

ENVIRONMENTAL IMPACT STATEMENT

**A CHANGE OF FUEL TYPE FOR THE EXISTING LAGAN CEMENT PLANT,
KILLASKILLEN, KINNEGAD, CO WESTMEATH**

APPENDIX 9.IV

**Cement Kiln Emissions Monitoring Data: TMS Environment Ltd.
Report Ref: 8201, 8293, 8456**

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Confidential Report

Customer: Lagan Cement Ltd.
Killaskillen,
Kinnegad,
Co Westmeath.

Customer Ref:

F.T.A.O.: Tom McManus
Jude Lagan

TMS Environment Ref: 8201/8265

Order No	Commencement Date: 14/02/2005	Completion Date: 11/04/2005
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Report title: Emissions Survey at Main Stack ; Event 1

Report by:		
Jonathan Daly	Mary Murphy	Colm Staunton
Nichola Collard	Sheelagh Flanagan	Tom Ryan
Approved by:		
Nicholas Kenny Monitoring Group Manager		

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2. This report relates only to the items tested
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1.0 Scope

This report deals with a survey of emissions to the atmosphere from the main stack from the raw mill and cement kiln at Lagan Cement Ltd., Killaskillen, Kinnegad, Co Westmeath.

2.0 Survey protocol

TMS Environment Ltd personnel conducted the survey during visits to the plant on the 14th, 16th and 28th of February 2005. Air emissions to atmosphere from the main stack were monitored. Temperature and velocity were measured *in situ* using a thermocouple, pitot tube and manometer, respectively. HCl was determined by adsorption into a solution of H₂SO₄. HF was determined by a filtration process using an MCE filter followed by absorption into an alkaline solution to selectively remove halogens. Analysis was performed by ion selective electrode for HF and titration for HCl. Total Organic Substances were sampled using activated charcoal adsorption tubes and were analysed by Gas Chromatography-coupled-Mass Spectrometry (GCMS) following solvent desorption in the laboratory. Samples were collected over a 30-minute sampling period.

Sampling for metals was carried out using a Tecora isokinetic sampling system. A known volume of air was drawn through a sampling train where particulate metals were trapped by filter and vaporous metals were trapped in a prescribed adsorbing solution. This method was based on USEPA method 29 Determination of Metal Emissions from Stationary Sources.

Sampling for PAHs was carried out in accordance with the general requirements set out in ISO 11338-1 Stationary Source Emissions - Determination of gas and particle phase polycyclic aromatic hydrocarbons.

The concentrations of all substances are expressed relative to dry gas, 273K, 101.3kPa. Correction for oxygen is at a reference value of 10%.

3.0 Results

The results are presented in Table 1 below.

Table 1 Emissions to atmosphere from the main stack at Lagan Cement Ltd. Killaskillen, Co Meath. (Event 1)

EMISSION SOURCE	MAIN STACK
MEASURED EMISSIONS	
TEMPERATURE, °C	129.5
VELOCITY, m/sec	9.59
FLOW RATE, Nm ³ /hr (Dry gas, temperature & pressure corrected)	165,469
PARAMETER	CONCENTRATION , mg/Nm³
PAHs	< 1.30 x 10 ⁻²
HF	< 2.80 x 10 ⁻³
HCl	0.71
TOC	0.67
METALS	
Cd	< 3.54 x 10 ⁻⁴
Tl	1.66 x 10 ⁻³
Hg	6.71 x 10 ⁻⁴
As	4.12 x 10 ⁻²
Cr	1.84 x 10 ⁻³
Cu	0.22
Co	2.74 x 10 ⁻³
Mn	0.67
Ni	1.74
Pb	0.11
Sb	1.08 x 10 ⁻³
V	1.07 x 10 ⁻³

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Confidential Report

Customer: Lagan Cement Ltd.
Killaskillen,
Kinnefad,
Co Westmeath.


