

## Report for Periodic Monitoring of Emissions to Atmosphere

Part 1: **Executive Summary**

Permit Number: **RP3133LD**

Operator: **RWE Generation UK plc.**

Installation: **Aberthaw Power Station**

Emission Points: **Unit 7, Unit 8, Unit 9**

Monitoring Date: **4<sup>th</sup> March 2016 & 2<sup>nd</sup> November 2016**



Contract Reference: FTBS 39556

Operator: RWE Generation UK plc.

Address: Aberthaw Power Plant  
The Leys  
Aberthaw, Nr Barry  
South Glamorgan  
CF62 4ZW

Monitoring Organisation: RPS Consultants

Address: Noble House, Capital Drive, Linford  
Wood, Milton Keynes, MK14 6QP

Report Date: 1<sup>st</sup> February 2017

Report Approved By: Glyn Harrison

Position: Operations Manager

MCERTS Registration Number: MM 03 228

MCERTS Certification Level: 2

Technical Endorsements: TE1, TE2, TE3, TE4

Signature:

A handwritten signature in black ink, appearing to read 'Glyn Harrison', enclosed within a rectangular box.

RPS Consultants has produced this report within the term of the contract with the client and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

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## Monitoring Objectives

At the request of Richard Kadim of RWE Generation UK plc, RPS Consultants conducted stack emission monitoring at the Aberthaw site in March and November 2016.

The monitoring programme at this installation was carried out to provide data on emissions to atmosphere for comparison with the limits specified in the air emission criteria for this site.

The following tables detail the parameters requested for monitoring at each emission point and the actual monitoring conducted.

**Table 1.1**

Parameters Requested to be Monitored	Emission Point
	Unit 7
Total Mercury	✓
<b>Specific Requirements</b>	None

Notes:

✓ Represents pollutants sampled

**Table 1.2**

Parameters Requested to be Monitored	Emission Point
	Unit 8
Total Mercury	✓
<b>Specific Requirements</b>	None

Notes:

✓ Represents pollutants sampled

**Table 1.3**

Parameters Requested to be Monitored	Emission Point
	Unit 9
Total Mercury	✓
<b>Specific Requirements</b>	None

Notes:

✓ Represents pollutants sampled

## Monitoring Results

**Table 2.1 Monitoring results for Unit 7, Carried out on the 4<sup>th</sup> March 2016.**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Mercury	No Limit	0.00068	mg/m <sup>3</sup>	+/- 0.000092	273K, 101.3kPa, Dry, 6% O <sub>2</sub>	04/03/2016	12:00 – 13:00	EN 13211:2001	MCERTS	Normal
	-	0.0011	Kg/hr	-						

**Table 2.2 Monitoring results for Unit 8, Carried out on the 2<sup>nd</sup> November 2016**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Mercury	No Limit	0.00066	mg/m <sup>3</sup>	+/- 0.000095	273K, 101.3kPa, Dry, 6% O <sub>2</sub>	02/11/2016	11:41 – 12:41	EN 13211:2001	MCERTS	Normal
	-	0.00097	Kg/hr	-						

**Table 2.3 Monitoring results for Unit 9, Carried out on the 4<sup>th</sup> March 2016.**

Substance Monitored	Emission Limit Value	Periodic Monitoring Result	Units	Uncertainty (Expressed expanded k=2)	Reference Conditions 273K, 101.3kPa	Sampling Date	Sampling Times	Monitoring Reference Method	Accreditation Status	Operating Status
Total Mercury	No Limit	0.0042	mg/m <sup>3</sup>	+/- 0.00063	273K, 101.3kPa, Dry, 6% O <sub>2</sub>	04/03/2016	10:28 – 11:28	EN 13211:2001	MCERTS	Normal
	-	0.0057	Kg/hr	-						

## Operating Information

**Table 3.1 Operating conditions during the monitoring of Unit 7 carried out on the 4<sup>th</sup> March 2016.**

Parameter	Result
Sample Date	04/03/2016
Process Type	Continuous
Process Duration	N/A
If 'Batch', was monitoring carried out over the whole batch?	N/A
Abatement/Operational?	Bag Filter / Operational

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.2 Operating conditions during the monitoring of Unit 8 carried out on the 2<sup>nd</sup> November 2016**

Parameter	Result
Sample Date	02/11/2016
Process Type	Continuous
Process Duration	N/A
If 'Batch', was monitoring carried out over the whole batch?	N/A
Abatement/Operational?	Bag Filter / Operational

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

**Table 3.3 Operating conditions during the monitoring of Unit 9 carried out on the 4<sup>th</sup> March 2016.**

Parameter	Result
Sample Date	04/03/2016
Process Type	Continuous
Process Duration	N/A
If 'Batch', was monitoring carried out over the whole batch?	N/A
Abatement/Operational?	Bag Filter / Operational

Comparison of Operator CEM and Periodic Monitoring Results		
Substance	CEMs Results (mg/m <sup>3</sup> )	Periodic Monitoring Results (mg/m <sup>3</sup> )
No CEMS Installed/Data Available		

## Monitoring Deviations

**Table 4.1 Monitoring Deviations for Emission Point Unit 7**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Mercury.	None	Due to the size of duct and limited space, we were unable to monitor at all the points along the duct.	None

**Table 4.2 Monitoring Deviations for Emission Point Unit 8**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Mercury.	None	Due to the size of duct and limited space, we were unable to monitor at all the points along the duct.	None

**Table 4.3 Monitoring Deviations for Emission Point Unit 9**

Pollutant	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Total Mercury.	None	Due to the size of duct and limited space, we were unable to monitor at all the points along the duct.	None



## Report for Periodic Monitoring of Emissions to Atmosphere

Part 2: **Supporting Information**

Permit Number: **RP3133LD**

Operator: **RWE Generation UK plc.**

Installation: **Aberthaw Power Station**

Emission Points: **Unit 7, Unit 8, Unit 9**

Monitoring Date: **4<sup>th</sup> March 2016 & 2<sup>nd</sup> November 2016**



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Address: Noble House, Capital Drive, Linford  
Wood, Milton Keynes, MK14 6QP

