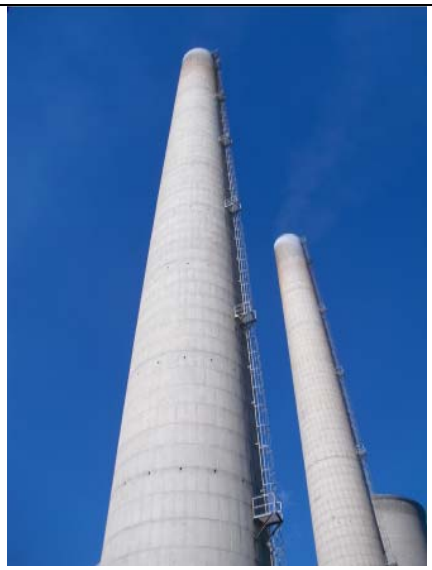
REPORT CV/90921A Rev.00 **RESTRICTED**



EMISSIONS TESTING

AT BOILERS NO's. 3 & 4

ROOIWAL POWER STATION

C.J.L. ELS **AUGUST 2009**

EXECUTIVE SUMMARY

Rooiwal Power Station commissioned testwork on the Boiler no's. 3 and 4 bagfilter emissions. The testwork included isokinetic sampling to determine the particulate emission from the bagfilter, determination of sulphur oxide (SO_x) emissions (EPA Method 6), determination of nitrogen oxide (NO_x) emissions (EPA Method 7D) and sampling and analysis of the coals fed to the boiler, A set of tests was completed on the 14th, 15th and 16th of July 2009.

The **results** of the testwork are as follows:

Boiler 4:

- *Bagfilter particulate emission*

		Without catalyst		With catalyst		
Description	**Unit**	**No 1**	**No 2**	**No 3**	**No 4**	**No 5**
Gas temperature	°C	118	125	123	123	123
Total gas volumetric flow	Am^3/s	117.0	129.0	148.0	158.1	142.9
	Nm^3/s	68.5	73.9	86.0	92.4	83.4
% CO_2 measured	%	12.2	10.9	14.6	14.0	15.5
Dust load (@ 12% CO_2)	mg/Nm^3	71	59	31	57	58

- *SO_x test results*

	Unit	Without catalyst			With catalyst		
		Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Test 6**
Gaseous SO_x concentration as SO_2	mg/Nm^3	3440	3264	2647	481	461	223
	ppm	1204	1142	926	168	161	78
SO_2 emission rate	kg/h	848	836	705	149	153	67

- *NO_x test results*

	Unit	Without catalyst			With catalyst		
		Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Test 6**
Gaseous NO_x concentration	mg/Nm^3	207	109	92	21	18	24
	ppm	72	38	32	7	6	8
NO_x emission rate	kg/h	51	28	25	7	6	7

Boiler 3:

- *Bagfilter particulate emission*

Description	Unit	No 1	No 2	No 3
Gas temperature	°C	111	111	111
Total gas volumetric flow	Am^3/s	109.0	118.2	115.8
	Nm^3/s	65.4	70.5	66.6
% CO_2 measured	mg/Nm^3	46	70	73
Dust load (@ 12% CO_2)	%	12.2	14.5	11.1
Dust load (12% CO_2 corrected)	mg/Nm^3	45	58	79

- *SO_x test results*

	Unit	Test 1	Test 2	Test 3
Gaseous SO_x concentration as SO_2	mg/Nm^3	3040	3059	4164
	ppm	1064	1070	1457
SO_2 emission rate	kg/h	715	777	998

- *NO_x test results*

	Unit	Test 1	Test 2	Test 3
Gaseous NO_x concentration	mg/Nm^3	123	66	191
	ppm	43	23	67
NO_x emission rate	kg/h	29	17	46

Conclusions of this report are**:**

- General boiler and bagfilter operation was normal over the test period.
- Boiler 4 was operated on average at 53MW on 14/7 and 52MW on 16/7.
- Boiler 3 was operated on average at 53MW on 15/7.
- Bagfilter differential pressure was consistent around 1.2kPa at boiler 4 and a little higher at 1.4kPa at boiler 3. This reflects the difference in bag operating life between the boilers: boiler 4 bags are new, while boiler 3 bags have completed approximately 36 000 hours of operation.
- Boiler 4 average total gas flowrate was 71.1Nm^3/s on 14/7, and significantly higher at 87.3Nm^3/s on 16/7. Gas temperatures at the fan inlet were between 118 and 125°C. Volumetric flow balance between A and B lanes was poor, with lane A consistenly higher than lane B.
- Boiler 4 filter emission level was 65mg/Nm^3 (corrected to 12% CO_2) on 14/7 and 49mg/Nm^3 (12% CO_2) on 16/7, in both cases below the certificate required emission of 75mg/Nm^3. Emission levels were not good, taking into account that a full bag change was

completed in June 2009. Lane A emission level was consistently higher than that of lane B, indicating possible bag installation problems at lane A.

- Particulate emission levels were not as good as achieved with the previous set of bags which, when tested in 2006 (55 000 hours operation), had an emission of 28mg/Nm^3.
- Boiler 4 sulphur oxide (SO_x) levels were on average 1091ppm on 14/7 and, after addition of the catalyst, SO_x levels were reduced to 136ppm. The SO_3 / SO_2 ratio was relatively low at 0.7 to 5.2%. Nitrogen oxide (NO_x) levels were on average 48ppm on 14/7 and, after addition of the catalyst, NO_x levels were reduced to 8ppm.
- SO_x emission levels were comparable with 2006 tests (879ppm), while NOx emission levels were significantly lower than in 2006 (508ppm).
- Boiler 3 average total gas flowrate was 67.4Nm^3/s. Gas temperature at the fan inlet was on average 111°C. The volumetric flow balance between A and B lanes was poor.
- Boiler 3 bagfilter emission level was 61mg/Nm^3 (corrected to 12% CO_2). The emission level is in line with the bag operating period of 36 000 hours (last change January 2004). Average particulate emission was 15kg/h.
- Particulate emission levels were not as good as achieved with the previous set of bags which, when tested in 2003 (65 000 hours operation), had an emission of less than 15mg/Nm^3.
- Boiler 3 sulphur oxide (SO_x) levels were on average 1153ppm. The SO_3 / SO_2 ratio was relatively low at 1.3 to 8.1%. Nitrogen oxide (NO_x) levels were on average 55ppm.
- Coal analyses were in line with values measured in 2006.
- **Catalyst usage** reduced gaseous emissions significantly:
  - SO_x emissions were on average reduced from 795 to 123kg/h, that is by 85%. If the improvement in coal sulphur content is taken into account (1.55% on 14/7 to 0.89% on 16/7), then the reduction is SO_x was 73%.
  - NO_x emissions were similarly reduced by 81% from 34 to 7kg/h by use of the catalyst.

REPORT REVISION REGISTER		
REV.	**DATE**	**REMARKS**
00	**31/08/09**	**Report first issued**
THIS PAGE IS A RECORD OF ALL ISSUES AND REVISIONS.		

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1 Introduction

Rooiwal Power Station commissioned testwork on the Boilers No. 3 and No. 4 bagfilter emissions. The testwork included the following:

- Isokinetic sampling to determine the particulate emission from the bagfilter.
- Determination of sulphur oxide (SO_x) emissions by means of EPA Method 6.
- Determination of nitrogen oxide (NO_x) emissions by means of EPA Method 7D.
- Sampling and analysis of the coals fed to the boiler

A set of tests was completed on the 14th, 15th and 16th of July 2009. Boiler 4 was tested on the 14th and 16th: without a catalyst material on the 14th and with a catalyst on the 16th. Boiler 3 was tested on the 15th.

2 Test Description

2.1 Isokinetic particulate testing

2.1.1 Test Procedure

Isokinetic sampling and gas velocity measurements were done in accordance with and surpassing the requirements of BS code 893.

A sampling grid of 20 points was used at each of the A and B lanes (5 access holes with 4 points per access hole). Before sampling commenced, the carbon dioxide (CO_2) and moisture content in the gas was determined for density correction. A full leakage test was done on the sampling train. Pitot differential and static pressures were taken continuously during the tests.

The clean filter thimbles were weighed over a period of a week until weights stabilized. Two thimbles from a box of 25 were used as reference thimbles. After completion of the measurements the used or dirty thimbles, as well as the reference thimbles went back to the weighing room for a week. When proper stabilization was obtained, the thimbles and reference thimbles were finally weighed and the mass of dust sampled, determined.

2.1.2 Test Equipment

Combination Isokinetic probes consist of the following:

- Sample suction pipe and head piece.
- S-type pitot tube.
- K-type thermo couple.
- Static pressure tube.

The combination probes enable real-time measurements. This obviates the need for a velocity traverse prior to isokinetic sampling. The pitot differential pressure is measured with a TSI digital manometer with an accuracy of 1 Pascal.

The sampling flow control unit consists of the following:

- Rotameter for sampling flow measurements
- K-type thermo couples.
- Control valve to control sampling flow rate.
- Vacuum pump for sample extraction.
- PC for data collection and processing.

The CO_2 concentration was measured with a TSI combustion analyser. Moisture content was determined by sampling a measured volume of gas through a silica gel container. The container weight was determined before and after.

2.2 Gaseous testing (SOx & NO_x)

2.2.1 Test Procedure

The SO_x and NO_x test methods are as follows (refer to EPA methods 6 & 7D for further details):

- Preparation of Collection Train
  - SO_x: Approximately 100ml of 80 percent isopropanol is placed in the first impinger and 100 ml of 3 percent hydrogen peroxide in both the second and third impingers.
  - NO_x: Approximately 100ml of potassium permanganate solution is placed in three impingers.
- Train Operation – The pump is started and the dry gas meter readings as well as temperature and pressure data is recorded on a datasheet in 5 minute intervals.
- At the conclusion of each run, the pump is turned off and the probe is removed from the stack.

- The ice bath is drained and, with the probe disconnected, the remaining part of the train is purged by drawing clean ambient air through the system at the average flow rate used for sampling.
- The samples are sent for analysis at a professional laboratory (Waterlabs CC / Chemtech laboratories).

2.2.2 Test Equipment

The equipment used included the following items:

- Probe – Borosilicate or quartz glass, with a heating system to prevent condensation during sampling.
- Impingers – Four-off. The first and third with a fritted tip and the second and fourth with an unconstricted tip.
- Dry Gas Meter with thermocouple and pressure gauge
- Barometer

2.3 Test Schedule

The isokinetic test schedule is shown in the table below.

Date	Boiler	Test	Test time	
		Number	Start	Stop
14 July	4 (without catalyst)	Boiler 4 Test 1	10:30	12:00
		Boiler 4 Test 2	15:30	17:30
15 July	3	1	11:00	12:30
		2	13:30	15:00
		3	15:30	17:00
16 July	4 (with catalyst)	Boiler 4 Test 3	09:00	10:30
		Boiler 4 Test 4	11:00	12:30
		Boiler 4 Test 5	13:20	15:00

2.4 Plant Operation

Information on the operation of the plant is given in Annexure A. A summary is given below, with average values for each of the three tests.

Boiler	Feed	Drum	S/heater	Boiler	Temperature		Baghouse dP		Ampere			
/ Test	Flow	Press	Outlet	O_2	ID Fan		kPa		ID Fan		FD Fan	
	t/h	MPa	Temp		A	B	A	B	A	B	A	B
4 / 1	223	7.18	420	4.40	94	140	1.20	1.22	50	47	20	21
4 / 2	212	7.10	423	4.23	135	141	1.19	1.19	49	47	20	21
3 / 1	214	7.08	413	3.90	126	126	1.40	1.40	54	55	18	18
3 / 2	217	7.02	419	3.70	124	125	1.40	1.40	53	54	18	18
3 / 3	221	7.14	423	3.37	125	126	1.40	1.40	53	54	18	18
4 / 3	215	7.10	428	4.60	137	144	1.24	1.22	53	49	22	23
4 / 4	222	7.15	421	4.27	137	143	1.25	1.23	53	49	21	22
4 / 5	227	7.18	436	4.18	136	142	1.21	1.20	51	48	21	22

3 RESULTS

3.1 Stack Isokinetic Tests

3.1.1 Boiler 4 results – Without catalyst

The results for the stack isokinetic tests are summarised in the table below. Full test sheets are attached as Annexure B.

		Test		Test	
		No 1		No 2	
Description	**Unit**	**Lane A**	**Lane B**	**Lane A**	**Lane B**
Date of measurement	-	14/07/09	14/07/09	14/07/09	14/07/09
Time of measurement	Start	10:30	11:08	16:30	15:24
Average gas velocity	m/s	12.2	8.1	12.3	10.0
Average gas temperature	°C	118	118	122	128
Average static pressure	kPa	84.6	84.4	84.6	84.3
Average duct flow (actual)	Am^3/s	70.33	46.64	71.17	57.86
Average duct flow (normal)	Nm^3/s	41.0	27.4	41.1	32.8
Volume of gas sampled	Nm^3	3.69	1.29	2.77	1.02
Mass of dust sampled	mg	403	21	220	19
Dust load	mg/Nm^3	109	17	80	18
Percentage CO_2 measured	%	12.2	12.2	10.6	11.1
Moisture content in gas (V/V)	%	5.3	5.9	5.9	5.1
Dust load (12% CO_2 corrected)	mg/Nm^3	107	16	90	20

3.1.2 Boiler 4 results – with catalyst

The results for the stack isokinetic tests are summarised in the table below. Full test sheets are attached as Annexure B.

		Test		Test		Test	
		No 1		No 2		No 3	
Description	**Unit**	**Lane A**	**Lane B**	**Lane A**	**Lane B**	**Lane A**	**Lane B**
Date of measurement		16/7	16/7	16/7	16/7	16/7	16/7
Time of measurement	Start	09:20	09:00	11:03	11:00	13:21	13:20
Average gas velocity	m/s	14.1	11.5	16.5	10.9	15.5	9.3
Average gas temperature	°C	124.7	120.7	123.35	121.75	121.75	123.35
Average static pressure	kPa	85.4	85.4	85.8	85.8	85.6	85.6
Average duct flow (actual)	Am^3/s	81.46	66.50	95.10	63.03	89.56	53.36
Average duct flow (normal)	Nm^3/s	47.1	38.9	55.5	36.9	52.4	31.1
Volume of gas sampled	Nm^3	2.12	1.21	2.48	1.72	2.35	1.92
Mass of dust sampled	mg	107	27	263	12	265	20
Dust load	mg/Nm^3	51	22	106	7	113	10
Percentage CO_2 measured	%	14.6	14.6	13.9	14.0	15.5	15.5
Moisture content in gas (V/V)	%	5.1	5.9	5.1	5.9	5.1	5.9
Dust load (12% CO_2 corrected)	mg/Nm^3	42	18	92	6	88	8

3.1.3 Boiler 3 results

The results for the stack isokinetic tests are summarised in the table below. Full test sheets are attached as Annexure B.

		Test		Test		Test	
		No 1		No 2		No 3	
Description	**Unit**	**Lane A**	**Lane B**	**Lane A**	**Lane B**	**Lane A**	**Lane B**
Date of measurement		15-Jul	15-Jul	15-Jul	15-Jul	15-Jul	15-Jul
Time of measurement	start	11:00	11:08	13:30	14:17	15:30	15:24
Average gas velocity	m/s	10.9	8.0	11.9	8.6	11.5	8.0
Average gas temperature	°C	110	113	111	110	111	111
Average static pressure	kPa	84.6	84.4	84.6	84.3	84.3	84.3
Average duct flow (actual)	Am^3/s	62.70	46.30	68.83	49.37	66.47	46.03
Average duct flow (normal)	Nm^3/s	37.7	27.6	41.2	29.3	39.4	27.2
Volume of gas sampled	Nm^3	2.53	1.29	1.84	0.92	1.76	0.85
Mass of dust sampled	mg	134	47	111	77	106	78
Dust load	mg/Nm^3	53	37	60	84	60	91
Percentage CO_2 measured	%	12.2	12.2	14.5	14.5	11.1	11.1
Moisture content in gas (V/V)	%	4.4	5.1	4.4	5.1	4.4	5.1
Dust load (12% CO_2 corrected)	mg/Nm^3	52	36	50	70	65	99

3.2 Sulphur Oxide (SO_x) Tests

3.2.1 Boiler 4 results – with and without catalyst

The results for sulphur oxide sampling at boiler 4 are:

Parameter	Unit	Without catalyst			With catalyst		
		Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Date		14/7	14/7	14/7	16/7	16/7	16/7
Time		10:50	12:20	13:40	09:20	10:40	11:55
Gas Temperature	°C	118	121	125	123	123	123
Total Gas Volume	Nm^3/s	68.5	71.2	73.9	86.0	92.4	83.4
	Am^3/s	117.0	123.0	129.0	148.0	158.1	142.9
Gas volume sampled	Liter	211.9	176.6	181.6	168.6	170.8	169.4
Gas meter temp	°C	20	22	20	15	18	24
NTP Volume – dry	dNm^3	0.1715	0.1420	0.1470	0.1388	0.1392	0.1353
H_2O content	%	5.6	5.6	5.5	5.5	5.5	5.5
NTP volume - wet	Nm^3	0.1818	0.1505	0.1555	0.1469	0.1473	0.1431
Liquid analysis: SO_2							
Liquid sample volume	ml	176	138	120	210	234	196
SO_2 concentration	mg/l	3523	3523	3363	320	288	160
SO_2 quantity absorbed	mg	620	486	404	67	67	31
Gaseous SO_2							
Concentration	mg/Nm^3	3411	3231	2595	458	458	219
	ppm	1194	1131	908	160	160	77
Liquid analysis: SO_3							
Liquid sample volume	ml	41	63	63	54	88	97
SO_3 concentration	mg/l	160	96	161	80	7	7
SO_3 quantity absorbed	mg	7	6	10	4	1	1
Gaseous SO_3							
Concentration	mg/Nm^3	36	40	65	30	4	4
	ppm	10	11	18	8	1	1
Gaseous SO_x concentration as SO_2							
NTP conditions	mg/Nm^3	3440	3264	2647	481	461	223
	ppm	1204	1142	926	168	161	78
SO_2 emission rate	kg/h	848	836	705	149	153	67

Note: dNm^3 – dry gas volume, corrected to normal conditions, 101,3kPa and 0°C.