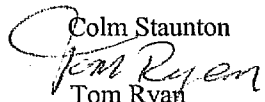
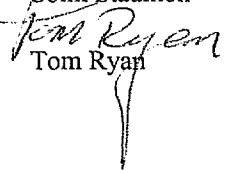
Customer Ref:

F.T.A.O.: Tom McManus
Jude Lagan

TMS Environment Ref: 8293, 8444

Order No	Commencement Date: 07/03/05	Completion Date: 22/04/05
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Report title: Emissions Survey at Main Stack ; Event 2

Report by: Johnathan Daly Nichola Collard Approved by:  Nicholas Kenny Monitoring Group Manager	 Mary Murphy Sheelagh Flanagan	 Colm Staunton  Tom Ryan
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2. This report relates only to the items tested
3. Complaints should be addressed in writing to the Laboratory Manager

1.0 Scope

This report deals with a survey of emissions to the atmosphere from the main stack from the raw mill and cement kiln at Lagan Cement Ltd., Killaskillen, Kinnegad, Co Westmeath.

2.0 Survey protocol

TMS Environment Ltd personnel conducted the survey during a visit to the plant on the 7th, 8th and 14th of March 2005. Air emissions to atmosphere from the main stack were monitored. Temperature and velocity were measured *in situ* using a thermocouple, pitot tube and manometer, respectively. HCl was determined by adsorption into a solution of H₂O. HF was determined by a filtration process using an MCE filter followed by absorption into an alkaline solution to selectively remove halogens. Analysis was preformed by ion selective electrode for (HF) and titration for chlorides as HCl. Total Organic Substances were sampled using activated charcoal adsorption tubes and were analysed by Gas Chromatography-coupled-Mass Spectrometry (GCMS) following solvent desorption in the laboratory. Samples were collected over a 30-minute sampling period.

Sampling for metals was carried out using a Tecora isokinetic sampling system. A known volume of air was drawn through a sampling train where particulate metals were trapped by filter and vaporous metals were trapped in a prescribed adsorbing solution. This method was based on USEPA method 29 Determination of Metal Emissions from Stationary Sources.

Sampling for PAHs was carried out in accordance with the general requirements set out in ISO 11338-1 Stationary Source Emissions - Determination of gas and particle phase polycyclic aromatic hydrocarbons.

The concentrations of all substances are expressed relative to dry gas, 273K, 101.3kPa. Correction for oxygen is at a reference value of 10%.

3.0 Results

The results are presented in Table 1 below.

Table 1 Emissions to atmosphere from the main stack at Lagan Cement Ltd. Killaskillen Co Westmeath. (Event 2)

EMISSION SOURCE	MAIN STACK
MEASURED EMISSIONS	
TEMPERATURE, °C	255.2
VELOCITY, m/sec	11.63
FLOW RATE, Nm ³ /hr (Dry gas, temperature & pressure corrected)	153,699
PARAMETER	CONCENTRATION , mg/Nm³
PAHs	< 5.60 x 10 ⁻³
HF	< 6.48 x 10 ⁻³
HCl	0.45
TOC	0.63
METALS	
Cd	< 1.59 x 10 ⁻⁴
Tl	2.61 x 10 ⁻³
Hg	< 5.22 x 10 ⁻⁴
As	1.04x 10 ⁻²
Cr	4.25 x 10 ⁻³
Cu	2.12 x 10 ⁻²
Co	< 2.19 x 10 ⁻²
Mn	8.97 x 10 ⁻³
Ni	1.54 x 10 ⁻²
Pb	3.12 x 10 ⁻³
Sb	9.27 x 10 ⁻⁴
V	1.67 x 10 ⁻³

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ENVIRONMENTAL IMPACT STATEMENT

**A CHANGE OF FUEL TYPE FOR THE EXISTING LAGAN CEMENT PLANT,
KILLASKILLEN, KINNEGAD, CO WESTMEATH**

APPENDIX 9.V

Cement Kiln Emissions Monitoring Data:

AES Report Ref: TMS-ENVIRO-9475

November 2004 and February 2005

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No 1181

Report for the Periodic Monitoring of Emissions to Air from Lagan Cement Co Westmeath

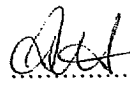
Nov-04

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Part 1: Executive Summary

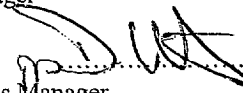
Contract Reference:	TMS-ENVIRO-9475
Client:	TMS Environment Ltd
Address:	53 Broomhill Drive, Tallaght, Dublin 24 Ireland
Contact:	Tom Ryan
Monitoring Organisation:	Analytical & Environmental Services Ltd Northumberland Dock Road Wallsend, Tyne & Wear, NE28 0QD Telephone: (0191) 2968500 Fax: (0191) 2968560 www.aes-labs.co.uk

Report written by
Designation

Andy Worthy 
Project Manager

Date... 8/3/05

Report Approved by
Designation
MCERTS Registration Number

Mark Elliott 
Air Emissions Manager
MM 02 006

Date... 8/3/05

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1.1

Monitoring Objectives

The scope of work of the monitoring as shown in the following table was required to demonstrate emission concentrations.