Report Date: 1<sup>st</sup> February 2017

Report Approved By: Glyn Harrison

Position: Operations Manager

MCERTS Registration Number: MM 03 228

MCERTS Certification Level: 2

Technical Endorsements: TE1, TE2, TE3, TE4

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#### **Appendix 1 – Staff & Methodology Details**

#### **Appendix 2 – Unit 7 Sampling, Analysis & Uncertainty Data**

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#### **Appendix 4 – Unit 8 Sampling, Analysis & Uncertainty Data**

#### **Appendix 5 – Certificates of analysis**

## **APPENDIX 1: General Information**

## Monitoring Organisation Staff Details

**Table 5.1 Sampling Personnel**

Sampling Personnel	Role	MCERTS Level	Technical Endorsements	MCERTS Registration Number
Edwin Powell	Team Leader	Level 2	TE1, TE2, TE3, TE4	MM 05 621
Dan Lewis	Technician	Level 1	-	MM 14 1291

**Table 5.2 Report Author**

Report Author	Position	MCERTS Level	Technical Endorsements	MCERTS Registration Number
Dan Lewis	Technician	Level 1	-	MM 14 1291

**Table 5.3 Report Reviewer**

Report Reviewer	Position	MCERTS Level	Technical Endorsements	MCERTS Registration Number
Glyn Harrison	Operations Manager	Level 2	TE1, TE2, TE4	MM 03 228

## Monitoring Organisation Method Details

**Table 6.1 Monitoring Methods**

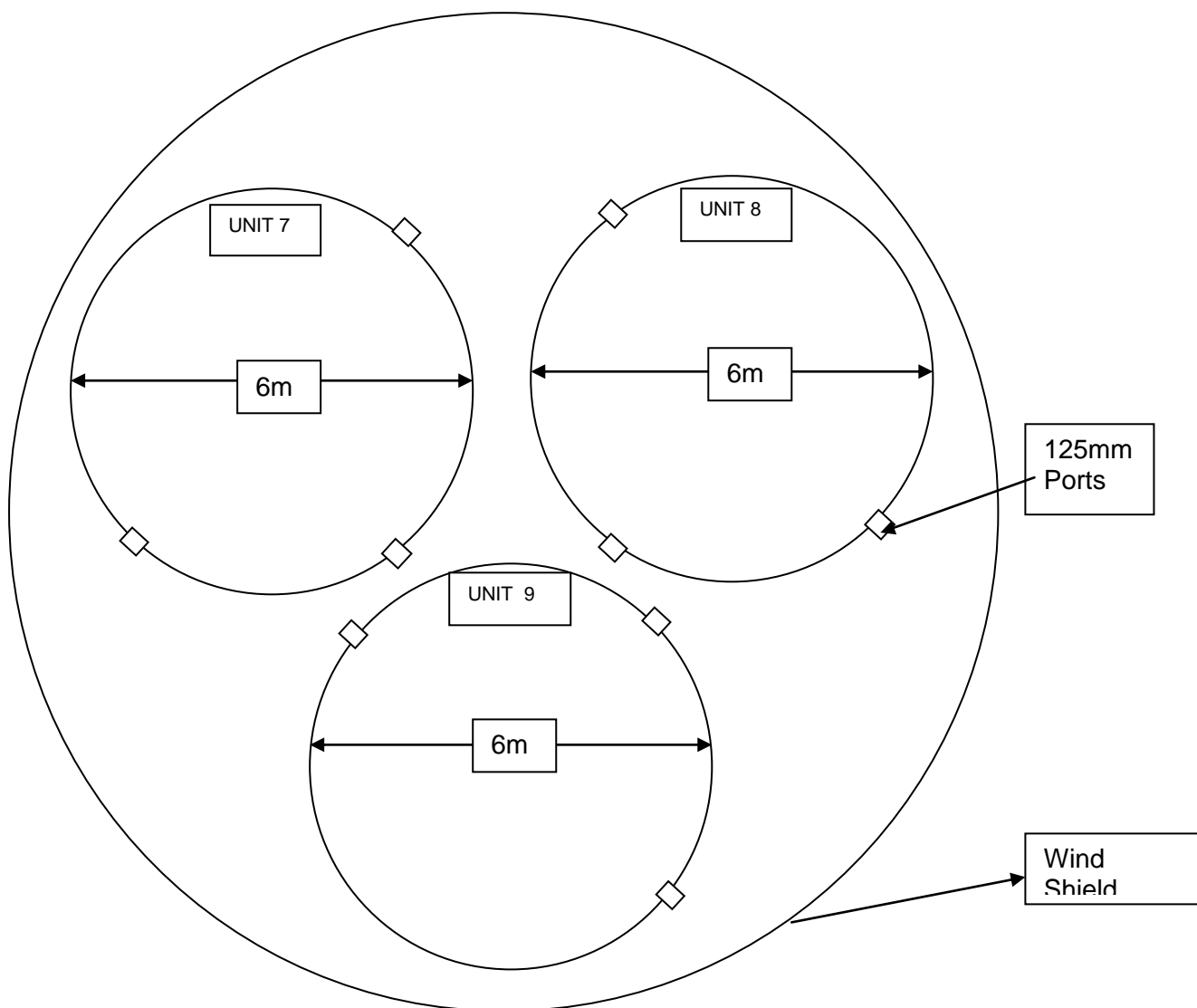
Emission Parameter	Standard Method	Monitoring Procedure No.	Monitoring Accreditation	Analysis	Analysis Procedure No.	Analytical Laboratory	Analysis Accreditation
Practical Considerations Prior to Monitoring	N/A	RPSCE/1/1	UKAS	N/A	N/A	N/A	N/A
Gas Flows	BS-EN 13284-1:2001	RPSCE/1/2	MCERTS	N/A	N/A	N/A	N/A
Gas Temperatures	BS-EN 13284-1:2001	RPSCE/1/2	MCERTS	N/A	N/A	N/A	N/A
Total mercury	EN 13211:2001	RPSCE/1/9b	MCERTS	ICP	M1	RPS Laboratories	UKAS