3.2.2 Boiler 3 results

The results for sulphur oxide sampling at boiler 3 are:

Parameter	Unit	Test 1	Test 2	Test 3
Date		15/7	15/7	15/7
Time		10:58	12:13	15:45
Gas Temperature	°C	111	111	111
Total Gas Volume	Nm^3/s	65.4	70.5	66.6
	Am^3/s	109.0	118.2	115.8
Gas volume sampled	Liter	182.6	174.6	126.0
Gas meter temp	°C	18	22	21
NTP Volume – dry	dNm^3	0.1488	0.1404	0.1016
H_2O content	%	4.7	4.0	4.0
NTP volume - wet	Nm^3	0.1562	0.1462	0.1058
Liquid analysis: SO_2				
Liquid sample volume	ml	221	170	143
SO_2 concentration	mg/l	2082	2434	3043
SO_2 quantity absorbed	mg	460	414	435
Gaseous SO_2				
Concentration	mg/Nm^3	**2946**	**2831**	**4111**
	ppm	1031	991	1439
Liquid analysis: SO_3				
Liquid sample volume	ml	96	93	62
SO_3 concentration	mg/l	192	449	112
SO_3 quantity absorbed	mg	18	42	7
Gaseous SO_3				
Concentration	mg/Nm^3	118	285	66
	ppm	33	80	18
Gaseous SOx concentration as SO_2				
NTP conditions	mg/Nm^3	3040	3059	4164
	ppm	1064	1070	1457
SO_2 emission rate	kg/h	715	777	998

Note: dNm^3 – dry gas volume, corrected to normal conditions, 101,3kPa and 0°C.

3.3 Nitrogen Oxide (NO_x) Tests

3.3.1 Boiler 4 results – with and without catalyst

The results for nitrogen oxide sampling are:

Boiler		**Without catalyst**			**With catalyst**		
Parameter	**Unit**	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Test 6**
Date		14/7	14/7	14/7	16/7	16/7	16/7
Time		15:05	15:55	16:45	13:15	14:05	14:45
Gas Temperature	°C	118	121	125	123	123	123
Total Gas Volume	Nm^3/s	68.5	71.2	73.9	86.0	92.4	83.4
	Am^3/s	117.0	123.0	129.0	148.0	158.1	142.9
Gas volume sampled	Liter	42.0	30.8	30.8	33.0	33.8	26.6
Gas meter temp	°C	19	20	20	22	21	22
NTP Volume – dry	dNm^3	0.0341	0.0249	0.0249	0.0265	0.0273	0.0214
H_2O content	%	5.6	5.6	5.6	5.6	5.6	5.6
NTP volume - wet	Nm^3	0.0361	0.0264	0.0264	0.0281	0.0289	0.0227
Liquid analysis: NO_x							
Liquid sample volume	ml	202	192	252	182	372	337
NO_x conc as NO_2	mg/l	36.956	14.98	9.689	3.255	1.392	1.601
NO_x absorbed	mg	7.47	2.88	2.44	0.59	0.52	0.54
Gaseous NO_x conc							
NTP conditions	**mg/Nm^3**	**207**	**109**	**92**	**21**	**18**	**24**
	ppm	72	38	32	7	6	8
NO_x emission rate	kg/h	51	28	25	7	6	7

Note: dNm^3 – dry gas volume, corrected to normal conditions, 101,3kPa and 0°C.

3.3.2 Boiler 3 results

The results for nitrogen oxide sampling are:

Parameter	Unit	Test 1	Test 2	Test 3
Date		15/7	15/7	15/7
Time		15:50	16:35	17:20
Gas Temperature	°C	111	111	111
Total Gas Volume	Nm^3/s	65.4	70.5	66.6
	Am^3/s	109.0	118.2	115.8
Gas volume sampled	Liter	31.8	29.2	26.2
Gas meter temp	°C	20	22	20
NTP Volume – dry	dNm^3	0.0257	0.0235	0.0212
H_2O content	%	5.6	5.6	5.6
NTP volume - wet	Nm^3	0.0273	0.0249	0.0225
Liquid analysis: NO_x				
Liquid sample volume	ml	397	412	297
NO_x conc as NO_2	mg/l	8.436	3.976	14.479
NO_x absorbed	mg	3.35	1.64	4.30
Gaseous NO_x conc				
NTP conditions	**mg/Nm^3**	**123**	**66**	**191**
	ppm	43	23	67
NO_x emission rate	kg/h	29	17	46

Note: dNm^3 – dry gas volume, corrected to normal conditions, 101,3kPa and 0°C.

3.4 Coal Analysis

Coal samples were taken on each test day for analysis. The results are given in the table below (see also Annexure C).

Parameter	Unit	14/7	15/7	16/7	2006	2006	2002	Typical analyses*
		Boiler 4	Boiler 3	Boiler 4	Boiler 2	Boiler 4		Delmas
Proximate Analysis								
Inherent Moisture#	%	3.8	4.1	3.4	4.4	4.9	4.4	4.5
Ash	%	23	24.2	24.7	21.1	21.5	16.2	16
Volatile Matter	%	23.9	25.4	23	24.6	25.1	22.4	24.5
Fixed Carbon	%	49.3	46.3	48.9	49.9	48.5	57.1	55
Calorific Value	MJ/kg	23.26	22.68	23.20	23.35	22.93	25.72	25.64
Sulphur	%	1.55	1.28	0.89	0.84	0.95	0.67	0.85
Total moisture	%	5.2	6.2	4.5	5.84	6.83	11.2	
Ultimate Analysis								
Carbon	%	59.74	58.94	59.68	61.82	61.22	66.11	65.25
Hydrogen	%	3.87	3.42	3.39	3.45	3.44	3.24	3.55
Nitrogen	%	1.59	1.52	1.49	1.51	1.47	1.63	1.54
Oxygen	%	6.45	6.54	6.45	6.88	6.52	7.75	8.58
Size Analysis								
+25	mm	0.0	0.0	0.0	0.3	0.2	0.5	
-25 + 13.0	mm	7.5	6.1	12.8	5.2	3.3	4.7	
-13.0 + 6.0	mm	29.0	19.8	24.8	33.6	34	17.5	
-6.0 + 3.0	mm	20.0	22.1	17.4	24.6	23.5	23.7	
-3	mm	43.5	52.0	45.0	36.3	39	53.7	

Parameter	Unit	14/7	15/7	16/7	2006	2006	2002	Typical analyses*
		Boiler 4	Boiler 3	Boiler 4	Boiler 2	Boiler 4		Delmas
Coal Ash analysis								
Calcium as CaO	%	8.79	10.67	3.34	10.2	9.7	6.17	8.19
Magnesium as MgO	%	1.65	2.43	0.75	1.2	1.2	1.42	1.8
Potassium as K_2O	%	0.91	1.35	0.38	0.61	0.51	0.91	0.5
Sodium as Na_2O	%	0.52	0.87	0.21	0.9	0.8	0.9	0.64
Total Iron as Fe_2O_3	%	7.53	5.39	4.84	3.07	2.82	2.27	3.49
Titanium as TiO_2	%	1.73	1.76	4.78	1.87	1.89	2.15	1.3
Aluminium as Al_2O_3	%	26.90	28.90	28.00	29.9	30.2	34.7	33.3
Total Silica as SiO_2	%	44.70	41.60	52.30	45	46	44	43.9
Manganese as MnO	%	0.03	0.03	0.04				
Sulphur as SO_3	%	4.34	4.13	2.38	5.47	5.64	4.68	4.32
Phosphorus as P_2O_5	%	0.82	0.85	0.82	1.12	1.32	0.94	1.32
Boiler Ash analysis								
Carbon in Ash								
Top (fly ash)	%	1.98	1.86	-	14.51	3.84		
Bottom (hearth)	%	1.97	1.05	0.72				

Notes:

* Delmas mine typical analyses as given in the document “Operating and Developing Coal Mines in the Republic of South Africa 2000” published by the Mineral Economics Directorate of the Minerals Bureau.

Inherent moisture: determined on residual moisture sample by crushing to <212μm and subsequently drying at 100°C for 2 hours

4 DISCUSSION

4.1 Plant Operating Conditions

Boiler and bagfilter operation was steady during test work at both boilers, with the exception of periods after 17:12 on 14/7 at Boiler 4, when mill D blocked.

Boiler 4 feed water flowrate varied between 204 and 230t/h on 14/7, corresponding to a boiler load of 49 to 56MW. The average load was 223t/h (54MW) for isokinetic test 1 and 212t/h (51MW) for test 2. On 16/7 the boiler 4 feed water flowrate varied between 203 and 241t/h (49 to 58MW). The average load was 215t/h (52MW) for isokinetic test 3, 222t/h (54MW) for test 4 and 227t/h (55MW) for test 5.

Boiler 3 feed water flowrate varied between 210 and 229t/h on 15/7, corresponding to a boiler load of 51 to 55MW. The average load was 214t/h (52MW) for isokinetic test 1, 217t/h (52MW) for test 2 and 221t/h (53MW) for test 3. Both boilers 3 and 4 can operate at up to 60MW, as outlined in the Air Pollution Registration Certificate no. 405 valid to 12 September 2011.

Boiler 4 oxygen concentration varied between 3.8 and 4.8% on 14/7, with an average of 4.4% for isokinetic test 1 and 4.2% for test 2. On 16/7, boiler oxygen concentration varied between 3.1 and 5.0%, with an average of 4.6% for isokinetic test 3, 4.3% for test 4 and 4.2% for test 5. Boiler 3 oxygen concentration varied between 2.4 and 4.6% on 15/7, with an average of 3.9% for isokinetic test 1, 3.7% for test 2 and 3.4% for test 3.

At boiler 4 the bagfilter tubesheet differential pressure was evenly distributed between A and B lanes. On 14/7, the differential pressure was on average between 1.19 and 1.22kPa and on 16/7 the differential pressure varied between 1.20 and 1.25kPa. At boiler 3 the bagfilter tubesheet differential pressure was evenly distributed between A and B lanes at 1.40kPa.

At boiler 4 the ID fan amps was higher at A lane (50A) than at B lane (47A) on 14/7 and on 16/7 the A lane amps varied between 51 and 53A, while B lane value varied between 48 and 49A. Boiler 3 ID showed good balance between the A-lane and B-lane fans, with 53 to 54A at lane A and 54 to 55A at lane B.

4.2 Isokinetic Emission and Gas SO_x and NO_x Tests

4.2.1 Boiler 4

At boiler 4, the combined (A and B lanes) bagfilter particulate emissions varied between 59 and 71mg/Nm^3 (corrected to 12%CO_2) on 14/7. With the addition of a catalyst, the 16/7 tests indicated an emission rate of between 31 and 58mg/Nm^3. More importantly, the particulate emission is not the same for both lanes: on 14/7 lane A particulate emission was 107 and 90mg/Nm^3 for tests 1 and 2 respectively, while lane B emission was between 16 and 20mg/Nm^3 for the same tests. On 16/7, the lane A particulate emission was 42, 92 and 88mg/Nm^3 for tests 3, 4 and 5 respectively, while lane B emission was 18, 6 and 8mg/Nm^3 for the same tests. Given that the bags were replaced during June/July 2009, the difference in emission value between the two lanes indicates bag installation problems at lane A. The total boiler emission varied between 12 and 22kg/h.

The emission values were not as good as those measured in 2006 on the previous set of bags. Test results then indicated an average emission of 28mg/Nm^3 after 55 000 hours of operation (see CV60921A).

Total gas flowrate was 68.5 and 73.9Nm^3/s on 14/7, which is between 3 and 10% below the design volume of 76Nm^3/s. On 16/7, the gas flowrate was 86.0, 92.4 and 83.4Nm^3/s for isokinetic tests 3, 4 and 5 – between 10 and 22% above the above design volumetric flow. Gas temperatures at the fan inlet were between 118 and 125°C.

The volumetric flow balance between A and B lanes was not good for all tests. On 14/7 the flows were 70.3 and 71.2Am^3/s at A lane and 46.6 and 57.9Am^3/s at B lane for isokinetic tests 1 and 2. On 16/7 the flows were 81.5, 95.1 and 89.6Am^3/s at A lane and 66.5, 63.0 and 53.4Am^3/s at B lane for isokinetic tests 3, 4 and 5.

Sulphur oxide (SO_x) levels were measured at between 926 and 1204ppm on 14/7. Addition of the catalyst resulted in significantly lower emission levels on 16/7: between 78 and 168ppm. Total SO_x emission was between 705 and 846kg/h on 14/7 and between 67 and 153kg/h on 16/7 after addition of the catalyst. SO_x emission levels measured on 14/7 compared well with previous test work in 2006, when the average emission was 879ppm.

Nitrogen oxide (NO_x) levels were measured at between 32 and 72ppm on 14/7. Addition of the catalyst resulted in lower emission levels of 6 to 8ppm on 16/7. Total NO_x emission was between 25 and 51kg/h on 14/7 and between 6 and 7kg/h on 16/7. NO_x emission levels were

on both days (with & without catalyst) significantly lower than when previously measured in 2006, when the average emission was 508ppm.

4.2.2 Boiler 3

At boiler 3, the combined (A and B lanes) bagfilter particulate emissions varied between 45 and 79mg/Nm^3 (corrected to 12%CO_2). The particulate emission was similar for both lanes: lane A particulate emission was between 50 and 65mg/Nm^3, while lane B emission was between 36 and 99mg/Nm^3. Given that the bags were last replaced during January 2004 and that the bags have completed some 36 000 hours of operation, the emission is quite good. The total boiler emission varied between 11 and 18kg/h.

The above emission values were not as good as measured in 2003 at boiler 3 (see report CV/30921A). Bags at that time had completed over 65 000 hours of operation and average emission was less than 15mg/Nm^3.

Total gas flowrate was 65.4 and 70.5Nm^3/s on 14/7, which is between 7 and 15% below the design volume of 76Nm^3/s. Gas temperature at the fan inlet was on average 111°C. The volumetric flow balance between A and B lanes was not good for all tests. Flows were between 63.1 and 68.8Am^3/s at A lane and 46.0 and 49.4Am^3/s at B lane.

Sulphur oxide (SO_x) levels were measured at between 1064 and 1457ppm. Total SO_x emission was between 711 and 998kg/h. Nitrogen oxide (NO_x) levels were measured at between 23 and 67ppm. Total NO_x emission was between 17 and 46kg/h.

4.3 Coal and Coal Ash Analysis

The coal samples on the three tests days were very similar and also compared well to samples analysed in 2006:

- Fixed carbon was between 46.3 and 49.3% (2006 samples 48.5 to 49.9%). All samples are significantly lower than the 2002 sample fixed carbon of 57.1%.
- Volatiles were between 23 and 25.4% (2006 samples 24.6 to 25.1%).
- Ash was between 23 and 24.7% (2006 samples 21.1 and 21.5%).
- Calorific value of between 22.7 and 23.3MJ/kg (2006 samples 22.9 to 23.4MJ/kg).

Overall, the coal quality decreased between 2002 and 2006, but the 2009 coal is very similar in quality to that of 2006. Sulphur content of the 14/7 and 15/7 samples at 1.55 and 1.28% respectively was higher than on 16/7 (0.89%) as well as for 2006 samples (0.84 to 0.95%).

When compared to the Delmas typical analysis, the coal samples had less fixed carbon (samples 46.3 to 49.3%, Delmas typical 55%) and a lower calorific value (samples 22.7 to 23.3MJ/kg, Delmas typical 25.6MJ/kg). The sample coal ash content is higher than Delmas typical (23 to 24.7% vs 16%).

Boiler 4 carbon content of ash was between 1.98% (fly ash) and 1.97% (bottom ash) on 14/7. With addition of the catalyst, the bottom ash analysed on 16/7 decreased in carbon content to 0.72%. Fly ash sampled on this date is being re-analysed due to a very high value. Boiler 3 carbon in ash was between 1.86% (fly ash) and 1.05% (bottom ash).

5 Conclusions

General boiler and bagfilter operation was normal over the test period. Boiler 4 was operated on average at 53MW on 14/7 and 52MW on 16/7. Boiler 3 was operated on average at 53MW on 15/7. Bagfilter differential pressure was consistent around 1.2kPa at boiler 4 and a little higher at 1.4kPa at boiler 3. This reflects the difference in bag operating life between the boilers: boiler 4 bags are new (changed June 2009), while boiler 3 bags have completed approximately 36 000 hours of operation.

Boiler 4 average total gas flowrate was 71.1Nm^3/s on 14/7, and significantly higher at 87.3Nm^3/s on 16/7. Gas temperatures at the fan inlet were between 118 and 125°C.
The volumetric flow balance between A and B lanes was not good: on 14/7 the average flow was 70.7Am^3/s at A lane and 52.4Am^3/s at B lane. On 16/7 the average flow was 88.7Am^3/s at A lane and 61.0Am^3/s at B lane.