Substances to be monitored	Location
	Main Stack
Polychlorinated Byphthelys	1 x 6 hours
Dioxins and Furans	1 x 6 hours
Oxygen	With all tests
Temperature	With all tests
Flow	With all tests

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1.2

Monitoring Results

Main Stack (referenced to 273K, 101.3kPa, 10% oxygen, dry)

Substance to be Monitored	Run	Units	Emission Limit Value	Date of Sampling	Start and End Times	Periodic Monitoring	Uncertainty ($\pm\%$)	Vol. Flow (Nm ³ /min)	Moisture (%H ₂ O)	Oxygen (O ₂ % dry)	Monitoring Method	Accreditation for use
Dioxins and Furans	1	TTEQ(1)ng/Nm ³	N.A.	23-Nov-04	12:34-18:34	0.0065	27	2860	14	3.6	BS EN 1948	UKAS and MCERTS
		TTEQ(2)ng/Nm ³				0.0065	27					
		WHO-TTEQ(1)ng/Nm ³				0.0068	27					
		WHO-TTEQ(2)ng/Nm ³				0.0068	27					
PCB	1	WHO-TTEQ ng/Nm ³	N.A.	23-Nov-04	12:34-18:34	0.00061	27	2860	14	3.6	BS EN 1948	UKAS and MCERTS

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1.3

Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results			
								Substance	CEMS Results	Periodic Monitoring Results	Units
Main Stack	23-Nov-04	Cement Production	Continuous	Not Known	Not Known	Not Known	c.115 tonne/hr	Not Applicable			

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1.4

Monitoring Deviations

Emission Point Reference	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Main Stack	None	Due to restrictions around the sampling platform, monitoring could only be conducted from a limited number of sampling points.	None

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Report for the Periodic Monitoring of Emissions to Air

Part 2: Supporting Information

Permit Number: N.A.

Operator: Lagan Cement

Installation: Co Westmeath

Monitoring dates: 23/11/2004

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2.1.1 Monitoring organisation staff details

Name	Position	MCERTS Level	TE1	TE2	TE3	TE4	TE5	MCERTS registration No.
Sampling Team								
Jonathan Kelly	Team Leader	II	✓	✓				MM03 208
John McBride	Air Technician	I						MM 04 515
Report Writing								
Andrew Worthy	Project Manager	II	✓	✓	✓	✓		MM02 053
Report Authorisation								
Mark Elliott	Air Emissions Manager	II	✓	✓	✓	✓		MM02 006

2.1.2 Monitoring organisation method details

Determinand	In House Method ID	Reference Standard	Analytical Laboratory
Dioxins and Furans	A47	BS EN 1948	AES

Monitoring organisation equipment check list references

2.1.3

Equipment Checklist Ref: TMS-ENVIRO-9475
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Calculation of Stack Gas Velocities, Volumetric Flow and Emission Concentrations