**Table 7.1 – Checklist Used**

Equipment Checklist Used	File Location Address
FTBS39556 Checklist	FTBS39556 Electronic & Work File

## **APPENDIX 2: Unit 7 Sampling, Analysis & Uncertainty Data**

### Unit 7, 8 & 9 Stack Diagram



Company Name: Aberthaw Power Station  
Site Name: Aberthaw  
Sampling Point Ref: Unit 7  
Project Reference: FTBS 29312

Date: 04/03/16  
Run: Metals

Mean Stack Temperature, °C 56.000

Traverse Stack Velocity, m/s 16.588

Stack Gas Volume Flow Rate, m³/s (acms) 469.022

Stack Gas Volume Flow Rate, m³/s. Dry, STP and O2 Corrected 395.348

Δp Measurement units  
(Pa or mmH2O) mmH2O

Pitot Coefficient 0.827

<b>Barometric</b>	753	mmHg	<b>Leak Test</b>		
<b>Static</b>			Instrument range	250	mmH2O
Port A	-24	mmH2O	Δp for leak test	187.5	mmH2O
Port B	-24	mmH2O	Positive leakage rate	0	per 15secs
<b>Mean</b>	-24	mmH2O	Negative leakage rate	0	per 15secs
			Pass/Fail	Pass	

<b>Stagnation Test</b>	
Static measurement	
Positive side	-24 mmH2O
Negative side	-24 mmH2O
Difference (Pa)	0
Pass/Fail	Pass

<b>Stack Dimensions</b>	
Rectangular A	(Width) m
Rectangular B	(Length) m
Circular diam A	6 m
Circular diam B	6 m
Circular Mean	6 m
Area	28.27431 m²

Traverse Point	Distance m	Port A							Port B						
		Δ p, mmH2O				Swirl Degrees	Temp °C	Average	Δ p, mmH2O			Swirl Degrees	Temp °C	Average	
		Reading 1	Reading 2	Reading 3	Average				Reading 1	Reading 2	Reading 3				
1	0.20	22	22	22	22	0	56	22	22	22	22	0	56	22	
2	0.63	21	21	21	21	0	56	21	23	23	23	0	56	23	
3	1.16	23	23	23	23	0	56	23	24	24	24	0	56	24	
4	1.94														
5	4.06														
6	4.84	23	23	23	23	0	56	23	24	24	24	0	56	24	
7	5.37	24	24	24	24	0	56	24	23	23	23	0	56	23	
8	5.80	21	21	21	21	0	56	21	22	22	22	0	56	22	
9															
10															

<b>Gas Data</b>	
Oxygen %	5.28
CO <sub>2</sub> %	13.53
CO %	

<b>Oxygen Correction</b>	
Required Correction Value	6
Actual Oxygen Factor	0.95
Leave BLANK if no O2 correction is required	

<b>BS EN 13284-1 &amp; M1 Sample Point Requirements</b>	<b>Requirement Met?</b>
Duct gas Flow: angle with regard to duct access <15°?	Y
Duct Gas Flow: No Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	Y
Working Area > 5m²?	
Handrails with removable chains / self closing gates across the top of the ladder?	
Handrails (approx 0,5 and 1,0 m high) and vertical baseboards (approx 0,25m high)?	
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m2 loading	
Handrails not restricting access to ports?	
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	

Authorisation/Permit Number: RP3133LD

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Company Name: Aberthaw Power Station In-stack Filter? **N** Bar. Press.mm Hg **753** K Factor **0.498247828** Ambient Temp. **15.33333333** Leak Rate (fin / %) **0.46**  
 Site Name: Aberthaw Outstack Filter? **Y** Cp **0.827** Dn used **3.917** Start Time **12:00** Leak Rate (start / %) **0.96**  
 Project Reference: FTBS 29312 Date: **04/03/16** Operators **EP DL** Bws% **1.26** Nozzle No. **0** Stop Time **13:00** Box/Probe setting **160 +/- 5 °C**  
 Run: Metals Meter Correction Yd **0.988**

Sample Filter Analysis

	Analysis Result (ug)	Analysis Blank Results (ug)	Analysis Result (mg)
Mercury	0.1070	0.0945	0.0001

Sample Impinger & Wash Solution Analysis

	Analysis Result (ug)	Analysis Blank Results (ug)	Analysis Result (mg)
Mercury	0.3714	0.0002	0.0004

Sample ID Nos

	Sample	Blank
Filter		
Wash		
Imp 1 & 2		
Imp 3		
HG Imp 1	30009052	30009048
HG Imp2	30009053	30009049

Sample Filter Blank Weighings

Weights	Initial	Final	Increase, mg
Impinger 1			
Impinger 2			
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel			
Total			10.5

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp, °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p,
				Desired	Actual								
	0	30	52	14.94743483	16	3234566.8	16		180	180	0	8	5.477
	5	29	52	14.449187	15		16		180	180	0	8	5.385
	10	29	52	14.449187	15		17		180	180	0	8	5.385
	15	28	52	13.95093917	15		17		180	180	0	9	5.292
	20	31	52	15.44568265	17		17		180	180	0	9	5.568
	25	31	52	15.44568265	17		17		180	180	0	9	5.568
Endpoint	30												
	0	31	52	15.44568265	17	3235295.5	18		180	180	0	10	5.568
	5	31	52	15.44568265	17		18		180	180	0	10	5.568
	10	32	52	15.94393048	17		18		180	180	0	10	5.657
	15	32	52	15.94393048	17		18		180	180	0	10	5.657
	20	32	52	15.94393048	17		18		180	180	0	10	5.657
	25	28	52	13.95093917	15		18		180	180	0	11	5.292
Endpoint	30												
	60.00	30.333	52.0	15.1	16.2	0.7	17.3	#DIV/0!	180.0	180.0	0.0	9.3	5.506

