ERW RUN 1.	Dx -3		
WT/VOL/TRAP	AES 348	/	/	AES 56.	1.018		
SIGN	Shee.						
$^{13}C_{12}$ STD ADDITIONS							
DATE/TIME	7-6-17	17:15	→	→	→		
STD	CENEXT160217	→	→	→	→		
VOL	100µl	→	→	→	→		
SIGN	Shee.	→	→	→	→		
EXTRACTION							
EXT DATES & TIMES	7-6-17 17:45	→	8-6-17 17:00.	→	→		
GLASSWARE N^{O}	19	9	10	23	24.		
ALUMINA CLEANUP							
DATE	14-6-17	/	/	→	→		
SIGN	[illegible]	/	/	→	→		
PCB KEEP?	✓	✓	✓	x	✓		
MIXED SILICA CLEANUP							
DATE	9-6-17			→	→		
SIGN	Shee	[illegible]		→	→		
OTHER CLEANUPS 1							
TYPE							
DATE	N/A	→	→	→	→	→	→
SIGN							
OTHER CLEANUPS 2							
TYPE							
DATE	N/A	→	→	→	→		
SIGN							
CONCENTRATION INTO NONANE							
DATE	14.6.17			→	→		
VOL	10µl	→	→	→	→		
SIGN	[signature]	→	→	→	→		
RECOVERY STD ADDITION							
DATE/TIME	14.6.17/17:15	→	→	→	→		
STD	CN1823003F7	→	→	→	→		
VOL	25µl	→	→	→	→		
Final VOL	35µl	→	→	→	→		
SIGN	[signature]	→	→	→	→		

RUN DATE: 15/06/17		
Position	**File Name**	**Sample ID**
Trayholder 1:Slot3:1	XHC01	GCRWD2 COLUMN CHECK
Trayholder 1:Slot3:2	XHC02	N
Trayholder 1:Slot3:3	XHC03	CNCS1
Trayholder 1:Slot3:4	XHC04	CNCS2
Trayholder 1:Slot3:5	XHC05	CNCS3
Trayholder 1:Slot3:6	XHC06	CNCS4
Trayholder 1:Slot3:7	XHC07	CNCS5
Trayholder 1:Slot3:8	XHC08	N
Trayholder 1:Slot3:9	XHC09	N
Trayholder 1:Slot3:10	XHC10	N
Trayholder 1:Slot3:11	XHC11	LAB BLANK 07/06/17
Trayholder 1:Slot3:12	XHC12	LAB BLANK FILTER 07/06/17
Trayholder 1:Slot3:13	XHC13	LAB BLANK RESIN 07/06/17
Trayholder 1:Slot3:14	XHC14	1450854 SOLID PHASE BLANK
Trayholder 1:Slot3:15	XHC15	1450863 VAPOUR PHASE BLANK
Trayholder 1:Slot3:16	XHC16	1449868 ERU BLANK
Trayholder 1:Slot3:17	XHC17	1449867 ERU RUN 1
Trayholder 1:Slot3:18	XHC18	N
Trayholder 1:Slot3:19	XHC19	1450865 VAPOUR PHASE RUN 1
Trayholder 1:Slot3:20	XHC20	N
Trayholder 1:Slot3:21	XHC21	1450882 VAPOUR PHASE RUN 2
Trayholder 1:Slot3:22	XHC22	N
Trayholder 1:Slot3:23	XHC23	1450864 SOILID PHASE RUN 1
Trayholder 1:Slot3:24	XHC24	N
Trayholder 1:Slot3:25	XHC25	1450881 SOLID PHASE RUN 2
Trayholder 1:Slot3:26	XHC26	N
Trayholder 1:Slot3:27	XHC27	DX3 07/06/17
Trayholder 1:Slot3:28	XHC28	N
Trayholder 1:Slot3:5	XHC29	CNCS3
Trayholder 1:Slot3:5	XHC30	N
Trayholder 1:Slot3:31	XHC31	N
Trayholder 1:Slot3:32	XHC32	N
N= NONANE WASH		