Total pressure (mm Hg) =	Atmospheric pressure(mm Hg) + static pressure (mm Hg)
Dry Gas volume sampled @ ntp (Nm3) =	$\frac{\text{Dry gas volume sampled(l)} * 273 * \text{Atmospheric pressure(mm Hg)}}{1000 * \text{average ambient temp(K)} * 760}$
Bws =	$\frac{\text{mass H2O collected (g)} * 0.001333}{\text{Dry gas volume sampled@ntp(Nm3)} + (\text{mass H2O collected(g)} * 0.001333)}$
Wet Gas volume sampled @ ntp (Nm3)=	Dry gas volume sampled@ntp(Nm3)+(mass H2O collected(g) * 0.001333)
Mol. Wt. of wet gas =	Mol. Wt. dry gas * (1-Bws) + 18*Bws Default value for wt. of dry gas = 29.5 (Comb. Process)
Actual mean gas velocity (m/s) =	$\frac{34.97 * \text{Pitot Coefficient} * \text{root delta P (mm H2O)} * (\text{Stack temp. (K)})^{0.5}}{(\text{Mol wt of wet gas} * \text{total pressure(mm Hg)})^{0.5}}$
Actual mean gas velocity @ ntp (m/s) =	$\frac{\text{Actual gas velocity(m/s)} * \text{total pressure(mm Hg)} * 273}{\text{stack temperature(K)} * 760}$
Stack cross section area (m2) =	[(stack diameter (m))^2*(π/4)]
Actual volume flow (m ³ /min) =	60* c.s.a.(m2)* actual gas velocity (sampling) (m/s)
Corrected Volume flow @ 11% Oxygen, Dry (Nm ³ /min) =	60*stack c.s.a(m2)*mean actual gas velocity (m/s)*ref temp (K)/Duct temp (K)*total pressure (mmHg)/ref. Pressure*((100 - BWS)/100)*((20.9-measured O2)/(20.9-ref O2))
Pollutant Concentration @ 11% Oxygen, Dry (mg/Nm3) =	$\frac{\text{Mass of Pollutant collected (mg) or ng ITEQ}}{\text{Dry gas volume sampled @ ntp(Nm3)}}$
Isokinetic Rate=	$\frac{4639800 * \text{Stack Temp (K)} * \text{Dry Gas volume sampled @ntp(Nm3)}}{\text{total pressure (mmHg)} * \text{gas velocity at sampling points(m/s)} * \text{nozzle csa(mm2)} * \text{run time(min)} * \text{Bws}}$

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Analytical and Environmental Services
Velocity and Temperature Data

DATE: 23-Nov-04

JOB REF.: 9475

Client:
Location:
Stack:
Pitot Type:
Bar. Pressure:
Ambient Temp.:
Stack O2 (%):
Stack CO2 (%):
Stack Moisture (%):

TMS Environmental		
Lagan Cement		
Kiln Stack		
s	Pitot Cp:	0.83
101.8	Static:	
10		
-13		
N/A		
-13		

Operators:
Test For:
In-house method:
Probe ID:
Duct Shape : Circle (C) or Square (S)
Stack Diameter (mm):
Port Length (mm):
Area (m²):

JK JMC		
PM and D & F		
A47 A55		
829	Meter ID:	3291
		c
3000	by	0
	260	
	7.07	

Traverse Point Number	Distance (mm)	Sample Port 1			Sample Port 2		
		Temp °C	ΔP cm H ₂ O	Sq.root ΔP	Temp °C	ΔP cm H ₂ O	Sq.root ΔP
1	150	129	0.325	0.57	129	0.375	0.61
2	450	129	0.375	0.61	129	0.375	0.61
3	750	129	0.4	0.63	129	0.375	0.61
4	1050	130	0.425	0.65	129	0.4	0.63
5	1350	129	0.4	0.63	128	0.425	0.65
6	1650	129	0.425	0.65	128	0.45	0.67
7	1950	129	0.45	0.67	128	0.425	0.65
8	2250	128	0.45	0.67	128	0.475	0.69
9	2550	127	0.45	0.67	127	0.475	0.69
10	2850	126	0.5	0.71	126	0.45	0.67
Total	T _A =	1285			T _B =	1281	
Average		128.5	0.42	0.65	128.1	0.42	0.65