### Uncertainty Calculation for Metals to BS EN 14385

Measured Values		
Sampled Volume	0.7287	m <sup>3</sup>
Sampled gas Temperature	290.3333333	K
Sampled gas Pressure	100.16	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	5.28	% by volume
Volume Impinger 1 + 2	213	ml
Volume Impinger 3	189	ml
Total Impinger Volume	402	litre
Leak	0.71	%

Standard Uncertainties for Measured Values		
Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Volume in Impinger	0.001	litre

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.930			Oxygen Correction Factor	0.9539		
	Sensitivity Coefficient		Uncertainty, Uv		Sensitivity Coefficient		Uncertainty, Uo
Sampled gas Temperature	0.0032		0.0064	Oxygen Measurement	0.0608		0.0061
Sampled gas Pressure	0.0093		0.0093				
Sampled gas Humidity	0.0093		0.0093				
	Sqrt (Uv)*2		0.0146				
	Total Uv		0.011		Total Uo		0.0061

Metal	Total Mass - Impingers	Total Mass - Part Fraction	Analytical uncertainty %		Standard Uncertainties - Mass		Concentration (mg/m <sup>3</sup> )	Itemised Uncertainty Contributions				Uncertainty Contributions - Concentration (mg/m <sup>3</sup> )				Calculated Uncertainties	
								Sensitivity Coefficients									
			Particulate	Impingers	Particulate	Impingers		Volume Correction	Mass Analyte	Oxygen Correction	Leaks	Volume Correction	Mass Analyte	Oxygen Correction	Leaks	Expanded - mg/m <sup>3</sup>	% of Result
Mercury	0.0003714	0.000107	6	5	0.0	0.000	0.000679763	0.001012556	1.42091	0.00	1.00	1.0832E-05	2.7919E-05	0.00	2.79863E-06	0.000092	14
(Uncertainty has been expanded with a coverage factor of 2 (K=2))																	

Company Name: Aberthaw Power Station  
Site Name: Aberthaw  
Sampling Point Ref: Unit 7  
Run: Metals

Date: 04/03/16  
Run: Metals

Barometric Pressure, mm Hg	753.00
Stack Pressure, mm Hg	751.23
Volume of Water as gas at STP, scm	0.013
Meter Volume (Standardised m <sup>3</sup> ), Dry	0.671
Meter Volume (Standardised m <sup>3</sup> ) Wet	0.684
Stack Moisture Content, %	1.9
%O <sub>2</sub>	5.28
Average Stack Velocity, m/sec	19.07
Stack Area, m <sup>2</sup>	28.27
Stack Flow Rate, (Actual m <sup>3</sup> /s)	539.253
Stack Flow Rate (Standardised m <sup>3</sup> /s) wet	469.109
Stack Flow Rate, (Standardised m <sup>3</sup> /s), dry	460.142
Nozzle Diameter, mm	3.92
% Isokinetic Variation	99.5

**SAMPLE CONCENTRATIONS & MASS EMISSION RATES**

Analyte	Concentration. Dry, STP, and O2 Corrected (Particulate Phase - mg/m3)	Concentration. Dry, STP, and O2 Corrected (Vapour Phase, mg/m3)	Mass Concentration, Dry, STP, and O2 Corrected (mg/m3)	Mass Emissions Dry, STP, and O2 Corrected (Kg/hr)	ELV
Mercury	0.00015	0.00053	0.00068	0.00113	

**BLANK CONCENTRATIONS & MASS EMISSIONS RATES**

Analyte	Concentration. Dry, STP, and O2 Corrected (Particulate Phase - mg/m3)	Concentration. Dry, STP, and O2 Corrected (Vapour Phase, mg/m3)	Mass Concentration, Dry, STP, and O2 Corrected (mg/m3)	Mass Emissions Dry, STP, and O2 Corrected (Kg/hr)
Mercury	0.00013	0.00000030	0.00013	0.00022

## **APPENDIX 3: Unit 9 Sampling, Analysis & Uncertainty Data**

Company Name: Aberthaw Power Station  
Site Name: Aberthaw  
Sampling Point Ref: Unit 9  
Project Reference: FTBS 29312

Date: 04/03/16  
Run: Metals

Mean Stack Temperature, °C 70.000

Traverse Stack Velocity, m/s 18.101

Stack Gas Volume Flow Rate, m³/s (acms) 511.789

Stack Gas Volume Flow Rate, m³/s. Dry, STP and O2 Corrected 399.030

Δp Measurement units  
(Pa or mmH2O) mmH2O

Pitot Coefficient 0.827

<b>Barometric</b>	753	mmHg	<b>Leak Test</b>		
<b>Static</b>			Instrument range	250	mmH2O
Port A	-26	mmH2O	Δp for leak test	187.5	mmH2O
Port B	-26	mmH2O	Positive leakage rate	0	per 15secs
<b>Mean</b>	-26	mmH2O	Negative leakage rate	0	per 15secs
			Pass/Fail	Pass	

<b>Stagnation Test</b>	
Static measurement	
Positive side	-26 mmH2O
Negative side	-26 mmH2O
Difference (Pa)	0
Pass/Fail	Pass

<b>Stack Dimensions</b>	
Rectangular A	(Width) m
Rectangular B	(Length) m
Circular diam A	6 m
Circular diam B	6 m
Circular Mean	6 m
Area	28.27431 m²

Traverse Point	Distance m	Port A							Port B						
		Δ p, mmH2O				Swirl Degrees	Temp °C	Average	Δ p, mmH2O			Swirl Degrees	Temp °C	Average	
		Reading 1	Reading 2	Reading 3	Average				Reading 1	Reading 2	Reading 3				
1	0.20	22	22	22	22	0	70		23	23	24	23	0	70	
2	0.63	23	23	23	23	0	70		25	25	25	25	0	70	
3	1.16	23	23	23	23	0	70		28	28	28	28	0	70	
4	1.94														
5	4.06														
6	4.84	26	26	26	26	0	70		28	28	28	28	0	70	
7	5.37	28	28	28	28	0	70		26	26	26	26	0	70	
8	5.80	32	32	32	32	0	70		27	27	27	27	0	70	
9															
10															