Boiler 4 bagfilter emission level was 65mg/Nm^3 (corrected to 12% CO_2) on 14/7 and 49mg/Nm^3 (12% CO_2) on 16/7. The emission levels are not in line with the fact that a full bag change was done during June 2009. Lane A emissions were 99mg/Nm^3 on 14/7 and 74mg/Nm^3 on 16/7, while lane B emissions were 18mg/Nm^3 on 14/7 and 11mg/Nm^3 on 16/7. All corrected to 12% CO_2. The difference in emission value between the two lanes appears to indicate bag installation problems at lane A. Average particulate emission at boiler 4 was 18kg/h. Particulate emission levels are however not as good as achieved with the previous set of bags which, when tested in 2006 (55 000 hours operation), had an emission of 28mg/Nm^3.

Boiler 4 sulphur oxide (SO_x) levels were on average 1091ppm on 14/7 and, after addition of the catalyst, SO_x levels were reduced to 136ppm. Nitrogen oxide (NO_x) levels were on average 48ppm on 14/7 and, after addition of the catalyst, NO_x levels were reduced to 8ppm. SO_x emission levels were comparable with 2006 tests (879ppm), while NOx emission levels were significantly lower than in 2006 (508ppm).

The catalyst improved overall gaseous emission levels significantly. SO_x emissions were on average reduced from 795 to 123kg/h, that is by 85%. If the improvement in coal sulphur content is taken into account (1.55% on 14/7 to 0.89% on 16/7), then the reduction is SO_x was 73%. NO_x emissions were similarly reduced by 81% from 34 to 7kg/h by use of the catalyst.

Boiler 3 average total gas flowrate was 67.4Nm^3/s. Gas temperature at the fan inlet was on average 111°C. The volumetric flow balance between A and B lanes was not optimal: the average flow was 66.1Am^3/s at A lane and 47.3Am^3/s at B lane.

Boiler 3 bagfilter emission level was 61mg/Nm^3 (corrected to 12% CO_2). The emission level is in line with the bag operating period of 36 000 hours (last change January 2004). Average particulate emission was 15kg/h. Particulate emission levels are however not as good as achieved with the previous set of bags which, when tested in 2003 (65 000 hours operation), had an emission of less than 15mg/Nm^3. Boiler 3 sulphur oxide (SO_x) levels were on average 1153ppm. Nitrogen oxide (NO_x) levels were on average 55ppm.

Plant Data - Summarised for Report

Date	Test	Time	Feed flow	Drum	Superheater	Boiler	Temperature		FD Fan	Baghouse dP		Ampere				Boiler
				Pressure	Outlet	O_2	ID Fan		%	kPa		ID Fan		FD Fan		
			t/h	MPa	Temp		A	B		A	B	A	B	A	B	MW
2009/07/14	Boiler 4	10:00	223	7.08	421	4.6	134	141	38	1.21	1.24	50	47	21	21	53.9
		11:00	225	7.11	418	4.7	134	140	37	1.2	1.21	50	47	20	21	54.3
		12:00	220	7.36	422	3.9	13	140	39	1.19	1.20	50	47	20	21	53.1
		13:00	215	7.25	421	4.5	134	142	35	1.16	1.17	50	47	20	21	51.9
		14:00	230	7.30	415	4.7	135	141	33	1.19	1.19	50	47	20	21	55.6
		15:00	212	7.18	425	4.1	134	140	35	1.22	1.22	50	47	20	21	51.2
		16:00	204	7.13	425	4.2	134	140	34	1.19	1.19	50	47	20	21	49.3
		17:00	218	7.10	419	3.8	135	141	34	1.21	1.20	49	46	20	21	52.7
		18:00	213	6.97	424	4.8	137	143	34	1.13	1.13	48	46	20	21	51.4
	Ave		**218**	**7.16**	**421**	**4.37**	**121**	**141**	**35**	**1.19**	**1.19**	**50**	**47**	**20**	**21**	52.6
	Max		**230**	**7.36**	**425**	**4.80**	**137**	**143**	**39**	**1.22**	**1.24**	**50**	**47**	**21**	**21**	55.6
	Min		**204**	**6.97**	**415**	**3.80**	**13**	**140**	**33**	**1.13**	**1.13**	**48**	**46**	**20**	**21**	49.3
	Test 1		**223**	**7.18**	**420**	**4.40**	**94**	**140**	**38**	**1.20**	**1.22**	**50**	**47**	**20**	**21**	53.8
	Test 2		**212**	**7.10**	**423**	**4.23**	**135**	**141**	**34**	**1.19**	**1.19**	**49**	**47**	**20**	**21**	51.1
2009/07/15	Boiler 3	10:00	214	6.81	438	4.6	126	126	23	1.40	1.40	55	55	18	18	51.7
		11:00	218	7.29	410	3.6	128	128	26	1.40	1.40	56	56	18	18	52.7
		12:00	213	7.02	412	3.9	126	126	23	1.40	1.40	53	54	18	18	51.4
		13:00	210	6.92	418	4.2	124	125	24	1.40	1.40	53	54	18	18	50.7
		14:00	215	7.04	418	3.6	124	125	26	1.40	1.40	53	54	18	18	51.9
		15:00	225	7.11	421	3.3	125	125	31	1.40	1.40	54	54	18	18	54.3
		16:00	224	7.13	425	3.4	123	126	30	1.40	1.40	54	54	18	18	54.1
		17:00	214	7.17	424	3.4	127	127	22	1.40	1.40	52	53	17	18	51.7
		18:00	229	7.25	419	2.4	125	126	18	1.40	1.40	52	53	17	18	55.3
	Ave		**218**	**7.08**	**421**	**3.6**	**125**	**126**	**25**	**1.40**	**1.40**	**54**	**54**	**18**	**18**	52.7
	Max		**229**	**7.29**	**438**	**4.6**	**128**	**128**	**31**	**1.40**	**1.40**	**56**	**56**	**18**	**18**	55.3
	Min		**210**	**6.81**	**410**	**2.4**	**123**	**125**	**18**	**1.40**	**1.40**	**52**	**53**	**17**	**18**	50.7
	Test 1		**214**	**7.08**	**413**	**3.90**	**126**	**126**	**24**	**1.40**	**1.40**	**54**	**55**	**18**	**18**	51.6
	Test 2		**217**	**7.02**	**419**	**3.70**	**124**	**125**	**27**	**1.40**	**1.40**	**53**	**54**	**18**	**18**	52.3
	Test 3		**221**	**7.14**	**423**	**3.37**	**125**	**126**	**28**	**1.40**	**1.40**	**53**	**54**	**18**	**18**	53.4
2009/07/16	Boiler 4	10:00	227	7.26	428	4.2	136	143	40	1.21	1.20	53	49	22	23	54.8
		11:00	203	6.94	427	5.0	138	144	40	1.26	1.24	53	49	22	23	49.0
		12:00	229	7.30	409	3.1	137	142	39	1.28	1.26	54	48	21	22	55.3
		13:00	234	7.22	428	4.7	136	142	41	1.20	1.19	53	49	21	22	56.5
		14:00	241	7.35	418	4.1	136	142	41	1.20	1.20	52	48	21	22	58.2
		15:00	217	7.17	451	4.0	137	142	38	1.20	1.19	48	46	21	22	52.4
		16:00	215	6.96	446	3.9	134	141	37	1.22	1.20	51	50	20	21	51.9
		17:00	209	7.08	445	4.0	136	140	37	1.22	1.21	50	47	20	21	50.5
		18:00	211	6.91	448	4.3	136	143	36	1.20	1.21	50	50	20	21	51.0
	Ave		**221**	**7.13**	**433**	**4.4**	**136**	**142**	**39**	**1.20**	**1.21**	**52**	**48**	**21**	**22**	53.3
	Max		**241**	**7.35**	**451**	**5.0**	**138**	**144**	**41**	**1.28**	**1.26**	**54**	**50**	**22**	**23**	58.2
	Min		**203**	**6.91**	**409**	**3.1**	**134**	**140**	**36**	**1.20**	**1.19**	**48**	**46**	**20**	**21**	49.0
	Test 3		**215**	**7.10**	**428**	**4.60**	**137**	**144**	**40**	**1.24**	**1.22**	**53**	**49**	**22**	**23**	51.9
	Test 4		**222**	**7.15**	**421**	**4.27**	**137**	**143**	**40**	**1.25**	**1.23**	**53**	**49**	**21**	**22**	53.6
	Test 5		**227**	**7.18**	**436**	**4.18**	**136**	**142**	**39**	**1.21**	**1.20**	**51**	**48**	**21**	**22**	54.8

ROOIWAL POWER STATION

Boiler Logsheet

NO. 04

Date. 14/07/2009

	Temperatures °C																				F.D FAN	Baghouse			Ampere					
	Econ. Feed		Air Heater								Econ		I.D Fan		Superheater Steam							D.P			I.D. Fan				F.D.Fan	
	Inlet	Outlet	Air Inlet		Air Outlet		Gas Inlet		Gas outlet		Gas Inlet		Gas Inlet		Prim Outlet		Sec Inlet					5	6	Pulse Rate	High Speed		Low Speed			
		B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A		%	A	B	-	A	B	A	B	A	B
0	204	286	285	44	29	263	254	302	292	165	162	575	565	142	135	428	427	421	426		39	1.20	1.21	..	51	47			21	23
0	205	287	286	43	28	263	255	303	293	165	162	579	564	141	134	426	426	420	424		41	1.20	1.20	..	51	47			21	23
0	205	287	286	43	27	262	254	302	292	163	161	578	566	140	133	426	425	418	424		40	1.20	1.20		51	47			21	23
0	205	287	286	43	27	262	254	302	292	163	160	578	566	140	133	426	425	418	424		40	1.19	1.20		51	47			21	23
00	205	287	285	42	26	262	253	302	292	163	160	580	553	139	132	426	424	417	424		40	1.19	1.18		51	47			21	23
00	205	288	287	41	27	261	253	300	291	163	160	577	558	139	132	423	422	419	421		39	1.20	1.22		51	47			22	23
00	205	288	287	41	27	261	253	300	291	163	160	577	558	139	132	423	422	419	421		39	1.20	1.22		51	47			22	23
00	207	290	288	42	27	262	254	303	293	163	160	583	554	139	132	423	424	418	422		40	1.20	1.21		51	47			21	22
.00	205			42	27	262	253			163	160	578	560	139	132							1.19	1.20							
VE	206	290	289	42	28	266	257	305	295	168	164	593	571	142	135	420	421	417	419		37	1.19	1.20		51	47			21	22
.00	206	290	288	43	28	266	257	305	295	166	163	588	572	142	135	426	424	415	424		39	120	121		51	47			21	22
.00	205	286	285	45	30	260	252	295	287	164	162	573	547	141	134	422	420	416	420		38	121	124		50	47			21	21
.00	205	289	287	45	31	259	251	295	286	164	162	565	563	140	134	418	418	414	417		37	1.20	1.21		50	47			20	21
1.00	205	288	287	47	32	258	251	297	288	164	162	573	569	140	134	422	422	418	420		39	1.19	1.20		50	47			20	21
2.00	205	287	286	46	33	260	252	296	287	166	164	567	559	142	135	421	420	416	419		35	1.16	1.17		50	47			20	21
3.00	206	290	288	47	33	259	252	296	287	165	163	563	560	141	135	446	445	411	413		33	1.19	1.19		50	47			20	21
4.00	204	286	285	47	34	255	248	290	283	163	162	563	554	140	134	425	424	419	423		35	1.22	1.22		50	47			20	21
5.00	205			45	31	260	252			165	162	573	561	141	134							1.19	1.20							
AVE																														
6.00	204	287	286	48	34	256	248	293	284	164	162	568	551	140	134	424	424	420	423		34	1.19	1.19		50	47			20	21
7.00	204	286	285	48	34	257	249	292	284	165	163	559	553	141	135	419	419	415	417		34	1.21	1.20		49	46			20	21
8.00	203	285	284	48	34	260	252	295	286	168	166	567	560	143	137	423	425	417	421		32	1.13	1.13		48	46			20	21
9.00	206	288	287	48	33	261	253	298	289	167	165	577	562	143	137	427	428	418	426		36	1.21	1.21		48	46			20	21
0.00	205	287	286	45	31	262	254	300	290	166	163	580	569	143	137	430	430	415	423		35	1.22	1.22		48	46			20	21
1.00	206	288	287	45	29	263	254	302	292	166	163	583	565	141	135	428	428	416	426		35	1.20	1.20		50	47			21	23
2.00	206	290	288	44	29	263	255	302	292	166	163	588	565	141	135	426	428	416	424		39	121	120		50	47			21	23
3.00	205	287	286	44	28	264	255	303	293	165	162	590	566	141	134	428	430	416	425		35	1.19	1.21		50	48			21	22
AVE	205			46	32	261	254			166	163	577	561	141	135							1.20	1.20		-					
AVE	205			44	30	261	253			165	161	576	561	140	134							1.19	1.20							

NIGHT SHIFT

MORNING SHIFT

AFTERNOON SHIFT

ROOIWAL POWER STATION

Boiler Logsheet

Date: 18/07/2009

Boiler No: 04

TIME	Pressure (M.p.a)			Steam	Feed	Air	Superheat Control					O²	Draughts										Fuel Oil	
							S.H. Steam		Burner	Spray Water			Air To Burners		Comb.	Boiler Outlet		Econ Outlet		Airheater Outlet		I.D.Fan Inlet		
	Drum	Super Heater	Feed	Flow	Flow	Flow	B	A	Tilt	A	B		A	B	Chamb.	A	B	A	B	A	B	A	B	Temp.	Press.
00.00	702	637	866	248	214	46	493	488	-3	0	7	3.8	-83	.83	-04	-19	-19	.37	.37	-81	-81	2.39	2.39	92	33
01.00	709	643	866	251	220	46	492	489	-3	0	12	3.8	-87	-87	-03	-17	-17	-46	-46	-79	-79	-2.36	2.36	91	32
02.00	714	649	867	247	217	46	491	488	-3	0	13	3.8	-83	-83	-04	-18	-18	-46	-46	-80	-80	2.36	2.36	92	33
03.00	714	649	867	247	217	46	491	488	-3	0	13	3.8	-82	-82	-04	18	-18	.47	.47	-80	-80	.236	2.36	92	32
04.00	707	641	866	250	217	46	496	488	-3	0	12	3.8	-84	-84	-03	-17	-17	.45	.45	-78	-78	2.30	2.30	93	33
05.00	730	667	860	244	215	45	489	483	-3	0	0	3.8	-79	-79	-04	-17	-17	-45	-45	-78	-78	2.24	2.24	92	33
06.00	730	669	860	244	215	45	489	483	-3	0	0	3.8	-78	-78	-04	-17	-17	-45	-45	-78	-78	2.24	2.24	92	33
07.00	7.38	6.75	8.54	243	227	45	489	485	-3	0	6	3.8	-80	-80	-04	-16	-16	-45	-45	-78	-78	-2.24	-2.24	92	33
AVE	7.18	6.53	8.63				490	486				3.8													
08.00	7.35	6.66	8.63	250	233	44	490	483	-3	0	3	3.8	-81	-81	-01	-18	-18	-46	-46	-81	-81	2.29	2.29	92	33
09.00	7.44	6.77	8.58	257	231	46	490	489	-3	4	11	4.5	-81	-81	-05	-18	-18	-48	-48	-83	-83	-2.28	-2.28	90	33
10.00	7.08	6.41	8.62	250	223	43	491	486	-3	0	0	4.6	-72	-72	-03	-15	-15	-44	-44	-74	-74	-2.17	-2.17	90	32
11.00	7.11	6.48	8.57	243	225	43	487	481	-3	0	0	4.7	68	68	-03	-14	-14	-40	-40	-70	-70	-2.12	-2.12	90	32
12.00	7.36	6.70	8.63	255	220	43	493	488	-3	0	3	3.9	-73	-73	-03	-15	-15	-43	-43	-74	-74	-2.23	-2.23	92	33
13.00	7.25	6.60	8.70	250	215	43	490	484	-3	0	0	4.5	-67	-67	-03	-15	-15	-42	-42	-72	-72	-2.20	-2.20	94	33
14.00	7.30	6.66	8.54	243	230	43	482	476	-3	0	0	4.7	-63	-63	-04	-15	-15	-40	-40	-69	-69	-2.19	-2.19	93	33
15.00	7.18	655	8.65	244	212	41	495	489	+5	0	5	4.1	-62	-62	-03	-15	-15	-39	-39	-66	-66	-2.19	-2.19	94	33
AVE	725	660	861				489	484				4.3													
16.00	713	650	866	245	204	42	494	490	+5	0	10	4.2	-63	-63	-04	-18	-18	-41	-41	-69	-69	-2.16	-2.16	92	32
17.00	710	644	867	249	218	41	490	483	+5	0	0	3.8	-63	-63	-01	-14	-14	-38	-38	-67	-67	-2.15	-2.15	93	33
18.00	697	633	869	239	213	42	494	496	+5	0	5	4.8	-64	-64	-03	-16	-16	-40	-40	-70	-70	2.14	2.14	90	32
19.00	736	673	872	248	215	42	495	494	+5	0	21	4.1	-67	-67	-03	-20	-20	-42	-42	-72	-72	-2.22	-2.22	91	33
20.00	711	642	868	258	214	44	491	490	+5	9	14	4.1	-78	-78	-02	-18	-18	-42	-42	-73	-73	-224	-2.24	91	33
21.00	735	670	870	253	218	43	493	493	+5	20	22	3.6	-72	-72	-04	-19	-19	-42	-42	-73	-73	-222	-222	92	33
22.00	746	681	858	255	228	44	492	492	+5	17	20	3.7	-79	-79	-03	-18	-18	-43	-43	-75	-75	-228	228	92	33
23.00	717	645	874	259	206	45	493	493	+5	21	26	3.9	-81	-81	-03	-18	-18	-45	-45	-77	-77	-225	225	92	33
AVE	7.21	6.56	8.68				493	491				4.0													
TOT AVE	7.21	656	8.64				491	487				4.0													

RUNNING HOURS

.....