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CLIENT: TMS Environmental

LOCATION: Lagan Cement

DATE: 23-Nov-04

STACK: Kiln Stack

TIME OF SAMPLING: 12:34-18:34

SAMPLING DATA		Dioxins & Furans Run		1	
Run Time (min)	360				
Total mass H ₂ O collected (g)	585.6				
Pilot tube constant, C _p	0.78				
Dry gas meter (DGM) volume (litres)	4683.77				
Temperature DGM (°C)	13				
Temperature stack (°C)	210				
Mean pilot tube pressure drop (traverse), delta P(cm H ₂ O)	0.42				
Mean pilot tube pressure drop at sample point (traverse), delta P(cm H ₂ O)	0.42				
Mean pilot tube pressure drop (sample run), delta P(cm H ₂ O)	0.44				
Mean orifice pressure drop, delta H(cm H ₂ O)	2.13				
Barometric Pressure (kPa)	101.8				
X-sectional area of stack (m ²)	7.07				
Nozzle Size (cm)	0.795				
% Isokinetic	99				
Reference Conditions					
Temperature (K)	273				
Pressure (kPa)	101.3				
Oxygen (%)	10				
Flow Data					
Velocity, actual (m/s)	8.713				
Velocity, ntp (m/s)	4.935				
Vol.Flow, actual (m ³ /min)	3695				
Vol.Flow, ntp wet gas	2093				
Vol.Flow, ntp dry gas ref. oxygen (m ³ /min)	2860				
Volume sampled, ntp, dry gas (Nm ³)	4.493				
Volume sampled, ntp, wet gas (Nm ³)	5.219				
Analytical Data (pg ITEQ collected)					
		ITEQ(1)	ITEQ(2)		
2,3,7,8-TCDF		10.834	10.834		
2,3,7,8-TCDD		1.733	1.733		
1,2,3,7,8-PeCDF		1.938	1.938		
2,3,4,7,8-PeCDF		11.974	11.974		
1,2,3,7,8-PeCDD		2.64	2.64		
1,2,3,4,7,8-HxCDF		8.165	8.165		
1,2,3,6,7,8-HxCDF		2.776	2.776		
2,3,4,6,7,8-HxCDF		1.42	1.42		
1,2,3,7,8,9-HxCDF		0.30	0.30		
1,2,3,4,7,8-HxCDD		0.44	0.44		
1,2,3,6,7,8-HxCDD		0.772	0.772		
1,2,3,7,8,9-HxCDD		0.416	0.416		
1,2,3,4,6,7,8-HpCDF		1.59	1.59		
1,2,3,4,7,8,9-HpCDF		0.636	0.636		
1,2,3,4,6,7,8-HpCDD		0.332	0.332		
OCDF		0.415	0.415		
OCDD		0.027	0.027		
Total Dioxins / Furans		46.407	46.407		
Concentration Data					
		wet gas		dry gas @ ref.O2	
(ng/Nm ³ ITEQ unless otherwise stated)		ITEQ(1)	ITEQ(2)	ITEQ(1)	ITEQ(2)
				WHO-TEQ (1) WHO-TEQ(2)	
O ₂ (% vol) dry	3.6				
H ₂ O (% vol)	13.9				
2,3,7,8-TCDF		0.00208	0.00208	0.00152	0.00152
2,3,7,8-TCDD		0.0003	0.0003	0.0002	0.0002
1,2,3,7,8-PeCDF		0.00037	0.00037	0.00027	0.00027
2,3,4,7,8-PeCDF		0.00229	0.00229	0.00168	0.00168
1,2,3,7,8-PeCDD		0.0005	0.0005	0.0004	0.0004
1,2,3,4,7,8-HxCDF		0.00156	0.00156	0.0011	0.0011
1,2,3,6,7,8-HxCDF		0.00053	0.00053	0.00039	0.00039
2,3,4,6,7,8-HxCDF		0.00027	0.00027	0.00020	0.00020
1,2,3,7,8,9-HxCDF		0.0001	0.000057	0.00004	0.000042
1,2,3,4,7,8-HxCDD		0.0001	0.00008	0.00006	0.000062
1,2,3,6,7,8-HxCDD		0.000148	0.00015	0.000108	0.00011
1,2,3,7,8,9-HxCDD		0.000080	0.00008	0.000058	0.00006
1,2,3,4,6,7,8-HpCDF		0.000305	0.000305	0.000223	0.000223
1,2,3,4,7,8,9-HpCDF		0.0001219	0.0001219	0.0000892	0.0000892
1,2,3,4,6,7,8-HpCDD		0.000064	0.000064	0.000047	0.000047
OCDF		0.00007952	0.00007952	0.0000582	0.00005820
OCDD		0.0000052	0.0000052	0.0000038	0.0000038
Total Dioxins / Furans		0.0089	0.0089	0.0065	0.0065

CLIENT: TMS Environmental

LOCATION: Lagan Cement

DATE:

23-Nov-04

STACK: Kiln Stack

TIME OF SAMPLING:

12:34-18:34

SAMPLING DATA		PCB Run		1	
Run Time (min)		360			
Total mass H ₂ O collected (g)		585.6			
Pitot tube constant, C _p		0.78			
Dry gas meter (DGM) volume (litres)		4683.77			
Temperature DGM (°C)		13.0			
Temperature stack (°C)		210.0			
Mean pitot tube pressure drop (traverse), delta P(cm H ₂ O)		0.42			
Mean pitot tube pressure drop at sample point (traverse), delta P(cm H ₂ O)		0.42			
Mean pitot tube pressure drop(sample run) , delta P(cm H ₂ O)		0.44			
Mean orifice pressure drop,delta H(cm H ₂ O)		2.13			
Barometric Pressure (kPa)		101.8			
X-sectional area of stack (m ²)		7.069			
Nozzle Size (cm)		0.795			
% Isokinetic		98.63			
Reference Conditions					
Temperature (K)		273			
Pressure (kPa)		101.3			
Oxygen (%)		10			
Flow Data					
Velocity, actual (m/s)		8.71			
Velocity, ntp (m/s)		4.93			
Vol.Flow, actual (m ³ /min)		3695.5			
Vol.Flow, ntp wet gas		2093.0			
Vol.Flow, ntp dry gas ref. oxygen (m ³ /min)		2859.7			
Volume sampled, ntp, dry gas (Nm ³)		4.493			
Volume sampled, ntp, wet gas (Nm ³)		5.219			
Analytical Data (ng/collected)					
Pentachloro, BZ#105		0.27			
Pentachloro, BZ#114		0.033			
Pentachloro, BZ#118		0.70			
Pentachloro, BZ#123		0.13			
Hexachloro, BZ#156		0.050			
Hexachloro, BZ#157		0.022			
Hexachloro, BZ#167		0.041			
Heptachloro, BZ#189		0.011			
Tetrachloro, BZ#81		0.25			
Tetrachloro, BZ#77		1.3			
Pentachloro, BZ#126		0.045			
Hexachloro, BZ#169		nd			
Total PCB		2.85			
Concentration Data					
(ng/Nm ³ unless otherwise stated)		wet gas		dry gas @ ref.O ₂	
		As measured	WHO-TEQ	As Measured	WHO-TEQ
O ₂ (% vol)dry	3.6				
H ₂ O (% vol)	13.9				
Pentachloro, BZ#105		0.052	0.0000052	0.034	0.0000034
Pentachloro, BZ#114		0.0063	0.0000032	0.0042	0.0000021
Pentachloro, BZ#118		0.134	0.0000134	0.089	0.0000089
Pentachloro, BZ#123		0.025	0.0000025	0.017	0.0000017
Hexachloro, BZ#156		0.010	0.0000048	0.0064	0.0000032
Hexachloro, BZ#157		0.0042	0.0000021	0.0028	0.0000014
Hexachloro, BZ#167		0.0079	0.00000079	0.0052	0.00000052
Heptachloro, BZ#189		0.0021	0.00000021	0.0014	0.00000014
Tetrachloro, BZ#81		0.048	0.0000048	0.032	0.0000032
Tetrachloro, BZ#77		0.25	0.000025	0.17	0.000017
Pentachloro, BZ#126		0.0086	0.000086	0.0057	0.000057
Hexachloro, BZ#169		ND	ND	ND	ND
Total PCB		0.55	0.00092	0.40	0.00061

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Conor McSweeney

Analytical & Environmental Services Ltd
 Northumberland Dock Road
 Wallsend
 Tyne & Wear
 NE28 0QD
 Tel. 0191 2968500 Fax. 0191 2968535

Client: **TMS ENVIRONMENT LTD**
 Contract: **TMS-ENVIRO-9475**
Ambient Dioxin Testing & Analysis

Sample ID Number	Description	Date Taken	Date Received	Date Started	Method	O055	O084
					Dioxin/Furan (CEN Method)	WHO PCBs	
3020699	LAGAN CEMENT MAIN STACK DIOXIN RUN MIXED SOLVENT/TOLUENE WASH/RESIN TRAP/FILTER/CONDENSATE	23/11/04	26/11/2004	26/11/2004	D3120	D3127P	
3020700	LAGAN CEMENT MAIN STACK DIOXIN BLANK MIXED SOLVENT/TOLUENE WASH/RESIN TRAP/FILTER	23/11/04	26/11/2004	26/11/2004	D3121	D3128P	

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Authorised by: *Brian Gardner* Brian Gardner, Analytical Manager

Tests marked "*" in this report are NOT included in the UKAS accreditation schedule for this laboratory.

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 In the event of a query please contact them on the above number
 Opinions and interpretations expressed herein are out side the scope of UKAS accreditation
 Results relate only to the items tested