<b>Gas Data</b>	
Oxygen %	5.81
CO <sub>2</sub> %	13.55
CO %	

<b>Oxygen Correction</b>	
Required Correction Value	6
Actual Oxygen Factor	0.99
Leave BLANK if no O2 correction is required	

<b>BS EN 13284-1 &amp; M1 Sample Point Requirements</b>	<b>Requirement Met?</b>
Duct gas Flow: angle with regard to duct access <15°?	Y
Duct Gas Flow: No Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	Y
Working Area > 5m²?	
Handrails with removable chains / self closing gates across the top of the ladder?	
Handrails (approx 0,5 and 1,0 m high) and vertical baseboards (approx 0,25m high)?	
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m2 loading	
Handrails not restricting access to ports?	
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	

Authorisation/Permit Number: RP3133LD

Visit number 1 of 1

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Company Name: Aberthaw Power Station In-stack Filter? **N** Bar. Press.mm Hg **753** K Factor **0.473133932** Ambient Temp. **13** Leak Rate (fin / %) **0.43**  
 Site Name: Aberthaw Outstack Filter? **Y** Cp **0.827** Dn used **3.917** Start Time **10:28** Leak Rate (start / %) **0.86**  
 Project Reference: FTBS 29312 Date: **04/03/16** Operators **EP DL** Bws% **2.08** Nozzle No. **0** Stop Time **11:28** Box/Probe setting **160 +/- 5 °C**  
 Run: Metals Meter Correction Yd **0.971**

Sample Filter Analysis

	Analysis Result (ug)	Analysis Blank Results (ug)	Analysis Result (mg)
Arsenic			
Antimony			
Cadmium			
Chromium			
Mercury	0.1005	0.0945	0.0001
Cobalt			
Copper			
Iron			
Lead			
Manganese			
Nickel			
Selenium			
Thallium			
Tin			
Vanadium			
Zinc			

Sample Impinger & Wash Solution Analysis

	Analysis Result (ug)	Analysis Blank Results (ug)	Analysis Result (mg)
Arsenic			
Antimony			
Cadmium			
Chromium			
Mercury	2.2899	0.2240	0.0023
Cobalt			
Copper			
Iron			
Lead			
Manganese			
Nickel			
Selenium			
Thallium			
Tin			
Vanadium			
Zinc			

Sample ID Nos

	Sample	Blank
Filter	30009042	30009038
Wash	30009043	30009039
Imp 1 & 2		
Imp 3		
HG Imp 1	30009044	30009040
HG Imp 2	30009045	30009041

Sample Filter Blank Weighings

Weights	Initial	Final	Increase, mg
Impinger 1			
Impinger 2			
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel			9.5
Total			9.5

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp, °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp, °C	Root Δ p,
				Desired	Actual								
	0	22	61	10.4089465		3233950.5	10		180	180	0	12	4.690
	5	22	61	10.4089465			15		180	180	0	12	4.690
	10	21	61	9.935812571			16		180	180	0	12	4.583
	15	21	61	9.935812571			16		180	180	0	12	4.583
	20	23	61	10.88208043			16		180	180	0	12	4.796
	25	23	61	10.88208043			16		180	180	0	12	4.796
Endpoint	30												
	0	23	61	10.88208043			16		180	180	0	12	4.796
	5	22	61	10.4089465			16		180	180	0	13	4.690
	10	22	61	10.4089465			16		180	180	0	13	4.690
	15	22	61	10.4089465			16		180	180	0	13	4.690
	20	23	61	10.88208043			16		180	180	0	13	4.796
	25	23	61	10.88208043			16		180	180	0	13	4.796
Endpoint	30					3234565.5							
	60.00	22.250	61.0	10.5	#DIV/0!	0.6	15.4	#DIV/0!	180.0	180.0	0.0	12.4	4.716

Company Name: Aberthaw Power Station  
Site Name: Aberthaw  
Sampling Point Ref: Unit 9  
Run: Metals

Date: 04/03/16  
Run: Metals

Barometric Pressure, mm Hg	753.00
Stack Pressure, mm Hg	751.09
Average Stack Temp, °C	61.0
Volume of Water as gas at STP, scm	0.012
Meter Volume (Standardised m <sup>3</sup> ), Dry	0.560
Meter Volume (Standardised m <sup>3</sup> ) Wet	0.572
Stack Moisture Content, %	2.1
%O <sub>2</sub>	5.81
Average Stack Velocity, m/sec	16.562
Stack Flow Rate, (Actual m <sup>3</sup> /s)	468.280
Stack Flow Rate (Standardised m <sup>3</sup> /s) wet	382.866
Stack Flow Rate, (Standardised m <sup>3</sup> /s), dry	374.944
% Isokinetic Variation	98.4

**SAMPLE CONCENTRATIONS & MASS EMISSION RATES**

Analyte	Concentration. Dry, STP, and O2 Corrected (Particulate Phase - mg/m3)	Concentration. Dry, STP, and O2 Corrected (Vapour Phase, mg/m3)	Mass Concentration, Dry, STP, and O2 Corrected (mg/m3)	Mass Emissions Dry, STP, and O2 Corrected (Kg/hr)	ELV
Mercury	0.00018	0.0040	0.0042	0.0057	

**BLANK CONCENTRATIONS & MASS EMISSIONS RATES**

Analyte	Concentration. Dry, STP, and O2 Corrected (Particulate Phase - mg/m3)	Concentration. Dry, STP, and O2 Corrected (Vapour Phase, mg/m3)	Mass Concentration, Dry, STP, and O2 Corrected (mg/m3)	Mass Emissions Dry, STP, and O2 Corrected (Kg/hr)
Mercury	0.00017	0.00039	0.00056	0.00076