FEED FLOW

START .....

END .....

DIFFERENCE .....

Night Shift

Morning Shift

Afternoon Shift

ROOIWAL POWER STATION
Boiler Logsheet

Boiler No.: 04 Date: 14/07/2009

TIME	A Mill Group										B Mill Group										C Mill Group										D Mill Group									
	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR
00.00	"	305	55	210	2.6	6.0	60	140	50	39											-04	3.00	39	220	1.8	6.0	60	180	50	36	-03	339	40	210	1.5	7.0	60	160	50	23
01.00		306	54	205	2.8	6.0	60	140	50	45											-06	3.00	38	220	1.8	6.0	60	170	50	39	-07	332	40	200	1.5	7.0	60	150	50	26
02.00	"	304	55	200	2.8	6.0	60	140	50	41											-07	3.01	39	220	1.8	6.0	60	160	50	31	-05	3.48	41	200	1.5	7.0	60	150	50	24
03.00		304	55	200	2.8	6.0	60	140	50	41											-06	3.02	39	210	1.8	6.0	60	160	50	32	-05	3.48	41	200	1.5	7.0	60	150	50	25
04.00	"	302	53	200	2.0	6.0	60	145	50	48											-06	3.04	37	220	1.8	6.0	60	165	50	37	-05	3.46	41	200	1.5	7.0	60	145	50	23
05.00		290	51	205	2.2	6.0	60	130	50	34											-08	3.15	39	210	1.8	6.0	60	150	50	36	-07	340	42	200	1.6	7.0	60	150	50	25
06.00		291	51	205	2.2	6.0	60	130	50	34				S/by							-08	3.14	39	210	1.8	6.0	60	150	50	36	-07	341	42	200	1.6	7.0	60	150	50	23
07.00	S/c	290	51	205	2.5	5.2	60	165	50	48											-04	3.12	39	220	2.0	5.5	60	165	50	38	-02	344	42	210	1.8	5.5	60	165	50	22
08.00	"	289	51	215	2.5	5.5	60	165	55	42											-06	307	38	229	2.0	5.5	60	170	55	41	-04	334	41	215	2.0	5.5	60	170	55	25
09.00	"	282	52	210	2.3	5.5	60	165	51	38											-06	301	38	221	2.1	6.0	60	175	51	40	-04	326	42	210	2.1	6.0	60	165	51	26
10.00	"	291	54	205	1.7	6.0	65	160	49	41											-07	317	44	219	1.6	6.0	65	155	49	27	-05	343	45	205	1.7	6.1	65	155	50	23
11.00		280	58	200	1.5	6.0	65	155	49	29											-07	319	45	220	1.6	6.0	65	150	49	28	-05	358	47	210	1.5	6.0	65	155	50	22
12.00	"	294	57	211	1.7	5.2	60	155	54	41											-06	322	44	220	1.6	5.1	60	155	54	33	-04	356	48	211	1.5	5.0	60	150	54	25
13.00		294	55	210	1.7	5.0	60	155	54	42											-06	327	46	220	1.6	5.0	60	155	54	29	-04	371	51	210	1.5	5.0	60	155	54	22
14.00	"	281	55	200	1.7	5.1	60	155	45	41											-03	318	46	211	1.6	5.2	60	150	45	29	-02	359	50	201	1.5	5.1	60	140	46	21
15.00	"	280	56	200	1.7	5.1	60	150	45	42											-05	313	47	210	1.6	5.2	60	145	45	26	-03	357	51	200	1.5	5.1	60	140	46	22
16.00	"	288	56	200	1.7	5.1	60	155	45	40											-06	316	49	210	1.5	5.2	60	140	45	25	-03	361	51	200	1.5	5.1	60	140	46	21
17.00		287	55	200	1.8	5.1	60	150	45	42											-06	314	50	210	1.5	5.2	60	140	45	24	-04	361	52	200	1.5	5.1	60	145	46	24
18.00		280	54	200	1.6	5.2	60	145	45	39											-07	309	49	210	1.6	5.2	60	140	45	29	-05	359	51	200	1.5	5.1	60	140	46	28
19.00		279	54	200	1.6	5.2	60	160	45	37											-06	314	47	210	1.6	5.2	60	150	45	32	-04	355	49	200	1.5	5.1	60	150	45	21
20.00	"	280	54	200	1.6	5.2	60	150	45	40											-06	314	47	210	1.6	5.2	60	155	45	31	-04	346	50	200	1.5	5.0	60	140	45	22
21.00		278	52	200	1.7	5.3	60	165	45	37											-04	312	46	210	1.6	5.2	60	165	45	31	-03	348	49	200	1.5	5.0	60	150	45	22
22.00	"	285	55	200	1.6	5.3	60	150	45	36											-06	294	42	220	1.6	5.2	60	165	45	32	-04	332	46	200	1.5	5.0	60	150	45	21
23.00		295	56	200	1.6	5.0	60	180	45	36	=	=									-06	297	41	220	1.6	5.0	60	170	45	32	-05	305	44	200	1.5	5.0	60	180	45	26

MILL A - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL B - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL C - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL D - MILL HOURS

START .....

END .....

DIFFERENCE .....

Night Shift: ..... Morning Shift: ..... Afternoon Shift: .....

ROOIWAL POWER STATION
BOILER LOGSHEET - P.F PLANT

BOILER: 04

Date: 14 July 09

TIME	Mill Motor Oil Level							
	A		B		C		D	
	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
03.00	½	½	½	½	½	½	½	½
07.00	¼W	¼W	¼W	¼W	¼W	¼W	¼W	¼W
11.00	¼W	¼W	¼W	¼W	¼W	¼W	¼W	¼W
15.00	½	½	½	½	½	½	½	½
19.00	½	½	½	½	½	½	½	½
23.00	½	½	½	½	½	½	½	½

TIME	Mill Motor Oil Rings Turning							
	A		B		C		D	
	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	S/B	S/B	yes	yes	yes	yes
07.00	yes	yes	SBY	SBY	yes	yes	yes	yes
11.00	yes							
15.00	yes	yes	S/BY	S/BY	yes	yes	yes	yes
19.00	yes	yes	O/C	O/C	yes	yes	yes	yes
23.00	yes	yes	O/C	O/C	yes	yes	yes	yes

TIME	Mill Trunion Arm Oil Level							
	A		B		C		D	
	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
03.00	½	½	½	½	½	½	½	½
07.00	¼W	¼W	¼W	¼W	¼W	¼W	¼W	¼W
11.00	¼W	¼W	¼W	¼W	¼W	¼W	¼W	¼W
15.00	½	½	½	½	½	½	½	½
19.00	½	½	½	½	½	½	½	½
23.00	½	½	½	½	½	½	½	½

TIME	Exhauster Motor Oil Level							
	A		B		C		D	
	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
03.00								
07.00								
11.00								
15.00								
19.00								
23.00								

TIME	Exhauster Cooling Water Circulating			
	A	B	C	D
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00	yes	yes	yes	yes

NIGHT SHIFT: FREDDY

MORNING SHIFT: T. Mwabi

AFTERNOON SHIFT:

TIME	Mill 1A Gearbox Oil Pump					
	Amps	Alarm	Water	Oil		Flow
				Temp.	Press	
00.00						
01.00						
02.00						
03.00						
04.00						
05.00						
06.00						
07.00						
08.00						
09.00						
10.00						
11.00						
12.00						
13.00						
14.00						
15.00						
16.00						
17.00						
18.00						
19.00						
20.00						
21.00						
22.00						
23.00						

TIME	Exhauster fluid Drive Coupling Temp.			
	A	B	C	D
00.00	32	S/B	39	33
01.00	32	S/B	39	33
02.00	32	S/B	39	33
03.00	32	S/B	38	32
04.00	32	S/B	38	32
05.00	32	S/B	38	32
06.00	32	S/B	38	32
07.00	31	SBY	36	25
08.00	31	SBY	36	25
09.00	31	SBY	36	25
10.00	31	SBY	36	25
11.00	31	S/B	38	31
12.00	31	S/B	38	31
13.00	32	S/B	38	32
14.00	32	S/B	38	32
15.00	34	S/B	40	34
16.00	34	S/B	40	34
17.00	34	S/B	40	35
18.00	34	S/B	40	35
19.00	34	O/C	40	34
20.00	34	O/C	40	34
21.00	33	O/C	40	33
22.00	33	O/C	40	33
23.00	34	O/C	40	33

TIME	mill gearbox oil level			
	A	B	C	D
03.00	½	½	½	½
07.00	¼	¼	¼	¼W
11.00	¼W	¼W	¼W	¼W
15.00	½	½	½	½
19.00	½	½	½	½
23.00	½	½	½	½

TIME	mill gearbox oil pressure			
	A	B	C	D
03.00	52	S/B	100	60
07.00	50	SBY	100	60
11.00	52	S/B	101	60
15.00	50	S/B	101	60
19.00	50	O/C	101	60
23.00	50	O/C	100	55

TIME	Feeder gearbox oil level			
	A	B	C	D
03.00	3/4	3/4	3/4	3/4
07.00	3/4	3/4	3/4	3/4
11.00	3/4	3/4	3/4	3/4
15.00	3/4	3/4	3/4	3/4
19.00	3/4	3/4	3/4	3/4
23.00	3/4	3/4	3/4	3/4

TIME	Separator gearbox oil level			
	A	B	C	D
03.00	½	½	½	½
07.00	¼W	¼W	¼W	¼W
11.00	¼W	¼W	¼W	¼W
15.00	½	½	½	½
19.00	½	½	½	½
23.00	½	½	½	½

TIME	Propane	
	A	B
03.00	34	0
07.00	34	OSBY
11.00	33	S/B-0
15.00	32	S/B-
19.00	32	0
23.00	30	0

TIME	Chlorine flow	
	Yes	No
03.00		
07.00		
11.00		
15.00		
19.00		
23.00		

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ROOIWAL POWER STATION
BOILER LOGSHEET - ID/FD FAN PLANT

BOILER: 04

Date: 14 July 09

TIME	ID Fan Motor Bearing Oil Level			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	½	½	½	½
07.00	½	½	½	½
11.00	½	½	½	½
15.00	½	½	½	½
19.00	½	½	½	½
23.00	½	½	½	½

TIME	ID Fan Bearing Oil Level			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	½	½	½	½
07.00	½	½	½	½
11.00	½	½	½	½
15.00	½	½	½	½
19.00	½	½	½	½
23.00	½	½	½	½

TIME	FD Fan Motor Bearing Oil Level			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	½	½	½	½
07.00	½	½	½	½
11.00	½	½	½	½
15.00	½	½	½	½
19.00	½	½	½	½
23.00	½	½	½	½

TIME	FD Fan Bearing Oil Level			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	½	½	½	½
07.00	½	½	½	½
11.00	½	½	½	½
15.00	½	½	½	½
19.00	½	½	½	½
23.00	½	½	½	½

TIME	ID Fan Motor Bearing Oil Rings Turning			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00	yes	yes	yes	yes

TIME	ID Fan Bearing Oil Rings Turning			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00	yes	yes	yes	yes

TIME	FD Fan Motor Bearing Oil Rings Turning			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00				

TIME	FD Fan Bearing Oil Rings Turning			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00	yes	yes	yes	yes

TIME	ID Fan motor Bearing Temp			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	48	58	50	52
07.00	45	56	50	50
11.00	47	58	50	51
15.00	50	60	50	52
19.00	48	58	50	54
23.00				

TIME	ID Fan Bearing Temp			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00				
07.00				
11.00				
15.00				
19.00				
23.00				

TIME	FD Fan motor Bearing Temp			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00	54	25	38	40
07.00	54	25	37	40
11.00	63	26	38	42
15.00	64	25	41	40
19.00	60	25	39	42
23.00	60	25	40	43

TIME	FD Fan Bearing Temp			
	A		B	
	No. 1	No. 2	No. 1	No. 2
03.00				
07.00				
11.00				
15.00				
19.00				
23.00				

TIME	ID Fan Motor Cooling Water Circulating			
	A		D	
	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00	yes	yes	yes	yes

TIME	ID Fan Cooling Water Circulating			
	A		D	
	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00	yes	yes	yes	yes

TIME	FD Fan Motor Cooling Water Circulating			
	A		D	
	No. 1	No. 2	No. 1	No. 2
03.00	yes			
07.00				
11.00				
15.00				
19.00				
23.00				

TIME	FD Fan Cooling Water Circulating			
	A		D	
	No. 1	No. 2	No. 1	No. 2
03.00	yes	yes	yes	yes
07.00	yes	yes	yes	yes
11.00	yes	yes	yes	yes
15.00	yes	yes	yes	yes
19.00	yes	yes	yes	yes
23.00	yes	yes	yes	yes

	Gauge Column Levels	
Time	North	South
03.00	4.0	4.0
07.00	N.W.L	N.W.L
11.00	4-0	3-0
15.00	N.W.L	N.W.L
19.00	N.W.L	N.W.L
23.00	4-0	3-0

NIGHT SHIFT: FREDDY

MORNING SHIFT: T. Mavasi

AFTERNOON SHIFT:

14/07/2009

Boiler PPO logsheet

TIME	1D Fan Cooling Water Circulating				
	Blr 1	Blr 2	Blr 3	Blr 4	Blr 5
01 H00			YES	YES	
05 H00			YES	YES	
09 H00			YES	YES	
13 H00			YES	YES	
17 H00			YES	YES	
21 H00			YES	YES	

TIME	FD Fan Cooling Water Circulating				
	Blr 1	Blr 2	Blr 3	Blr 4	Blr 5
01 H00			YES	YES	
05 H00			YES	YES	
09 H00			YES	YES	
13 H00			YES	YES	
17 H00			YES	YES	
21 H00			YES	YES	

Ashplant water level		
TIME	High	Low
01 H00		Low
05 H00		Low
09 H00		Low
13 H00		Low
17 H00		Low
21 H00		Low

TIME	Gauge Column Levels									
	Blr 1		Blr 2		Blr 3		Blr 4		Blr 5	
	North	South	North	South	North	South	North	South	North	South
01 H00				-	ISOL	3.0	4.0	3.0		
05 H00					ISOL	3.0	4.0	3.0		
09 H00					ISOL	3.0	4.0	3.0		
13 H00					ISOL	3.0	4.0	3.0		
17 H00					ISOL	3.0	4.0	3.0		
21 H00					ISOL	3.0	4.0	3.0		

Mill Gearbox Pressure									
TIME	Boiler 1				TIME	Boiler 2			
	A	B	C	D		A	B	C	D
01 H00					01 H00				
05 H00					05 H00				
09 H00					09 H00				
13 H00					13 H00				
17 H00					17 H00				
21 H00					21 H00				

Mill Gearbox Pressure									
TIME	Boiler 3				TIME	Boiler 4			
	A	B	C	D		A	B	C	D
01 H00	94	87	69	114	01 H00	50	84	100	60
05 H00	94	84	68	114	05 H00	50	84	100	60
09 H00	"	85	70	114	09 H00	52	"	105	59
13 H00	"	84	65	112	13 H00	52	"	105	60
17 H00	94	89	65	114	17 H00	50	94	100	60
21 H00	94	86	70	114	21 H00	50	94	100	60

Propane Gas Pressure		
TIME	A	B
01 H00	35	0
05 H00	35	0
09 H00	34	0
13 H00	32	0
17 H00	32	0
21 H00	30	0

Night Shift

Afternoon Shift

Mill Gearbox Pressure				
TIME	Boiler 5			
	A	B	C	D
01 H00				
05 H00				
09 H00				
13 H00				
17 H00				
21 H00				

OIL PLANT CLEAN		
TIME	Yes	No
01 H00	YES	
05 H00	YES	
09 H00	YES	
13 H00	YES	
17 H00	YES	
21 H00	YES	

ROOIWAL POWER STATION
BOILER FUEL LOGSHEET

DATE: 14/07/2009

TIME	LP 20 Diff	HP 40 Diff East	HP 40 Diff West	LINE 40 Diff	L.P OIL METER	L.P Oil Press.KPA	H.P Oil Press.MPA	H.P Oil Line Temp.	H.P.Pump Running	L.P.Pump Running	Tank Level A%	Tank Level B%	Tank Temp
00.00	0	0	0	16	305437	4.02	36.5	100	23/25/24	3.5=3.0	60	61	48/50
02.00	0	0	0	15	306197	4.00	36.7	100	23/25/24	3.5=3.0	60	60	48/50
04.00	0	0	0	10	307133	4.01	36.6	100	23/25/24	3.5=3.1	60	60	48/50
06.00	1	0	0	15	307874	4.00	36.3	100	23/25/24	3.5/3.0	60	60	48/51
08.00	0	0	0	35	308167	3.97	36.3	100	24 24 25	3.5 3.0	60	60	48 50
10.00	0	0	6	29	309648	4.04	36.6	100	24 24 26	3.2 3.0	60	60	44 45
12.00	0	0	0	40	313035	3.98	36.5	100	24 24 26	3.3 3.0	60	60	44 45
14.00	0	0	0	5	314047	4.04	36.4	100	24 24 26	3.3 3.0	59	59	44 45
16.00	0	0	0	6	316075	4.02	36.6	100	24/25/25	3.3=3.0	59	59	44/46
18.00	0	0	0	5	318844	4.01	36.8	100	25/26/25	3.4/3.3/3.0	57	57	44/46
20.00	0	0	0	8	319977	4.03	36.4	100	23/24/24	3.1/3.1/2.9	55	55	48/52
22.00	0	0	0	11	320735	4.00	36.6	100	24/24/24	3.3/3.3/3.0	55	55	44/52

NIGHT SHIFT: [illegible] S.