RUN DATE: 25/06/17		
Position	**File Name**	**Sample ID**
Trayholder 1:Slot3:1	YHC01	GCRWD2 COLUMN CHECK
Trayholder 1:Slot3:2	YHC02	N
Trayholder 1:Slot3:3	YHC03	CNCS3
Trayholder 1:Slot3:4	YHC04	N
Trayholder 1:Slot3:5	YHC05	N
Trayholder 1:Slot3:6	YHC06	1449867 ERU RUN 1
Trayholder 1:Slot3:7	YHC07	N
Trayholder 1:Slot3:8	YHC08	DX3 07/06/17
Trayholder 1:Slot3:9	YHC09	N
Trayholder 1:Slot3:3	YHC10	CNCS3
Trayholder 1:Slot3:11	YHC11	N
Trayholder 1:Slot3:12	YHC12	N
Trayholder 1:Slot3:13	YHC13	N
Trayholder 1:Slot3:35	YHC14	PCBCS1 COLUMN CHECK
Trayholder 1:Slot3:34	YHC15	PCB RES CHECK
Trayholder 1:Slot3:35	YHC16	PCBCS1
Trayholder 1:Slot3:36	YHC17	PCBCS2
Trayholder 1:Slot3:37	YHC18	PCBCS3
Trayholder 1:Slot3:38	YHC19	PCBCS4
Trayholder 1:Slot3:39	YHC20	PCBCS5
Trayholder 1:Slot3:40	YHC21	N
Trayholder 1:Slot3:41	YHC22	N
Trayholder 1:Slot3:14	YHC23	CNCS1
Trayholder 1:Slot3:15	YHC24	CNCS2
Trayholder 1:Slot3:16	YHC25	CNCS3
Trayholder 1:Slot3:17	YHC26	CNCS4
Trayholder 1:Slot3:18	YHC27	CNCS5
Trayholder 1:Slot3:40	YHC28	N
Trayholder 1:Slot3:41	YHC29	N
Trayholder 1:Slot3:42	YHC30	N
Trayholder 1:Slot3:43	YHC31	N
Trayholder 1:Slot3:44	YHC32	LAB BLANK 07/06/17
Trayholder 1:Slot3:45	YHC33	LAB BLANK FILTER 07/06/17
Trayholder 1:Slot3:46	YHC34	LAB BLANK RESIN 07/06/17
Trayholder 1:Slot3:47	YHC35	1450854 SOLID PHASE BLANK
Trayholder 1:Slot3:48	YHC36	1450863 VAPOUR PHASE BLANK
Trayholder 1:Slot3:49	YHC37	N
Trayholder 1:Slot3:50	YHC38	1450865 VAPOUR PHASE RUN 1
Trayholder 1:Slot3:51	YHC39	N
Trayholder 1:Slot3:52	YHC40	1450882 VAPOUR PHASE RUN 2
Trayholder 1:Slot3:53	YHC41	N
Trayholder 1:Slot3:54	YHC42	1450864 SOILID PHASE RUN 1
Trayholder 1:Slot3:55	YHC43	N
Trayholder 1:Slot3:56	YHC44	1450881 SOLID PHASE RUN 2
Trayholder 1:Slot3:57	YHC45	N
Trayholder 1:Slot3:58	YHC46	HRMS BLANK
Trayholder 1:Slot3:59	YHC47	DX3 07/06/17
Trayholder 1:Slot3:60	YHC48	N
Trayholder 1:Slot3:37	YHC49	PCBCS3
Trayholder 1:Slot3:37	YHC50	N
Trayholder 1:Slot3:42	YHC51	N
N= NONANE WASH		

APPENDIX 2

GLOSSARY

The following terms and abbreviations are used throughout this report.

PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuran
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
HpCDD	Heptachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran
OCDD	Octachlorodibenzo-p-dioxin
OCDF	Octachlorodibenzofuran
HxCDPE	Hexachlorodiphenyl ether
HpCDPE	Heptachlorodiphenyl ether
OCDPE	Octachlorodiphenyl ether
NCDPE	Nonachlorodiphenyl ether
DCDPE	Decachlorodiphenyl ether
TEF	Toxic Equivalent Factor
TEQ	Toxic Equivalent
I-TEF	International Toxic Equivalent Factor (NATO/CCMS)
I-TEQ	International Toxic Equivalent (NATO/CCMS)
LOQ	Limit of Quantitation