### Uncertainty Calculation for Metals to BS EN 14385

Measured Values		
Sampled Volume	0.615	m <sup>3</sup>
Sampled gas Temperature	288.416667	k
Sampled gas Pressure	100.14	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	5.81	% by volume
Volume Impinger 1 + 2	225	ml
Volume Impinger 3	213	ml
Total Impinger Volume	438	litre
Leak	0.64	%

Standard Uncertainties for Measured Values		
Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	k
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Volume in Impinger	0.001	litre

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.936			Oxygen Correction Factor	0.9874		
	Sensitivity Coefficient		Uncertainty, Uv		Sensitivity Coefficient		Uncertainty, Uo
Sampled gas Temperature	0.0032		0.0065	Oxygen Measurement	0.0652		0.0065
Sampled gas Pressure	0.0093		0.0093				
Sampled gas Humidity	0.0094		0.0094				
	Sqrt (Uv)^2		0.0147				
	Total Uv		0.009			Total Uo	0.0065

Itemised Uncertainty Contributions																	
Metal	Total Mass - Impingers	Total Mass - Part Fraction	Analytical uncertainty %		Standard Uncertainties - Mass		Concentration (mg/m <sup>3</sup> )	Sensitivity Coefficients				Uncertainty Contributions - Concentration (mg/m <sup>3</sup> )				Calculated Uncertainties	
			Particulate	Impingers	Particulate	Impingers		Volume Correction	Mass Analyte	Oxygen Correction	Leaks	Volume Correction	Mass Analyte	Oxygen Correction	Leaks	Expanded - mg/m <sup>3</sup>	% of Result
Mercury	0.0022899	0.0001005	6	5	0.0	0.000	0.004212675	0.007518797	1.762331	0.00	1.00	6.8526E-05	0.00020206	0.00	1.5608E-05	0.00063	15
Uncertainty has been expanded with a coverage factor of 2 (K=2)																	



## **APPENDIX 4: Unit 8 Sampling, Analysis & Uncertainty Data**

Company Name: Aberthaw power station  
Site Name: Aberthaw  
Sampling Point Ref: unit 8  
Project Reference:

Date: 02/11/16  
Run: Metals

Mean Stack Temperature, oC 65.000

Traverse Stack Velocity, m/s 19.867

Stack Gas Volume Flow Rate, m³/s (acms) 561.729

Stack Gas Volume Flow Rate, m³/s. Dry, STP and O2 Corrected 417.669

Δp Measurement units (Pa or mmH2O) mmH2O

Pitot Coefficient 0.831

<b>Barometric</b>	758	mmHg	<b>Leak Test</b>		
<b>Static</b>			Instrument range	250	mmH2O
Port A	-25	mmH2O	Δp for leak test	187.5	mmH2O
Port B	-25	mmH2O	Positive leakage rate	0	per 15secs
<b>Mean</b>	-25	mmH2O	Negative leakage rate	0	per 15secs
			Pass/Fail	Pass	

<b>Stagnation Test</b>		
Static measurement		
Positive side	-25	mmH2O
Negative side	-25	mmH2O
Difference (Pa)	0	
Pass/Fail	Pass	

<b>Stack Dimensions</b>		
Rectangular A		(Width) m
Rectangular B		(Length) m
Circular diam A	6	m
Circular diam B	6	m
Circular Mean	6	m
Area	28.27431	m²

Traverse Point	Distance m	Port A						Port B					
		Δ p, mmH2O			Average	Swirl Degrees	Temp °C	Δ p, mmH2O			Average	Swirl Degrees	Temp °C
		Reading 1	Reading 2	Reading 3				Reading 1	Reading 2	Reading 3			
1	0.20	28	28	28	28	0	63	27	27	27	27	0	63
2	0.63	33	33	33	33	0	66	33	33	33	33	0	66
3	1.16	34	34	34	34	0	66	34	34	34	34	0	66
4	1.94												
5	4.06												
6	4.84	33	33	33	33	0	66	34	34	34	34	0	66
7	5.37	32	32	32	32	0	66	34	34	34	34	0	66
8	5.80	29	29	29	29	0	63	30	30	30	30	0	63
9													
10													

<b>Gas Data</b>	
Oxygen %	6.90
CO <sub>2</sub> %	13.80
CO %	

<b>Oxygen Correction</b>	
Required Correction Value	6
Actual Oxygen Factor	1.06
Leave BLANK if no O2 correction is required	

<b>BS EN 13284-1 &amp; M1 Sample Point Requirements</b>	<b>Requirement Met?</b>
Duct gas Flow: angle with regard to duct access <15°?	Y
Duct Gas Flow: No Negative Velocity: Not Permitted	Y
Duct Gas Flow: Ratio of max to min velocity <3:1?	Y
Working Area > 5m²?	y
Handrails with removable chains / self closing gates across the top of the ladder?	y
Handrails (approx 0.5 and 1.0 m high) and vertical baseboards (approx 0.25m high)?	y
Scaffold Built to 'Heavy Duty' Scafftag Rating or at least 2.5kN/m2 loading	N/A
Handrails not restricting access to ports?	y
Room opposite sampling port equal or greater than the length of the sampling probe plus 1 metre?	y
Sufficient Power (Waterproof 110V BS4343 Standard) close or on the platform?	y

Company Name: Aberthaw power station In-stack Filter? **N** Bar. Press.mm Hg **758**  
Site Name: Aberthaw Outstack Filter? **Y** Cp **0.831**  
Sampling Point Ref: unit 8 Project Reference:  
Date: 02/11/16 Operators **EP DL** Bws% **2.5**  
Run: Metals

K Factor **1.330738298**  
Dn used **5.033**  
Nozzle No. **00711**  
Meter Correction Yd **0.988**

Ambient Temp. **17.25**  
Start Time **11:41**  
Stop Time **12:41**

Leak Rate (fin / %) **0.00**  
Leak Rate (start / %) **0.00**  
Box/Probe setting **160 +/- 5 °C**