MORNING SHIFT:.....

AFTERNOON SHIFT: [illegible] S. [signature]

OFF LOADING METER

TANKER	1	2	3	4	5	6	7
START							
END							
DIFF							
A.P.A							

ROOIWAL POWER STATION

Boiler Logsheet

Boiler No: 3 Date: 15-07-2009

TIME	Temperatures °C																				F.D FAN	Baghouse			Ampere					
	Econ. Feed			Air Heater								Econ		I.D Fan		Superheater Steam					D.P			I.D. Fan				F.D.Fan	
	Inlet	Outlet		Air Inlet		Air Outlet		Gas Inlet		Gas outlet		Gas Inlet		Gas Inlet		Prim Outlet		Sec Inlet			5	6	Pulse Rate	High Speed		Low Speed			
		B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	%	A	B	-	A	B	A	B	A	B
00.00	201	282	284	35	32	243	237	283	280	156	156	596	567	122	121	428	437	411	422	15	1.4	1.4		52	54			18	18
01.00	202	284	286	33	31	242	237	284	280	156	156	609	573	121	121	430	433	405	421	28	1.4	1.4		54	56			18	18
02.00	203	286	288	33	30	246	240	289	286	156	157	612	581	121	121	430	434	411	424	28	1.4	1.4		54	54			18	18
03.00	202	284	286	32	30	246	240	286	284	157	157	603	575	121	121	428	431	410	423	25	1.4	1.4		54	54			18	18
04.00	203	285	287	32	30	246	241	290	286	157	157	614	584	121	121	430	433	410	423	30	1.4	1.4		54	56			18	19
05.00	203	287	288	32	30	247	242	291	287	157	157	612	584	122	121	431	434	411	425	27	1.4	1.4		54	54			18	18
06.00	203	285	287	31	29	245	240	286	283	156	157	603	577	121	121	431	435	411	424	17	1.4	1.4		52	54			18	18
07.00	200	283	285	31	28	245	240	287	284	156	156	609	586	120	120	433	436	410	423	23	1.4	1.4		53	54			18	18
AVE	202			32	30	245	239			156	156	607	578	121	121						1.4	1.4							
08.00	203	285	286	31	28	246	241	289	286	156	156	610	591	120	120	431	435	411	425	23	1.4	1.4		53	54			18	18
09.00	203	285	287	32	30	252	246	293	290	163	163	617	603	125	125	428	436	414	423	23	1.4	1.4		55	55			18	18
10.00	202	283	284	33	31	252	247	293	289	164	164	615	603	126	126	434	440	412	423	23	1.4	1.4		55	55			18	18
11.00	204	287	289	31	35	252	247	293	289	166	167	597	580	128	128	408	413	310	409	26	1.4	1.4		56	56			18	18
12.00	203	284	285	31	36	244	239	281	278	160	161	579	568	126	126	409	415	411	411	23	1.4	1.4		53	54			18	18
13.00	202	283	284	38	36	243	238	283	280	153	159	586	574	124	125	415	422	410	415	24	1.4	1.4		53	54			18	18
14.00	202	284	286	38	37	244	239	282	281	159	160	591	574	124	125	414	421	411	414	26	1.4	1.4		53	54			18	18
15.00	203	286	287	39	37	247	241	288	284	160	161	604	584	125	125	418	425	409	417	31	1.4	1.4		54	54			18	18
AVE	202			35	33	247	242			161	161	600	581	124	125						1.4	1.4							
16.00	203	289	287	38	38	257	254	289	280	161	162	573	561	128	126	419	430	408	421	30	1.4	1.4		54	54			18	16
17.00	204	286	287	40	38	248	242	287	282	161	161	601	583	127	127	420	429	409	420	22	1.4	1.4		52	53			17	18
18.00	203	287	288	40	37	247	241	286	281	161	161	603	577	125	126	414	423	409	414	18	1.4	1.4		52	53			17	18
19.00	203	286	287	39	36	247	241	286	281	161	161	605	577	126	126	421	428	408	420	25	1.4	1.4		52	53			18	18
20.00	203	286	288	37	35	247	240	289	285	159	159	611	592	124	124	423	432	408	423	27	1.4	1.4		52	54			18	18
21.00	202	285	286	36	33	247	240	287	282	158	158	604	586	124	123	420	430	410	420	24	1.4	1.4		54	54			18	18
22.00	202	285	286	36	33	247	241	289	284	158	158	607	590	123	123	423	432	409	423	23	1.4	1.4		54	54			18	18
23.00	202	286	287	35	33	246	240	290	285	157	158	612	592	123	123	422	431	412	422	28	1.4	1.4		54	56			18	18
AVE	202			39	35	247	240			160	160	602	584	125	125						1.4	1.4							
AVE	202			35	33	246	241			159	159	603	581	123	124						1.4	1.4							

NIGHT SHIFT

MORNING SHIFT

AFTERNOON SHIFT

ROOIWAL POWER STATION

Boiler Logsheet

Boiler No: 3 Date: 15-07-2009

TIME	Pressure (M.p.a) Drum	Super Heater	Feed	Steam Flow	Feed Flow	Air Flow	Superheat Control S.H. Steam B	S.H. Steam A	Burner Tilt	Spray Water A	Spray Water B	O²	Draughts Air To Burners A	Air To Burners B	Comb. Chamb.	Boiler Outlet A	Boiler Outlet B	Econ Outlet A	Econ Outlet B	Airheater Outlet A	Airheater Outlet B	I.D.Fan Inlet A	I.D.Fan Inlet B	Fuel Oil Temp.	Fuel Oil Press.
00.00	685	642	9.08	212	209	41	491	491	+0	20	26	3·8	53	53	-03	-21	-21	-36	-36	-69	-69	o/c	o/c	94	34
01.00	710	662	9.08	224	216	43	490	488	-10	19	27	2·9	56	56	-03	-22	-22	-39	-39	-73	-73	"	"	94	32
02.00	720	671	9.05	224	223	43	491	490	-10	17	25	3·0	60	60	-03	-22	-22	-38	-38	-73	-73	"	"	93	33
03.00	701	655	9.09	217	209	41	490	489	-10	15	23	2·8	53	53	-02	-20	-20	37	-37	-69	-69	"	"	92	32
04.00	712	664	9.10	224	226	43	490	489	-10	16	24	3·1	62	62	-03	-22	-22	-39	-39	-73	-73	"	"	93	32
05.00	725	677	894	229	222	43	490	489	-10	15	24	3·0	62	62	-03	-22	-22	-39	-39	-73	-73	"	"	93	33
06.00	707	663	896	210	210	40	490	489	-10	16	24	3·4	48	48	-03	-21	-21	-37	-37	-69	-69	"	"	95	32
07.00	6·99	6·52	9.05	219	211	42	490	489	-10	17	26	3.3	-55	-55	-03	-21	-21	-38	-38	-70	-70			93	33
AVE	7·07	6·60	9.04				490	489				3·1													
08.00	7.09	6·63	9.05	216	216	42	490	490	-10	17	24	3.3	-54	-54	-03	-21	-21	-38	-38	-70	-70			93	33
09.00	7.03	6·56	9.16	223	224	41	490	489	-10	15	25	3.8	-52	-53	-05	-25	-25	-41	-41	-80	-80			93	33
10.00	6·81	6.37	9.14	212	214	41	490	490	-10	23	27	4.6	-53	-52	-04	-24	-24	-40	-40	-78	-78			92	33
11.00	7.29	6·79	8·97	230	228	42	488	491	±0	0	0	3.6	-55	-55	-03	-24	-24	-42	-42	-83	-83			92	33
12.00	7.02	6·57	9.03	212	213	41	489	476	±0	0	0	3.9	-53	-53	-02	-20	-20	-36	-36	-68	-68			91	33
13.00	6·92	6.48	9.09	211	210	41	490	482	±0	0	16	4.2	-53	-53	-04	-22	-22	-37	-37	-72	-72			92	33
14.00	7.04	6·59	9.04	216	215	41	490	481	±0	0	12	3.6	-53	-53	-03	-20	-20	-37	-37	-70	-70			94	33
15.00	7.11	6.62	9.05	225	225	42	490	486	+0	0	19	3·3	-61	-61	-02	-21	-21	-38	-38	-73	-73			92	33
AVE	7.04	6·57	9.06				489	483				3·8													
16.00	7.13	6.66	9.06	223	224	42	490	490	+0	11	23	3·4	61	61	-02	22	22	39	39	-73	-73			92	33
17.00	7.17	6.73	8.93	212	214	40	490	487	+0	0	21	3.3	52	52	-03	20	20	37	-37	-68	-68			92	33
18.00	7.25	6.75	8·97	228	229	40	490	485	+0	0	16	2·4	52	52	-03	-18	-18	-35	-35	-66	-66			92	33
19.00	7.14	6.66	9.01	218	222	41	491	489	+0	3	23	2.9	56	56	-02	-18	-18	36	36	-67	-67			92	33
20.00	7.24	6.77	8·97	219	222	42	490	491	+0	17	25	3·1	57	57	-03	-20	-20	-39	-39	-71	-71			92	33
21.00	7.09	6.65	8·96	214	214	41	490	486	+0	0	20	3·3	53	53	02	-20	-20	-36	-36	-69	-69			92	32
22.00	7.09	6.65	9.04	215	215	41	490	489	0	0	23	3·8	55	55	-03	-21	-21	-37	-37	-70	-70			93	32
23.00	712	664	9·06	225	225	43	492	489	+0	0	24	3·1	61	61	-03	-22	-22	39	-39	-73	-73			94	33
AVE	715	669	9.00				490	488				3·2													
TOT AVE	709	662	9·03				489	487				3·4													

RUNNING HOURS

.....

FEED FLOW

START .....

END .....

DIFFERENCE .....

Night Shift

Morning Shift

Afternoon Shift

ROOIWAL POWER STATION
Boiler Logsheet

Boiler No.: 5 Date: 15-07-2009

TIME	A Mill Group										B Mill Group										C Mill Group										D Mill Group									
	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR
00.00			o/c					o/c			-01	332	60	250	2.0	4.0	80	170	100	11	-03	306	58	255	2.0	4.0	90	160	100	0	00	271	60	250	1.8	8.5	95	180	100	38
01.00											00	321	58	250	2.2	4.0	80	185	100	33	-04	306	57	260	2.3	4.0	90	160	100	32	00	261	56	250	1.9	9.0	95	160	100	38
02.00											00	325	59	250	2.2	4.0	90	180	100	27	-02	305	58	260	2.3	6.0	90	160	100	32	00	262	56	250	1.9	9.0	95	170	100	38
03.00											-02	332	61	250	2.2	8.0	95	150	100	24	-01	307	60	255	2.2	8.0	95	150	100	28	00	253	54	250	2.0	9.5	95	165	100	39
04.00											-01	319	59	250	2.2	8.0	90	170	98	28	-02	305	57	250	2.2	8.5	95	150	97	30	-01	239	52	250	2.0	9.5	95	160	94	39
05.00											-01	305	56	240	2.2	8.0	90	195	65	29	-03	309	57	250	2.2	7.0	90	155	65	32	-03	237	52	235	2.0	9.5	95	170	66	39
06.00											-01	325	58	250	2.2	10.0	100	170	100	28	-02	309	60	250	2.1	9.0	100	150	100	26	-01	256	58	245	2.0	10.0	100	165	100	35
07.00											-00	318	58	250	2.2	10.0	100	180	100	31	-02	305	59	250	2.2	8.1	100	160	99	29	-01	259	58	240	2.0	9.9	100	165	99	34
08.00											-01	317	58	250	2.2	9.9	100	175	99	26	-00	305	61	250	2.2	8.5	100	150	99	27	-00	257	59	240	2.0	9.8	100	150	99	34
09.00											-02	339	66	250	2.2	9.5	100	165	99	18	-00	309	58	250	2.4	8.5	100	150	99	30	-00	258	58	245	2.0	9.5	100	160	99	36
10.00											-02	342	71	249	2.1	8.9	100	140	99	14	-02	309	59	250	2.3	8.2	100	170	99	30	-01	260	62	240	2.0	9.5	100	170	99	33
11.00											-03	376	62	249	2.1	6.5	80	170	91	25	-02	309	55	250	2.3	7.0	90	160	93	34	-00	258	59	245	2.0	8.5	95	160	97	37
12.00											-00	377	62	249	2.1	6.5	80	150	99	28	-02	308	55	250	2.4	7.0	90	170	99	34	-01	252	58	245	2.1	8.8	95	170	99	40
13.00											-03	381	63	245	2.1	6.5	80	145	99	30	-03	313	52	255	2.3	7.0	90	170	99	36	-00	249	53	245	2.0	8.8	95	170	99	40
14.00											-02	387	60	245	2.2	6.5	80	155	99	35	-02	308	55	255	2.2	7.0	90	170	99	35	-01	256	54	245	2.0	8.9	95	180	99	44
15.00											01	393	58	250	2.1	6.5	80	160	99	35	03	309	55	250	2.1	7.0	90	165	99	33	00	261	53	245	2.0	8.5	95	180	99	39
16.00											01	397	56	250	2.1	6.5	80	170	99	35	02	312	55	250	2.1	7.0	90	165	99	32	00	266	54	250	2.0	8.5	95	180	99	41
17.00											01	378	54	230	2.1	6.5	80	160	57	35	03	300	56	250	2.0	7.0	90	160	57	34	01	250	55	230	2.0	8.5	95	150	57	36
18.00											00	373	54	245	2.1	6.5	80	170	98	35	03	308	55	250	2.1	7.0	90	160	99	33	01	265	54	250	2.0	8.5	95	170	99	38
19.00											00	369	54	245	2.1	6.5	80	170	87	35	03	309	55	250	2.1	7.0	90	160	93	31	00	264	53	250	2.0	8.5	95	180	95	42
20.00											00	354	54	250	2.1	6.5	80	170	73	33	02	309	55	250	2.1	7.0	90	160	73	32	02	268	54	250	2.0	8.5	95	170	73	41
21.00											02	356	60	250	2.1	10	100	150	99	25	03	321	54	250	2.3	9.5	100	170	99	33	00	284	53	250	2.0	10.0	100	180	99	43
22.00											02	332	63	250	2.0	6.5	80	150	99	25	03	315	54	250	2.2	7.0	90	170	99	36	00	269	53	250	2.0	8.5	95	180	99	41
23.00											-02	337	56	250	2.0	5.0	80	150	84	33	-03	310	55	250	2.2	5.0	90	170	80	33	-00	264	51	250	2.0	8.5	95	195	74	43

MILL A - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL B - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL C - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL D - MILL HOURS

START .....

END .....

DIFFERENCE .....

Night Shift: ..... Morning Shift: ..... Afternoon Shift: .....

ROOIWAL POWER STATION

Boiler Logsheet

Boiler No. 4 Date. 16-07-2009

TIME	Temperatures °C																				F.D FAN %	Baghouse			Ampere					
	Econ. Feed			Air Heater									Econ		I.D Fan		Superheater Steam					D.P			I.D. Fan				F.D.Fan	
	Inlet	Outlet		Air Inlet		Air Outlet		Gas Inlet		Gas outlet			Gas Inlet		Gas Inlet		Prim Outlet		Sec Inlet			5	6	Pulse Rate	High Speed		Low Speed			
		B	A	B	A	B	A	B	A	B	A		B	A	B	A	B	A	B	A		A	B		A	B	A	B	A	B
00.00	208	290	289	43	28	268	259	307	297	168	165		595	561	144	137	423	425	420	421	40	1·19	1·20	=	52	48	=	=	22	24
01.00	208	289	288	43	28	266	258	306	296	167	164		590	563	143	136	424	426	419	423	38	1·21	1·19	=	52	48	=	=	21	22
02.00	208	289	287	43	27	265	258	305	295	167	164		589	565	142	136	424	426	417	422	39	1·20	1·20	=	52	48	=	=	21	22
03.00	208	289	287	41	27	265	258	306	296	166	163		590	565	141	135	424	427	417	422	40	1·20	1·21	=	52	48	=	=	21	22
04.00	207	288	286	40	27	266	258	307	297	165	162		592	566	141	134	425	428	416	423	40	1·20	1·21	=	52	48	=	=	21	22
05.00	207	288	287	39	26	267	259	310	299	165	162		597	567	141	135	424	427	417	423	40	1·20	1·19	=	52	48	=	=	22	23
06.00	208	290	289	40	25	268	259	309	299	165	163		597	565	141	135	422	424	416	421	41	1·22	1·20	=	52	48	=	=	22	23
07.00	207	289	288	39	24	266	258	304	294	165	161		587	555	141	134	421	423	417	420	38	1·21	1·21		52	48			21	23
AVE	207			41	26	266	258			166	163		592	563	141	135						1·20	1·20							
08.00	207	290	289	38	25	267	259	308	298	166	163		593	560	141	134	423	426	416	422	40	1·21	1·19		53	49			22	23
09.00	207	289	288	41	25	268	260	308	299	168	164		586	578	142	136	427	429	416	425	40	1·21	1·21		53	49			22	23
10.00	206	288	287	41	27	267	259	307	297	168	165		590	562	143	136	426	429	417	424	40	1·21	1·20		53	49			22	23
11.00	205	285	283	45	30	266	258	301	293	167	164		575	566	144	138	425	428	422	424	40	1·26	1·24		53	49			22	23
12.00	206	288	287	47	31	260	252	294	285	167	164		572	536	142	137	409	409	405	408	39	1·28	1·26		54	48			21	22
13.00	206	288	286	47	31	261	253	302	291	165	163		584	547	142	136	419	416	413	417	41	1·20	1·19		53	49			22	22
14.00	206	289	288	47	32	262	254	303	293	166	163		586	553	142	136	418	417	414	417	41	1·20	1·20		52	48			21	22
15.00	206	287	286	49	35	255	248	290	282	164	162		567	526	141	137	440	462	423	429	38	1·20	1·19		48	46			21	22
AVE	206			44	28	264	255			167	163		579	553	142	137						1·20	1·20							
16.00	203	281	281	48	35	254	244	290	282	163	161		554	517	140	134	443	448	418	424	37	1·22	1·20		51	50			20	21
17.00	206	286	284	48	34	253	248	291	282	166	163		560	530	143	136	446	444	420	429	37	1·22	1·21		50	47			20	21
18.00	204	285	284	48	34	256	247	292	283	165	161		561	533	142	136	449	446	420	430	36	1·20	1·21		50	50			20	21
19.00	204	284	283	47	33	256	247	293	283	163	160		565	527	140	134	448	445	419	429	37	1·20	1·19		51	47			20	21
20.00	205	286	285	46	32	256	248	294	284	163	159		570	536	139	133	446	444	417	426	37	1·21	1·19		51	47			20	21
21.00	206	286	285	44	26	257	248	295	285	162	159		568	530	138	132	445	446	418	425	38	1·21	1·20		51	47			21	23
22.00	206	286	285	43	28	258	249	296	287	163	158		574	527	138	132	445	444	418	425	37	1·20	1·20		51	47			21	23
23.00	205	287	285	43	28	258	249	297	287	163	158		577	530	137	131	445	445	416	425	37	1·21	1·19		50	48			20	22
AVE	205			46	32	256	248			163	160		566	525	140	134						1·21	1·20							
AVE	206			44	29	262	254			165	162		579	547	141	135						1·20	1·20							

NIGHT SHIFT

MORNING SHIFT

AFTERNOON SHIFT

ROOIWAL POWER STATION

Boiler Logsheet

Boiler No: 4 Date: 16-07-2009

TIME	Pressure (M.p.a) Drum	Super Heater	Feed	Steam Flow	Feed Flow	Air Flow	Superheat Control S.H. Steam B	S.H. Steam A	Burner Tilt	Spray Water A	Spray Water B	O²	Draughts Air To Burners A	Air To Burners B	Comb. Chamb.	Boiler Outlet A	Boiler Outlet B	Econ Outlet A	Econ Outlet B	Airheater Outlet A	Airheater Outlet B	I.D.Fan Inlet A	I.D.Fan Inlet B	Fuel Oil Temp.	Fuel Oil Press.
00.00	7.44	6.73	8.56	265	238	46	491	487	+5	0	13	3.6	-91	-91	-03	-18	-18	-47	-47	-81	-81	-2.09	-2.09	93	33
01.00	7.35	6.67	8.62	260	228	45	491	489	+5	0	18	3.9	-84	-84	-04	-18	-18	-47	-47	-81	-81	-2.26	-2.26	93	33
02.00	7.27	6.58	8.62	261	229	45	490	487	+5	0	16	4.0	-84	-84	-03	-16	-16	-45	-45	-79	-79	-2.23	-2.23	93	33
03.00	7.20	6.50	8.63	264	231	45	489	489	+5	0	19	3.9	-88	-88	-03	-17	-17	-46	-46	-81	-81	-2.24	-2.24	93	33
04.00	7.25	6.54	8.64	267	235	46	488	488	+5	4	17	3.7	-93	-93	-03	-18	-18	-47	-47	-82	-82	-2.25	-2.25	93	33
05.00	7.29	6.57	8.64	267	241	46	488	488	+5	0	16	3.8	-97	-97	-04	-19	-19	-50	-50	-87	-87	-2.28	-2.28	92	33
06.00	7.54	6.81	8.52	273	245	47	487	486	+5	0	13	3.3	-99	-99	-02	-18	-18	-47	-47	-84	-84	-2.23	-2.23	92	33
07.00	7.37	6.68	8.61	261	234	46	487	484	+5	0	15	3.5	-86	-86	-04	-18	-18	-47	-47	-80	-80	-2.11	-2.11	91	33
AVE	7.33	6.63	8.60				488	487				3.7													
08.00	7.42	6.71	8.61	267	241	46	487	487	+5	0	18	3.7	-91	-91	-02	-15	-15	-47	-47	-82	-82	-2.14	-2.14	92	33
09.00	7.36	6.67	8.62	264	230	45	488	490	+5	10	23	4.0	-91	-91	-01	-13	-13	-45	-45	-81	-81	-2.11	-2.11	91	33
10.00	7.26	6.56	8.68	263	227	45	490	491	+5	1	24	4.2	-89	-89	-01	-13	-13	-46	-46	-81	-81	-2.10	-2.10	92	33
11.00	6.94	6.29	8.85	251	203	45	492	489	+5	0	20	5.0	-85	-85	-03	-14	-14	-45	-45	-79	-79	-2.16	-2.16	96	32
12.00	7.30	6.60	8.68	266	229	44	474	468	+10	0	0	3.1	-83	-83	-02	-15	-15	-43	-43	-77	-77	-2.16	-2.16	94	33
13.00	7.22	6.53	8.60	259	234	47	482	476	+10	0	0	4.7	-87	-87	-03	-17	-17	-46	-46	-81	-81	-2.22	-2.22	93	33
14.00	7.35	6.64	8.57	263	241	46	486	480	±0	0	0	4.1	-85	-85	-04	-17	-17	-47	-47	-81	-81	-2.22	-2.22	94	33
15.00	7.17	6.57	8.64	251	217	43	494	494	-10	31	29	4.0	71	71	-03	16	16	43	43	72	72	2.18	2.18	92	33
AVE	7.37	6.56	8.63				486	486				4.1													
16.00	6.96	6.29	8.74	250	215	43	493	492	-10	33	34	3.9	+57	+57	-04	-17	-17	-41	-41	-71	-71	2.16	2.16	93	33
17.00	7.08	6.34	8.64	252	209	43	494	495	-10	31	30	4.0	+61	+61	-03	-14	-14	-39	-39	-69	-69	2.12	2.12	93	33
18.00	6.91	6.36	8.72	250	211	44	495	496	-10	38	35	4.3	+57	+57	-04	-17	-17	-43	-43	-72	-72	2.16	2.16	92	33
19.00	6.86	6.19	8.78	255	210	44	495	496	-10	41	38	4.4	+63	+63	-03	-17	-17	-43	-43	-74	-74	2.18	2.18	92	33
20.00	7.04	6.38	8.66	254	219	44	493	492	-10	39	36	4.2	+63	+63	-03	-18	-18	-43	-43	-73	-73	2.17	2.17	93	33
21.00	7.08	6.42	8.70	254	216	44	492	492	-10	38	35	4.4	63	63	-03	-16	-16	44	44	75	75	2.16	2.16	92	33
22.00	7.25	6.57	8.65	254	229	44	491	491	-10	38	35	4.4	66	66	-03	-17	-17	44	44	75	75	2.17	2.17	92	33
23.00	7.09	6.42	8.71	255	222	44	494	493	0	42	41	4.2	66	66	-03	16	16	44	44	76	76	2.20	2.20	93	33
AVE	7.03	6.35	8.70				493	493				4.2													
TOT AVE	7.24	6.51	8.64				489	488				4.0													

RUNNING HOURS

.....

FEED FLOW

START .....

END .....

DIFFERENCE .....

Night Shift

Morning Shift

Afternoon Shift

ROOIWAL POWER STATION
Boiler Logsheet

Boiler No.: 4 Date: 16-07-2009

TIME	A Mill Group										B Mill Group									
	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR
00.00	9C	3.04	53	210	1.6	5.0	55	160	50	51	5/54	=								
01.00	〃	2.94	53	210	1.6	5.0	60	140	50	30										
02.00	〃	3.01	55	210	1.6	5.0	60	150	50	32										
03.00	〃	3.04	54	210	1.5	5.0	55	150	55	30										
04.00	〃	3.06	53	210	1.4	5.0	55	150	55	28										
05.00	〃	3.08	52	210	1.5	5.0	55	160	55	31										
06.00	〃	3.07	52	215	1.5	5.0	55	165	55	28										
07.00	〃	2.73	52	200	1.5	5.0	55	165	45	28										
08.00	〃	2.71	52	200	1.6	5.5	60	180	45	27										
09.00	〃	2.71	53	200	1.5	5.5	60	170	45	25										
10.00	〃	2.69	57	199	1.5	5.5	60	165	45	23										
11.00	〃	2.83	57	210	1.6	5.5	60	165	51	27										
12.00	〃	3.12	53	225	1.6	5.1	55	180	68	31										
13.00	〃	3.01	57	220	1.5	4.9	55	170	60	30										
14.00	〃	2.99	57	220	1.6	5.0	55	165	65	30										
15.00		2.86	60	220	1.5	5.0	55	155	56	30	1/54									
16.00		2.85	59	205	1.5	5.0	55	157	46	32										
17.00		2.80	62	205	1.4	5.0	55	148	46	31										
18.00		2.83	61	201	1.5	5.0	55	150	46	30										
19.00		2.80	60	205	1.6	5.0	55	148	46	35										
20.00		2.74	58	204	1.6	5.0	55	156	46	35										
21.00		2.72	59	200	1.6	5.0	55	150	46	32										
22.00		2.80	62	200	1.5	5.0	55	150	46	33										
23.00		2.83	60	200	1.5	5.0	55	150	46	29	=	=								

TIME	C Mill Group										D Mill Group									
	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR	Air To Mill	Mill Diff	Mill Temp	Exh Amps	Feeder Amps	Separator Amps	Separator R.P.M.	Mill Amps	Control Exh	Control FDR
00.00	-07	2.96	36	220	1.5	5.0	55	170	50	40	-08	3.33	40	220	1.5	5.0	55	160	50	36
01.00	-06	3.00	37	220	1.8	5.5	60	170	50	41	-04	3.41	39	210	1.5	5.0	60	160	50	25
02.00	-06	3.00	37	220	1.7	5.5	60	170	50	40	-05	3.36	40	210	1.5	5.0	60	160	50	25
03.00	-06	3.01	37	225	1.8	5.0	55	170	55	42	-04	3.38	39	210	1.5	5.0	55	160	55	26
04.00	-06	3.03	36	225	2.0	5.0	55	170	55	44	-06	3.36	37	210	1.5	5.0	55	160	55	28
05.00	-06	3.05	35	230	2.0	5.0	55	170	55	65	-05	3.45	37	210	1.6	5.0	55	160	55	29
06.00	-05	2.92	35	225	2.0	5.0	55	170	55	49	-04	3.33	37	215	1.6	5.0	55	160	55	28
07.00	-06	2.81	36	215	2.5	5.5	55	175	45	50	-05	3.19	37	205	1.8	5.1	55	160	45	29
08.00	-06	2.90	36	215	2.5	5.9	60	170	45	47	-05	3.14	39	205	2.0	5.5	60	160	45	28
09.00	-06	3.04	39	215	2.3	5.5	60	160	45	50	-04	3.32	43	205	2.5	5.5	60	160	45	33
10.00	-06	3.08	43	209	2.3	5.5	60	160	45	44	-05	3.42	44	200	2.4	5.5	60	150	45	34
11.00	-07	3.20	45	220	1.6	5.5	60	160	51	32	-05	3.56	44	210	1.6	5.5	60	150	51	27
12.00	-05	3.32	45	230	1.7	5.5	60	160	60	32	-03	3.74	44	221	1.6	5.5	60	155	60	26
13.00	-06	3.26	46	230	1.6	5.5	55	150	60	33	-05	3.68	45	219	1.5	5.5	55	150	60	28
14.00	-08	3.28	45	231	1.6	5.5	55	150	65	32	-06	3.68	46	221	1.5	5.5	55	150	66	27
15.00	-06	3.21	50	225	1.6	5.5	56	150	55	30	06	3.56	50	220	1.5	5.5	55	145	55	22
16.00	-04	3.09	50	215	1.5	5.4	56	146	46	30	-03	3.49	50	215	1.5	5.0	55	150	46	26
17.00	-04	3.06	52	210	1.6	5.0	56	149	46	29	-02	3.46	52	215	1.4	5.0	55	150	46	20
18.00	-04	3.07	51	210	1.5	5.0	57	150	46	28	-03	3.47	54	205	1.4	5.0	55	150	46	20
19.00	-04	3.05	49	215	1.6	5.0	56	154	46	31	-03	3.42	51	210	1.4	4.9	55	150	46	21
20.00	-05	3.02	48	220	1.7	5.0	56	154	46	31	-03	3.42	50	205	1.4	4.9	55	154	46	21
21.00	-05	3.01	48	215	1.7	5.0	56	155	46	29	06	3.44	48	205	1.5	5.0	55	155	46	22
22.00	-06	2.86	47	215	1.7	5.0	56	165	46	33	06	3.40	48	200	1.5	5.0	55	145	46	23
23.00	-06	2.96	44	220	1.7	5.0	55	170	55	36	-06	3.49	47	210	1.5	5.0	55	150	55	22

MILL A - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL B - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL C - MILL HOURS

START .....

END .....

DIFFERENCE .....

MILL D - MILL HOURS

START .....

END .....

DIFFERENCE .....

Night Shift: ..... Morning Shift: ..... Afternoon Shift: .....

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	14/07/09	M:	28.79 g/mol	Velocity	12.2 m/s
Duct:	2.82x2.045 mm	Time:	10:30	Nozzle c	6.447	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler 4 Lane A Test 1	Moisture	5.0 %	Volumetric flow	70.33 m^3/s
Team:	Leon	Barom P:	87.0 kPa	CO_2	12.2 %	Sampled volume	5.80 Am^3
Filter:	R2	Stack P:	84.6 kPa	Pitot const	3.75	Control pressure	71.8 kPa
Si-gel:	S1	Static P:	-2.387 kPa	Min/pt:	4 min	Control temperature	32 °C
Notes:	Large rotameter	Stack T:	118 °C	Nozzle:	12 mm	Sampled volume	3.69 Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control P	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	110	28.4	7.3	28	6	81	38.64	5.7	0.155	110	36.3	8.3	30	16	71	50.17	7.5	0.201
2	109	58.3	10.4	28	8.5	78.5	57.20	9.5	0.229	105	64.7	10.9	30	12	75	63.82	10.6	0.255
3	118	64.5	11.1	29	12	75	62.45	10.3	0.250	121	79.5	12.4	31	15	72	72.42	12.0	0.290
4	121	73.5	11.9	29	14	73	68.23	11.3	0.273	123	97	13.7	32	16	71	81.18	13.5	0.325
Total									0.906	Total								1.070

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control P	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	116	45.8	9.3	33	18	69	58.10	8.9	0.232	107	28.9	7.3	32	18	69	46.55	6.6	0.186
2	117	81.7	12.5	32	13	74	72.03	12.1	0.288	115	88.1	12.9	32	10	77	72.07	12.4	0.288
3	123	105.7	14.3	33	16	71	85.02	14.1	0.340	123	111.7	14.7	33	16	71	87.40	14.1	0.350
4	125	111	14.7	34	19	68	91.04	14.1	0.364	126	101.9	14.1	34	20	67	88.42	14.1	0.354
Total									1.225	Total								1.178

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	120	69.8	11.6	31	18	69	70.90	11.4	0.284
2	119	117.5	15.0	32	16	71	89.80	14.1	0.359
3	125	113.7	14.9	34	20	67	93.51	14.1	0.374
4	127	136	16.3	34	20	67	102.02	14.1	0.408
Total									1.425

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	14/07/09	M:	28.61 g/mol	Velocity	12.3 m/s
Duct:	2.82x2.045 mm	Time:	16:30	Nozzle c	6.447	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler 4 Lane A Test 4	Moisture	5.0 %	Volumetric flow	71.17 m^3/s
Team:	Leon	Barom P:	87.0 kPa	CO_2	10.6 %	Sampled volume	4.39 Am^3
Filter:	R14	Stack P:	84.6 kPa	Pitot const	3.75	Control pressure	72.0 kPa
Si-gel:	S5	Static P:	-2.356 kPa	Min/pt:	3 min	Control temperature	35 °C
Notes:	Large rotameter	Stack T:	121.6 °C	Nozzle:	12 mm	Sampled volume	2.77 Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	100	32.3	7.7	32	12	75	45.85	6.8	0.138	105	47.2	9.4	34	15	72	57.73	9.0	0.173
2	114	49.1	9.7	33	9	78	53.54	8.6	0.161	123	69.1	11.6	34	12	75	65.51	10.8	0.197
3	120	54.5	10.3	33	12	75	58.21	9.4	0.175	126	81.8	12.7	35	14	73	73.19	12.1	0.220
4	123	75.7	12.2	34	12	75	68.57	11.4	0.206	128	87.7	13.2	35	15	72	76.65	12.7	0.230
Total									0.679	Total								0.819