Sample Filter Analysis

	Analysis Result (ug)	Analysis Blank Results (ug)	Analysis Result (mg)
Mercury	0.5300	0.5300	0.0005

Sample Impinger & Wash Solution Analysis

	Analysis Result (ug)	Analysis Blank Results (ug)	Analysis Result (mg)
Mercury	0.1150	0.8450	0.0001

Sample ID Nos

	Sample	Blank
Filter	30011392	30011388
Wash	30011393	30011389
Imp 1 & 2		
Imp 3		
HG Imp 1	30011394	30011390
HG Imp2	30011395	30011391

Sample Filter Blank Weighings

Weights	Initial	Final	Increase, mg
Impinger 1			12.5
Impinger 2			
Impinger 3			
Impinger 4			
Impinger 5			
Silica Gel			
Total			12.5

Sample Point	Clock Time min	Pitot Δ p, mm H <sub>2</sub> O	Stack Temp, °C	Orifice Δ H, mm H <sub>2</sub> O		Gas Meter Reading m <sup>3</sup>	Temp at Gas Meter Outlet °C	Condenser Temp, °C	Filter Box Temp °C	Probe Temp °C	Pump Vacuum Inches Hg	Impinger Stem Temp. °C	Root Δ p,
				Desired	Actual								
	0	28	66	37.26067235		3549561	14		180	180	0		5.292
	7.5	30	66	39.92214894			20		180	180	0		5.477
	15	30	66	39.92214894			20		180	180	0		5.477
	22.5	30	66	39.92214894			20		180	180	0		5.477
Endpoint	30												
	0	30	66	39.92214894			20		180	180	0		5.477
	7.5	30	66	39.92214894			20		180	180	0		5.477
	15	30	66	39.92214894			20		180	180	0		5.477
	22.5	30	66	39.92214894			20		180	180	0		5.477
Endpoint	30					3550692							
	60.00	29.750	66.0	39.6	#DIV/0!	1.1	19.3	#DIV/0!	180.0	180.0	0.0	#DIV/0!	5.454

Company Name: Aberthaw power station  
Site Name: Aberthaw  
Sampling Point Ref: unit 8  
Run: Metals

Date: 02/11/16  
Run: Metals

Barometric Pressure, mm Hg	758.00
Stack Pressure, mm Hg	756.16
Average Stack Temp, °C	66.0
Volume of Water as gas at STP, scm	0.016
Meter Volume (Standardised m <sup>3</sup> ), Dry	1.044
Meter Volume (Standardised m <sup>3</sup> ) Wet	1.060
Stack Moisture Content, %	1.5
%O <sub>2</sub>	6.90
Average Stack Velocity, m/sec	19.273
Stack Flow Rate, (Actual m <sup>3</sup> /s)	544.939
Stack Flow Rate (Standardised m <sup>3</sup> /s) wet	410.014
Stack Flow Rate, (Standardised m <sup>3</sup> /s), dry	403.989
% Isokinetic Variation	95.7

**SAMPLE CONCENTRATIONS & MASS EMISSION RATES**

Analyte	Concentration. Dry, STP, and O2 Corrected (Particulate Phase - mg/m3)	Concentration. Dry, STP, and O2 Corrected (Vapour Phase, mg/m3)	Mass Concentration, Dry, STP, and O2 Corrected (mg/m3)	Mass Emissions Dry, STP, and O2 Corrected (Kg/hr)
Mercury	0.001	0.000	0.00066	0.00096

**BLANK CONCENTRATIONS & MASS EMISSIONS RATES**

Analyte	Concentration. Dry, STP, and O2 Corrected (Particulate Phase - mg/m3)	Concentration. Dry, STP, and O2 Corrected (Vapour Phase, mg/m3)	Mass Concentration, Dry, STP, and O2 Corrected (mg/m3)	Mass Emissions Dry, STP, and O2 Corrected (Kg/hr)
Mercury	0.001	0.001	0.001	0.002

### Uncertainty Calculation for Metals to BS EN 14385

Measured Values		
Sampled Volume	1.131	m <sup>3</sup>
Sampled gas Temperature	292.25	K
Sampled gas Pressure	100.82	kPa
Sampled gas Humidity	0	% by volume
Oxygen content	6.90	% by volume
Volume Impinger 1 + 2	0	ml
Volume Impinger 3	0	ml
Total Impinger Volume	0	litre
Leak	0.00	%

Standard Uncertainties for Measured Values		
Sampled Volume	0.001	m <sup>3</sup>
Sampled gas Temperature	2	K
Sampled gas Pressure	1	kPa
Sampled gas Humidity	1	% by volume
Oxygen content	0.1	% by volume
Volume in Impinger	0.001	litre

Uncertainty Calculation for Volume Correction				Uncertainty Calculation for Oxygen Correction			
Volume Correction Factor	0.930			Oxygen Correction Factor	1.0643		
	Sensitivity Coefficient		Uncertainty, Uv		Sensitivity Coefficient		Uncertainty, Uo
Sampled gas Temperature	0.0032		0.0064	Oxygen Measurement	0.0757		0.0076
Sampled gas Pressure	0.0092		0.0092				
Sampled gas Humidity	0.0093		0.0093				
	Sqrt (Uv)^2		0.0146				
	Total Uv		0.016			Total Uo	0.0076

Metal	Total Mass - Impingers	Total Mass - Part Fraction	Itemised Uncertainty Contributions													% of Result	
			Analytical uncertainty %		Standard Uncertainties - Mass		Concentration (mg/m <sup>3</sup> )	Sensitivity Coefficients				Uncertainty Contributions - Concentration (mg/m <sup>3</sup> )					Calculated Uncertainties
								Volume Correction	Mass Analyte	Oxygen Correction	Leaks	Volume Correction	Mass Analyte	Oxygen Correction	Leaks		
Mercury	0.000115	0.00053	6	5	0.0	0.000	0.000657241	0.000629262	1.018978	0.00	1.00	1.038E-05	3.2404E-05	0.00	0	0.000095	14
(Uncertainty has been expanded with a coverage factor of 2 (K=2))																	