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	116	44.8	9.3	34	16	71	56.22	8.6	0.169	112	64.7	11.1	34	20	67	71.97	11.3	0.216
2	124	76.7	12.3	35	12	75	69.16	11.5	0.207	125	90.1	13.3	35	15	72	77.98	13.0	0.234
3	128	99.9	14.1	35	15	72	81.81	13.7	0.245	129	116.3	15.2	36	16	71	89.69	14.4	0.269
4	129	112.1	14.9	36	18	69	90.61	14.4	0.272	130	131.1	16.1	36	19	68	99.30	14.4	0.298
Total									0.893	Total								1.017

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	115	48.7	9.7	35	19	68	61.48	9.4	0.184
2	126	112.4	14.9	35	12	75	83.51	14.4	0.251
3	130	102.4	14.3	36	19	68	87.76	14.3	0.263
4	129	116.5	15.2	36	19	68	93.73	14.4	0.281
Total									0.979

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	14/07/09	M:	28.79 g/mol	Velocity	8.1 m/s
Duct:	2.82x2.045 mm	Time:	11:08	Nozzle c	4.477	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler 4 Lane B Test 1	Moisture	5.0 %	Volumetric flow	46.91 m^3/s
Team:	Jaap	Barom P:	87.0 kPa	CO_2	12.2 %	Sampled volume	1.63 Am^3
Filter:	R2	Stack P:	84.4 kPa	Pitot const	3.75	Control pressure	87.0 kPa
Si-gel:	S5	Static P:	-2.6 kPa	Min/pt:	3 min	Control temperature	25 °C
Notes:	Small Rotameter	Stack T:	118.15 °C	Nozzle:	10 mm	Sampled volume	1.28 Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	95	73.5	11.5	25	0	87	40.54	18.1	0.122	102	78.4	12.0	25	0	87	41.48	18.6	0.124
2	103	57	10.3	25	0	87	35.32	15.6	0.106	110	56	10.3	25	0	87	34.69	15.3	0.104
3	120	51	9.9	25	0	87	32.68	14.3	0.098	123	41	8.9	25	0	87	29.19	12.6	0.088
4	126	62	11.0	25	0	87	35.76	15.8	0.107	129	25	7.0	25	0	87	22.62	9.3	0.068
Total									0.433	Total								0.384

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	105	72	11.6	25	0	87	39.59	17.7	0.119	103	62	10.7	25	0	87	36.83	16.3	0.111
2	107	48	9.5	25	0	87	32.24	14.1	0.097	122	22	6.5	25	0	87	21.41	8.7	0.064
3	124	32	7.9	25	0	87	25.75	10.9	0.077	129	5	3.1	25	0	87	10.12	2.5	0.030
4	130	25	7.0	25	0	87	22.59	9.3	0.068	131	16	5.6	25	0	87	18.05	6.9	0.054
Total									0.361	Total								0.259

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	120	43	9.1	25	0	87	30.00	13.0	0.090
2	124	9.7	4.3	25	0	87	14.18	4.8	0.043
3	128	5	3.1	25	0	87	10.13	2.5	0.030
4	132	5	3.2	25	0	87	10.08	2.5	0.030
Total									0.193

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	14/07/09	M:	28.66 g/mol	Velocity	10.0 m/s
Duct:	2.82x2.045 mm	Time:	15:24	Nozzle c	4.477	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler4, Lane B, test 3	Moisture	5.0 %	Volumetric flow	57.86 m^3/s
Team:	Jaap	Barom P:	87.0 kPa	CO_2	11.1 %	Sampled volume	1.39 Am^3
Filter:	R12	Stack P:	84.3 kPa	Pitot const	3.75	Control pressure	81.4 kPa
Si-gel:	S6	Static P:	-2.7 kPa	Min/pt:	2 min	Control temperature	25 °C
Notes:	Small Rotameter	Stack T:	127.95 °C	Nozzle:	10 mm	Sampled volume	1.02 Nm^3

	Traverse 1								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	115	99	13.8	25	6	81	49.29	21.4	0.099
2	117	81	12.5	25	6	81	44.47	19.2	0.089
3	124	85	12.9	25	7	80	45.72	19.7	0.091
4	128	80	12.6	25	7	80	44.13	19.0	0.088
Total									0.367

	Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	121	85	12.9	25	6	81	45.33	19.6	0.091
2	127	72	11.9	25	6	81	41.40	17.8	0.083
3	131	73	12.1	25	6	81	41.48	17.9	0.083
4	132	69	11.7	25	6	81	40.28	17.3	0.081
Total									0.337

	Traverse 3								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	121	88	13.1	25	5	82	45.56	19.9	0.091
2	129	75	12.2	25	6	81	42.15	18.2	0.084
3	131	45	9.5	25	6	81	32.57	13.7	0.065
4	134	44	9.4	25	6	81	32.09	13.5	0.064
Total									0.305

	Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	124	79	12.4	25	6	81	43.53	18.8	0.087
2	130	59	10.8	25	6	81	37.34	16.0	0.075
3	134	13.7	5.2	25	6	81	17.90	6.5	0.036
4	135	37	8.6	25	5	82	29.03	12.1	0.058
Total									0.256

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	126	30	7.7	25	4	83	26.11	10.8	0.052
2	132	12	4.9	25	4	83	16.39	5.8	0.033
3	134	5	3.2	25	4	83	10.56	2.6	0.021
4	134	5	3.2	25	4	83	10.56	2.6	0.021
Total									0.127

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	2009/07/15	M:	28.79 g/mol	Velocity	10.9 m/s
Duct:	2.82x2.045 mm	Time:	11:00	Nozzle c	6.447	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler 4 Lane A Test 1	Moisture	5.0 %	Volumetric flow	63.07 m^3/s
Team:	Paul	Barom P:	87.0 kPa	CO_2	12.2 %	Sampled volume	3.85 Am^3
Filter:	R7	Stack P:	84.4 kPa	Pitot const	3.75	Control pressure	73.6 kPa
Si-gel:	s	Static P:	-2.5654 kPa	Min/pt:	3 min	Control temperature	30 °C
Notes:	Large Rotameter	Stack T:	109.65 °C	Nozzle:	12 mm	Sampled volume	2.52 Nm^3

	Traverse 1								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	85	27.5	7.0	28	18	69	46.12	6.5	0.138
2	90	43.9	8.8	28	10	77	51.85	8.3	0.156
3	108	60.9	10.7	28	10	77	59.61	9.9	0.179
4	112	31.7	7.7	28	12	75	43.93	6.5	0.132
Total									0.605

	Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	105	39.5	8.6	28	10	77	48.20	7.5	0.145
2	107	70.3	11.5	28	10	77	64.13	10.8	0.192
3	113	81.1	12.4	29	14	73	72.33	12.1	0.217
4	116	50.9	9.9	30	16	71	58.88	9.2	0.177
Total									0.731

	Traverse 3								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	105	41.3	8.8	30	12	75	50.94	7.9	0.153
2	112	66.3	11.2	30	12	75	63.95	10.6	0.192
3	115	78.2	12.2	31	14	73	71.31	11.9	0.214
4	117	66.7	11.3	32	14	73	65.90	10.8	0.198
Total									0.756

	Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	107	24.1	6.7	30	12	75	38.81	5.3	0.116
2	112	83	12.5	32	10	77	70.15	12.0	0.210
3	116	97.2	13.6	32	14	73	79.66	13.5	0.239
4	118	86	12.8	33	16	71	77.10	12.7	0.231
Total									0.797

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	109	50.8	9.8	29	16	71	59.16	9.3	0.177
2	110	103.6	14.0	33	12	75	80.94	13.9	0.243
3	117	136.5	16.2	33	18	69	100.07	14.1	0.300
4	119	90.1	13.2	34	18	69	81.36	13.3	0.244
Total									0.965

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	2009/07/15	M:	29.05 g/mol	Velocity	11.9 m/s	
Duct:	2.82x2.045 mm	Time:	13:30	Nozzle c	6.447	Duct dimensions	2.82x2.045	m
Points:	4 / traverse	Test no:	Boiler 4 Lane A Test 1	Moisture	5.0 %	Volumetric flow	68.83	m^3/s
Team:	Paul	Barom P:	87.0 kPa	CO2	14.5 %	Sampled volume	2.92	Am^3
Filter:	R13	Stack P:	85.4 kPa	Pitot const	3.75	Control pressure	71.3	kPa
Si-gel:	S2	Static P:	-2.6 kPa	Min/pt:	2 min	Control temperature	32	°C
Notes:	Large Rotameter	Stack T:	111.4 °C	Nozzle:	12 mm	Sampled volume	1.84	Nm^3

	Traverse 1								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m3
1	98	43.2	8.8	29	16	71	55.43	8.6	0.111
2	102	61.6	10.5	30	12	75	62.53	10.3	0.125
3	108	72	11.5	30	14	73	68.90	11.4	0.138
4	111	50.6	9.7	30	16	71	59.16	9.3	0.118
Total									0.492

	Traverse 2								
Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m3
105	49.8	9.5	30	12	75	56.00	9.0	0.112
109	80.7	12.2	31	12	75	71.14	12.0	0.142
112	87.6	12.7	32	16	71	78.25	13.0	0.156
114	55.9	10.2	33	18	69	64.36	10.1	0.129
Total								0.539

	Traverse 3								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m3
1	108	42.9	8.9	32	20	67	58.33	8.8	0.117
2	112	84.4	12.5	32	14	73	74.70	12.0	0.149
3	115	89.9	13.0	33	22	65	86.53	12.0	0.173
4	117	85.5	12.7	33	22	65	84.17	12.0	0.168
Total									0.607

	Traverse 4								
Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m3
110	42.3	8.8	31	16	71	54.34	8.3	0.109
112	105.5	14.0	32	12	75	81.29	14.0	0.163
117	106.2	14.1	33	16	71	85.88	14.1	0.172
118	99.7	13.7	34	16	71	83.38	13.9	0.167
Total								0.610

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m3
1	111	61.2	10.6	31	16	71	65.27	10.5	0.131
2	113	115.5	14.6	33	12	75	85.22	14.1	0.170
3	117	123.5	15.2	32	16	71	92.31	14.1	0.185
4	119	126.8	15.5	34	16	71	93.91	14.1	0.188
Total									0.673

2.922

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	2009/07/15	M:	28.66 g/mol	Velocity	11.5 m/s
Duct:	2.82x2.045 mm	Time:	15:30	Nozzle c	6.447	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler 4 Lane A Test 1	Moisture	5.0 %	Volumetric flow	66.47 m^3/s
Team:	Paul	Barom P:	87.0 kPa	CO_2	11.1 %	Sampled volume	2.75 Am^3
Filter:	R8	Stack P:	84.3 kPa	Pitot const	3.75	Control pressure	72.9 kPa
Si-gel:	S7	Static P:	-2.66 kPa	Min/pt:	2 min	Control temperature	33 °C
Notes:	Large Rotameter	Stack T:	110.85 °C	Nozzle:	12 mm	Sampled volume	1.76 Nm^3

	Traverse 1								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	88	31.5	7.5	30	14	73	46.84	6.9	0.094
2	97	47.7	9.3	30	10	77	53.98	8.7	0.108
3	106	63.7	10.9	30	10	77	61.63	10.3	0.123
4	111	37.8	8.5	31	14	73	49.92	7.5	0.100
Total									0.425

	Traverse 2								
Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
105	49.9	9.7	31	10	77	54.80	8.9	0.110
109	82.1	12.4	31	12	75	71.79	12.1	0.144
113	87.8	12.9	32	16	71	78.27	13.0	0.157
116	53.9	10.2	33	16	71	61.29	9.7	0.123
Total								0.532

	Traverse 3								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	108	46.7	9.4	32	12	75	54.39	8.6	0.109
2	111	82	12.5	34	12	75	72.27	12.2	0.145
3	115	95.6	13.5	34	16	71	82.00	13.7	0.164
4	117	60.1	10.8	35	18	69	66.95	10.5	0.134
Total									0.551

	Traverse 4								
Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
111	38	8.5	33	14	73	50.38	7.6	0.101
114	92.8	13.3	34	10	77	74.59	12.8	0.149
117	94.3	13.5	35	16	71	81.49	13.5	0.163
119	91.9	13.3	35	16	71	80.25	13.3	0.160
Total								0.573

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	107	60.2	10.6	34	16	71	65.75	10.5	0.132
2	114	109.4	14.5	35	14	73	85.70	14.1	0.171
3	118	118.3	15.1	35	18	69	93.80	14.1	0.188
4	121	103.2	14.2	36	18	69	87.56	14.1	0.175
Total									0.666

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	2009/07/15	M:	28.79 g/mol	Velocity	8.1 m/s	
Duct:	2.82x2.045 mm	Time:	11:08	Nozzle c	4.477	Duct dimensions	2.82x2.045	m
Points:	4 / traverse	Test no:	Boiler 4 Lane B Test 1	Moisture	5.0 %	Volumetric flow	46.57	m^3/s
Team:	Leon	Barom P:	87.0 kPa	CO_2	12.2 %	Sampled volume	1.70	Am^3
Filter:	R2	Stack P:	84.4 kPa	Pitot const	3.75	Control pressure	81.3	kPa
Si-gel:	S5	Static P:	-2.6 kPa	Min/pt:	3 min	Control temperature	18	°C
Notes:	Small Rotameter	Stack T:	112.6 °C	Nozzle:	10 mm	Sampled volume	1.28	Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	100	64.1	10.8	16	6	81	39.17	17.1	0.118	108	54.2	10.1	18	4	83	35.02	15.3	0.105
2	104	70.3	11.4	16	6	81	40.80	17.9	0.122	112	41.2	8.8	18	6	81	31.12	13.2	0.093
3	109	61.6	10.8	17	6	81	38.07	16.5	0.114	114	45.4	9.3	18	6	81	32.59	13.9	0.098
4	112	52.2	9.9	18	6	81	35.03	15.1	0.105	115	45	9.3	18	6	81	32.40	13.8	0.097
Total									0.459	Total								0.393

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	107	19.8	6.1	18	6	81	21.72	8.6	0.065	105	37.2	8.3	18	6	81	29.85	12.6	0.090
2	114	2.4	2.1	18	6	81	7.49	0.8	0.022	115	23	6.6	18	6	81	23.16	9.3	0.069
3	115	12.2	4.8	18	6	81	16.87	6.1	0.051	118	28.7	7.4	18	6	81	25.78	10.6	0.077
4	117	41.8	8.9	18	3	84	30.03	12.9	0.090	120	38.4	8.6	18	6	81	29.74	12.5	0.089
Total									0.228	Total								0.326

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	112	14.5	5.2	18	6	81	18.46	6.9	0.055
2	116	29.7	7.5	18	6	81	26.29	10.9	0.079
3	119	36	8.3	18	6	81	28.83	12.1	0.086
4	120	25.9	7.1	18	6	81	24.42	9.9	0.073
Total									0.294

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	2009/07/15	M:	29.05 g/mol	Velocity	8.6 m/s
Duct:	2.82x2.045 mm	Time:	14:17	Nozzle c	4.477	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	boiler 4, lane b , test 2	Moisture	5.0 %	Volumetric flow	49.37 m^3/s
Team:	Leon	Barom P:	87.0 kPa	CO_2	14.5 %	Sampled volume	1.23 Am^3
Filter:	R15	Stack P:	84.3 kPa	Pitot const	3.75	Control pressure	80.8 kPa
Si-gel:	S5	Static P:	-2.7 kPa	Min/pt:	2 min	Control temperature	20 °C
Notes:	Small Rotameter	Stack T:	109.65 °C	Nozzle:	10 mm	Sampled volume	0.92 Nm^3

	Traverse 1								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	93	53.9	9.8	18	4	83	35.45	15.5	0.071
2	95	51.7	9.6	18	6	81	35.48	15.3	0.071
3	102	35.7	8.1	18	8	79	29.94	12.5	0.060
4	105	29.1	7.3	19	8	79	27.02	11.0	0.054
Total									0.256

	Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	102	51.2	9.7	19	6	81	35.10	15.1	0.070
2	107	47.5	9.4	20	6	81	33.70	14.4	0.067
3	110	118.9	14.9	20	6	81	53.10	23.3	0.106
4	111	244	21.4	20	10	77	79.92	28.0	0.160
Total									0.404

	Traverse 3								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	104	33.1	7.8	20	12	75	30.50	12.3	0.061
2	112	19.8	6.1	20	7	80	21.88	8.6	0.044
3	114	26.8	7.1	20	6	81	25.08	10.2	0.050
4	115	81.3	12.4	20	6	81	43.63	19.0	0.087
Total									0.242

	Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	112	5.2	3.1	20	7	80	11.21	2.9	0.022
2	114	26.2	7.0	20	4	83	24.20	9.9	0.048
3	116	40	8.7	20	4	83	29.82	12.7	0.060
4	118	11.9	4.8	20	6	81	16.63	5.9	0.033
Total									0.164

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	112	17.5	5.7	20	4	83	19.83	7.7	0.040
2	115	7.5	3.8	20	4	83	12.93	4.0	0.026
3	118	39.5	8.7	20	4	83	29.56	12.6	0.059
4	118	18	5.9	20	6	81	20.45	7.9	0.041
Total									0.166