## **APPENDIX 5: Certificates of Analysis**



Test Certificate

Date 22/03/2016

Client RPS Milton Keynes HSED  
Noble House  
Capital Drive  
Linford Wood  
Milton Keynes  
MK14 6QP

Order No. FTBS 29312  
Certificate No. WK16-1611  
Issue No. 2

Contact Edwin Powell  
Description 4 filters & 12 solutions for Mercury

Date Received 14/03/2016  
Technique ICP Stack

Parameter	Analysis Method	Accreditation	Method LOD	Uncertainty
Mercury	M112-BSEN13211	UKAS	F-0.03ug SN-0.5ug/l	12.00%

Sample No.	873288	30009038	Method
Mercury	<0.03 µg		M112-BSEN13211(U)
Sample No.	873289	30009039	Method
Mercury	<0.5 µg/l	129 ml	M112-BSEN13211(U)
Sample No.	873290	30009040	Method
Mercury	<0.5 µg/l	215 ml	M112-BSEN13211(U)
Sample No.	873291	30009041	Method
Mercury	<0.5 µg/l	233 ml	M112-BSEN13211(U)
Sample No.	873292	30009042	Method
Mercury	<0.03 µg		M112-BSEN13211(U)
Sample No.	873293	30009043	Method
Mercury	<0.5 µg/l	141 ml	M112-BSEN13211(U)
Sample No.	873294	30009044	Method
Mercury	8.0 µg/l	225 ml	M112-BSEN13211(U)

Page 1 of 3

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Test Certificate

Date 22/03/2016

Client	RPS Milton Keynes HSED		Certificate No.	WK16-1611
			Issue No.	2
Sample No.	873296	30009046	Method	
Mercury	2.3 µg/l	213 ml	M112-BSEN13211(U)	
Sample No.	873369	30009046	Method	
Mercury	<0.03 µg		M112-BSEN13211(U)	
Sample No.	873370	30009047	Method	
Mercury	<0.5 µg/l	128 ml	M112-BSEN13211(U)	
Sample No.	873371	30009048	Method	
Mercury	<0.5 µg/l	197 ml	M112-BSEN13211(U)	
Sample No.	873372	30009049	Method	
Mercury	<0.5 µg/l	229 ml	M112-BSEN13211(U)	
Sample No.	873373	30009060	Method	
Mercury	<0.03 µg		M112-BSEN13211(U)	
Sample No.	873374	30009061	Method	
Mercury	1.0 µg/l	77 ml	M112-BSEN13211(U)	
Sample No.	873376	30009062	Method	
Mercury	1.3 µg/l	213 ml	M112-BSEN13211(U)	
Sample No.	873376	30009063	Method	
Mercury	0.5 µg/l	189 ml	M112-BSEN13211(U)	

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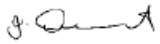


Test Certificate

Date 22/03/2016

Client	RPS Milton Keynes HSED	Certificate No.	WK16-1611
		Issue No.	2

Tested By	Andrew Grieve Thomas Wiggins	Date	22/03/2016
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Approved By	 Joanne Dewhurst Operational Manager	Date	22/03/2016
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For and on authority of RPS Laboratories Ltd.

Method Symbols	(U)	Analysis is UKAS Accredited
	(N)	Analysis is not UKAS Accredited

Concentration values (mg/m<sup>3</sup> and ppm) are calculated on the basis of information provided by the customer.  
Results stated as ml are referring to the sample volume.

Analysis carried out on samples 'as received'

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### Test Certificate

Date 15/11/2016

<b>Client</b>	RPS Milton Keynes HSED Noble House Capital Drive Linford Wood Milton Keynes MK14 6QP	<b>Order No.</b>	FTBS 29312
		<b>Certificate No.</b>	WK16-6978
		<b>Issue No.</b>	1

<b>Contact</b>	Edwin Powell	<b>Date Received</b>	08/11/2016
<b>Description</b>	8 samples for Mercury	<b>Technique</b>	ICP Stack

Parameter	Analysis Method	Accreditation	Method LOD	Uncertainty
Mercury	M112-BSEN13211	UKAS	F-0.03ug SN-0.5ug/l	12.00%

Sample No.	908786	30011392	Method
Mercury	<0.03 µg		M112-BSEN13211(U)
Sample No.	908787	30011393	Method
Mercury	<0.5 µg/l	130 ml	M112-BSEN13211(U)
Sample No.	908788	30011394	Method
Mercury	<0.5 µg/l	118 ml	M112-BSEN13211(U)
Sample No.	908789	30011395	Method
Mercury	<0.5 µg/l	112 ml	M112-BSEN13211(U)
Sample No.	908790	30011388	Method
Mercury	<0.03 µg		M112-BSEN13211(U)
Sample No.	908791	30011389	Method
Mercury	<0.5 µg/l	226 ml	M112-BSEN13211(U)
Sample No.	908792	30011390	Method
Mercury	4.8 µg/l	160 ml	M112-BSEN13211(U)

Page 1 of 2

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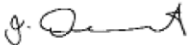


**Test Certificate**

Date 15/11/2016

Client	RPS Milton Keynes HSED		Certificate No.	WK16-6978
			Issue No.	1
Sample No.	908793	30011391	Method	
Mercury	<0.5 µg/l		154 ml	M112-BSN13211(U)

Tested By Calum Green Date 15/11/2016  
Lora McKerracher

Approved By  Date 15/11/2016  
Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

Method Symbols (U) Analysis is UKAS Accredited  
(N) Analysis is not UKAS Accredited

Concentration values (mg/m<sup>3</sup> and ppm) are calculated on the basis of information provided by the customer.  
Results stated as ml are referring to the sample volume.

Analysis carried out on samples 'as received'

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