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	2009/07/15	M:	28.66 g/mol	Velocity	8.0 m/s
Duct:	2.82x2.045 mm	Time:	15:24	Nozzle c	4.477	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler4, Lane B, test 3	Moisture	5.0 %	Volumetric flow	46.03 m^3/s
Team:	Leon	Barom P:	87.0 kPa	CO_2	11.1 %	Sampled volume	1.14 Am^3
Filter:	R12	Stack P:	84.3 kPa	Pitot const	3.75	Control pressure	81.6 kPa
Si-gel:	S6	Static P:	-2.7 kPa	Min/pt:	2 min	Control temperature	22 °C
Notes:	Small Rotameter	Stack T:	111.2 °C	Nozzle:	10 mm	Sampled volume	0.85 Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	96	79.9	12.1	20	4	83	43.57	19.3	0.087	96	67.6	11.1	22	6	81	41.35	17.9	0.083
2	101	85.7	12.6	20	6	81	45.93	20.1	0.092	109	50.9	9.8	22	6	81	35.26	15.1	0.071
3	104	69.3	11.4	22	6	81	41.42	17.9	0.083	113	48.8	9.6	22	6	81	34.35	14.6	0.069
4	107	56.7	10.3	22	6	81	37.32	16.0	0.075	114	59.9	10.7	22	6	81	38.01	16.4	0.076
Total									0.336	Total								0.298

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	109	21	6.3	22	6	81	22.65	9.0	0.045	109	15.1	5.3	23	4	83	18.81	7.1	0.038
2	114	24	6.8	22	6	81	24.06	9.7	0.048	115	7.2	3.7	23	4	83	12.89	4.0	0.026
3	117	17.1	5.7	22	5	82	19.98	7.7	0.040	118	42.4	9.0	23	4	83	31.15	13.3	0.062
4	118	23.2	6.7	22	6	81	23.53	9.4	0.047	120	58.3	10.6	24	6	81	37.46	16.0	0.075
Total									0.180	Total								0.201

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	109	29.3	7.4	24	6	81	26.94	11.0	0.054
2	115	8.4	4.0	24	6	81	14.31	4.6	0.029
3	119	4.8	3.0	24	5	82	10.63	2.7	0.021
4	121	5.7	3.3	23	4	83	11.38	3.1	0.023
Total									0.127

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	16/7	M:	29.06 g/mol	Velocity	14.1 m/s	
Duct:	2.82x2.045 mm	Time:	09:20	Nozzle c	6.447	Duct dimensions	2.82x2.045 m	
Points:	4 / traverse	Test no:	Boiler 4 Lane A Test 1	Moisture	5.0 %	Volumetric flow	81.46 m^3/s	
Team:	Paul	Barom P:	88.0 kPa	CO_2	14.6 %	Sampled volume	3.33 Am^3	
Filter:	P2	Stack P:	85.4 kPa	Pitot const	3.75	Control pressure	71.2 kPa	
Si-gel:	S5	Static P:	-2.6298 kPa	Min/pt:	2 min	Control temperature	29 °C	
Notes:	Large Rotameter	Stack T:	124.7 °C	Nozzle:	12 mm	Sampled volume	2.12 Nm^3	

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	110	40.4	8.6	25	16	72	51.31	7.9	0.103	118	95.4	13.4	27	18	70	80.81	13.5	0.162
2	119	80.5	12.3	26	10	78	66.31	11.4	0.133	124	146.7	16.7	28	18	70	99.78	14.1	0.200
3	123	120.8	15.2	26	14	74	85.19	14.1	0.170	127	159.4	17.5	28	20	68	106.66	14.1	0.213
4	125	133.9	16.0	26	18	70	94.57	14.1	0.189	128	144.5	16.7	29	20	68	101.77	14.1	0.204
Total									0.595	Total								0.778

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	120	20.1	6.2	28	18	70	37.12	4.7	0.074	125	96.7	13.6	29	26	62	91.65	14.1	0.183
2	125	71.8	11.7	29	6	82	59.71	10.3	0.119	127	134.8	16.1	30	18	70	95.92	14.1	0.192
3	128	75.9	12.1	29	14	74	67.78	11.3	0.136	129	148.5	16.9	30	20	68	103.38	14.1	0.207
4	130	185.1	18.9	30	16	72	108.87	14.1	0.218	131	191.6	19.3	31	20	68	117.52	14.1	0.235
Total									0.547	Total								0.817

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	120	100.7	13.8	30	20	68	86.10	14.2	0.172
2	126	20.1	6.2	31	20	68	38.30	4.8	0.077
3	129	65.3	11.2	31	10	78	59.96	10.0	0.120
4	130	204	19.9	31	14	74	111.57	14.1	0.223
Total									0.592

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	16/7/2009	M:	28.98 g/mol	Velocity	16.5 m/s	
Duct:	2.82x2.045 mm	Time:	11:03	Nozzle c	6.447	Duct dimensions	2.82x2.045 m	
Points:	4 / traverse	Test no:	Boiler 4 Lane A ˙ test2	Moisture	5.0 %	Volumetric flow	95.10 m^3/s	
Team:	Paul	Barom P:	88.0 kPa	CO2	13.9 %	Sampled volume	3.90 Am^3	
Filter:	P5	Stack P:	85.8 kPa	Pitot const	3.75	Control pressure	71.9 kPa	
Si-gel:	S7	Static P:	-2.2174 kPa	Min/pt:	2 min	Control temperature	31 °C	
Notes:	Large Rotameter	Stack T:	123.35 °C	Nozzle:	12 mm	Sampled volume	2.48 Nm^3	

	Traverse 1								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m3
1	102	75.5	11.7	29	16	72	72.11	12.0	0.144
2	113	83.2	12.4	29	14	74	72.60	12.3	0.145
3	119	99.9	15.2	30	14	74	87.80	14.1	0.176
4	122	110.6	14.5	30	16	72	85.33	14.1	0.171
Total									0.636

	Traverse 2								
Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m3
119	133.2	15.8	30	16	72	94.00	14.1	0.188
124	138	16.2	31	16	72	95.38	14.1	0.191
127	111.6	14.6	31	16	72	85.45	14.1	0.171
128	138.6	16.3	32	18	70	98.15	14.1	0.196
Total								0.746

	Traverse 3								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m3
1	120	130	15.7	31	16	72	93.05	14.1	0.186
2	125	180.8	18.6	32	16	72	109.40	14.1	0.219
3	127	186.9	18.9	33	16	72	111.32	14.1	0.223
4	129	197.4	19.5	33	16	72	114.11	14.1	0.228
Total									0.856

	Traverse 4								
Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m3
123	139.2	16.3	31	16	72	95.92	14.1	0.192
127	153.5	17.2	33	16	72	100.88	14.1	0.202
128	156.9	17.4	33	18	70	104.77	14.1	0.210
130	160.5	17.6	33	18	70	105.71	14.1	0.211
Total								0.815

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m3
1	119	130.1	15.6	30	16	72	92.90	14.1	0.186
2	126	167.5	17.9	32	16	72	105.17	14.1	0.210
3	129	185.5	18.9	33	16	72	110.62	14.1	0.221
4	130	194.6	19.4	33	16	72	113.16	14.1	0.226
Total									0.844

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	16/07/2009	M:	29.17 g/mol	Velocity	15.5 m/s
Duct:	2.82x2.045 mm	Time:	13:21	Nozzle c	6.447	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler 4 Lane A - test3	Moisture	5.0 %	Volumetric flow	89.56 m^3/s
Team:	Paul	Barom P:	88.0 kPa	CO_2	15.5 %	Sampled volume	3.66 Am^3
Filter:	P6	Stack P:	85.6 kPa	Pitot const	3.75	Control pressure	72.8 kPa
Si-gel:	S6	Static P:	-2.3628 kPa	Min/pt:	2 min	Control temperature	33 °C
Notes:	Large Rotameter	Stack T:	121.75 °C	Nozzle:	12 mm	Sampled volume	2.35 Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	105	29.4	7.3	30	16	72	44.79	6.4	0.090	112	45.8	9.2	32	16	72	55.76	8.7	0.112
2	117	79.8	12.2	31	8	80	65.60	11.3	0.131	119	77.2	12.0	32	10	78	66.23	11.3	0.132
3	123	114.8	14.7	31	12	76	82.19	14.1	0.164	124	147.8	16.7	32	12	76	93.45	14.1	0.187
4	126	130.6	15.8	31	16	72	92.19	14.1	0.184	126	158.9	17.4	33	16	72	102.36	14.1	0.205
Total									0.570	Total								0.636

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	111	107.9	14.1	33	16	72	85.98	14.1	0.172	121	136.8	16.0	34	16	72	95.89	14.1	0.192
2	119	130	15.6	33	16	72	93.41	14.1	0.187	127	165.3	17.8	35	16	72	104.95	14.1	0.210
3	126	141.6	16.4	34	16	72	96.94	14.1	0.194	128	155.7	17.3	35	16	72	101.73	14.1	0.203
4	128	177.2	18.4	34	16	72	108.17	14.1	0.216	129	204.5	19.8	35	16	72	116.44	14.1	0.233
Total									0.769	Total								0.838

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	116	136	15.9	35	16	72	96.53	14.1	0.193
2	123	165.5	17.7	35	18	70	108.56	14.1	0.217
3	127	175.1	18.3	36	18	70	111.46	14.1	0.223
4	128	166.7	17.9	36	18	70	108.62	14.1	0.217
Total									0.850

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	16/07/09	M:	29.06 g/mol	Velocity	11.5 m/s
Duct:	2.82x2.045 mm	Time:	09:00	Nozzle c	4.477	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	Boiler 4 Lane B Test 1	Moisture	5.0 %	Volumetric flow	66.50 m^3/s
Team:	Leon	Barom P:	88.0 kPa	CO_2	14.6 %	Sampled volume	1.55 Am^3
Filter:	P7	Stack P:	85.4 kPa	Pitot const	3.75	Control pressure	82.9 kPa
Si-gel:	s2	Static P:	-2.6 kPa	Min/pt:	2 min	Control temperature	14 °C
Notes:	Small Rotameter	Stack T:	120.7 °C	Nozzle:	10 mm	Sampled volume	1.21 Nm^3

	Traverse 1								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	102	42.3	8.7	12	4	84	30.21	13.2	0.060
2	112	60.7	10.6	12	4	84	35.72	15.9	0.071
3	121	45.6	9.3	12	4	84	30.60	13.4	0.061
4	124	44.6	9.2	12	4	84	30.15	13.2	0.060
Total									0.253

	Traverse 2								
Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
102	45.3	9.0	13	4	84	31.37	13.7	0.063
122	13.9	5.1	13	4	84	16.93	6.4	0.034
127	34.1	8.1	13	4	84	26.36	11.2	0.053
130	73	11.9	13	4	84	38.42	17.2	0.077
Total								0.226

	Traverse 3								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	102	54.6	9.9	13	5	83	34.86	15.3	0.070
2	124	79.6	12.3	14	5	83	41.05	18.3	0.082
3	129	78.4	12.3	14	6	82	40.98	18.1	0.082
4	131	83.9	12.8	14	6	82	42.29	18.7	0.085
Total									0.318

	Traverse 4								
Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
102	67.9	11.1	14	6	82	39.49	17.4	0.079
126	98.9	13.8	14	6	82	46.20	20.6	0.092
131	106	14.4	14	6	82	47.53	21.2	0.095
133	103	14.2	14	6	82	46.74	20.8	0.093
Total								0.360

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	102	83.2	12.2	14	6	82	43.71	19.4	0.087
2	128	121	15.3	15	6	82	51.15	22.8	0.102
3	132	121	15.4	15	6	82	50.90	22.7	0.102
4	134	115	15.0	16	6	82	49.67	22.1	0.099
Total									0.391

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	16/07/09	M:	28.99 g/mol	Velocity	10.9 m/s
Duct:	2.82x2.045 mm	Time:	11:00	Nozzle c	4.477	Duct dimensions	2.82x2.045 m
Points:	4 / traverse	Test no:	boiler 4, lane b , test 2	Moisture	5.0 %	Volumetric flow	63.03 m^3/s
Team:	Leon	Barom P:	88.0 kPa	CO_2	14.0 %	Sampled volume	2.28 Am^3
Filter:	P1	Stack P:	85.8 kPa	Pitot const	3.75	Control pressure	81.7 kPa
Si-gel:	S2	Static P:	-2.2 kPa	Min/pt:	3 min	Control temperature	18 °C
Notes:	Small Rotameter	Stack T:	121.75 °C	Nozzle:	10 mm	Sampled volume	1.72 Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	102	33.2	7.7	16	6	82	27.90	11.8	0.084	102	46	9.1	18	4	84	32.28	14.0	0.097
2	110	45.4	9.1	17	6	82	32.40	13.9	0.097	123	28.4	7.3	18	6	82	25.29	10.4	0.076
3	121	27.4	7.2	18	6	82	24.90	10.2	0.075	129	59.1	10.7	18	6	82	36.20	15.7	0.109
4	126	37.6	8.5	18	6	82	28.99	12.3	0.087	131	68.6	11.5	18	6	82	38.91	17.0	0.117
Total									0.343	Total								0.398

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	107	57.8	10.3	18	6	82	36.82	16.0	0.110	104	60.5	10.5	18	6	82	37.82	16.5	0.113
2	127	26.2	7.1	18	6	82	24.17	9.9	0.072	125	92.9	13.3	19	6	82	45.77	20.2	0.137
3	130	77.2	12.2	18	6	82	41.33	18.2	0.124	131	83.3	12.7	19	7	81	43.55	19.0	0.131
4	132	91	13.3	18	7	81	45.31	19.9	0.136	133	102	14.1	20	7	81	48.24	21.1	0.145
Total									0.443	Total								0.526

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	104	87	12.5	19	7	81	46.08	20.2	0.138
2	129	113	14.8	20	7	81	51.03	22.4	0.153
3	136	106	14.4	20	8	80	49.61	21.6	0.149
4	133	76.5	12.2	20	8	80	42.30	18.3	0.127
Total									0.567

Isokinetic Sampling: Rooiwal

Site:	Rooiwal	Date:	16/07/09	M:	29.17 g/mol	Velocity	9.3 m/s	
Duct:	2.82x2.045 mm	Time:	13:20	Nozzle c	4.477	Duct dimensions	2.82x2.045	m
Points:	4 / traverse	Test no:	Boiler4, Lane B, test 3	Moisture	5.0 %	Volumetric flow	53.36	m^3/s
Team:	Leon	Barom P:	88.0 kPa	CO_2	15.5 %	Sampled volume	2.55	Am^3
Filter:	P4	Stack P:	85.6 kPa	Pitot const	3.75	Control pressure	82.4	kPa
Si-gel:	S1	Static P:	-2.4 kPa	Min/pt:	4 min	Control temperature	22	°C
Notes:	Small Rotameter	Stack T:	123.35 °C	Nozzle:	10 mm	Sampled volume	1.92	Nm^3

	Traverse 1									Traverse 2								
Point	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T	Control	Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C	kPa	kPa	lpm	cm	Vol, m^3
1	106	8.1	3.8	20	6	82	13.84	4.5	0.055	106	23.6	6.5	22	6	82	23.79	9.6	0.095
2	119	35.7	8.2	20	6	82	28.57	12.0	0.114	128	36.2	8.3	22	5	83	28.30	11.9	0.113
3	126	33.5	8.0	21	6	82	27.53	11.5	0.110	131	52.7	10.1	22	5	83	34.01	14.7	0.136
4	130	40.9	8.9	21	6	82	30.27	12.8	0.121	132	56.9	10.5	22	5	83	35.30	15.3	0.141
Total									0.401	Total								0.486

	Traverse 3									Traverse 4								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	106	11.5	4.6	22	5	83	16.41	5.9	0.066	106	46.5	9.2	22	6	82	33.39	14.3	0.134
2	127	40.6	8.8	22	5	83	30.00	12.7	0.120	129	44.8	9.3	22	6	82	31.82	13.5	0.127
3	130	34.5	8.2	22	5	83	27.56	11.5	0.110	131	76.6	12.2	22	6	82	41.51	18.1	0.166
4	132	74.1	12.0	22	5	83	40.28	17.6	0.161	132	84	12.0	22	6	82	40.85	17.8	0.163
Total									0.457	Total								0.590

	Traverse 5								
Point	Stack T	Vel P	Velocity	Control T		Control P	S Rate	Rot read	Sampled
	°C	Pa	m/s	°C		kPa	lpm	cm	Vol, m^3
1	109	26.9	7.0	22	6	82	25.30	10.4	0.101
2	126	68	11.4	22	6	82	39.35	17.1	0.157
3	130	92.9	13.4	22	6	82	45.77	20.1	0.183
4	131	84.9	12.8	22	6	82	43.70	19.1	0.175
Total									0.616

SOx test Results Summary

	Unit	SOx								
		Boiler 4						Boiler 3		
		Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 1	Test 2	Test 3
Date										
Boiler		4	4	4	4	4	4	3	3	3
Time - Start		10:50	12:20	13:40	09:20	10:40	11:55	10:58	12:13	15:45
Barometric pressure	kPa	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0
Gas temperature	°C	118	121	125	123	123	123	111	111	111
Gas volumetric flow	Nm^3/s	68.3	71.1	73.9	86.0	92.4	83.4	65.0	70.5	66.6
	Am^3/s	117.2	123.1	129.0	148.0	158.1	142.9	109.6	118.2	115.8
SOx test data										
Gas meter data:										
Start	liter	18148.3	18363.0	18544.0	19621.0	19792.2	19967.2	18846.2	19030.8	19389.4
Stop	liter	18360.2	18539.6	18725.6	19789.6	19963.0	20136.6	19028.8	19205.4	19515.4
Volume sampled (meter reading)	liter	211.9	176.6	181.6	168.6	170.8	169.4	182.6	174.6	126.0
Gas meter temperature	°C	20	22	20	15	18	24	18	22	21
NTP Volume - dry	dNm^3	0.1715	0.1420	0.1470	0.1388	0.1392	0.1353	0.1488	0.1404	0.1016
H_2O content	%	5.6	5.6	5.5	5.5	5.5	5.5	4.7	4.0	4.0
NTP volume - wet	Nm^3	0.1818	0.1505	0.1555	0.1469	0.1473	0.1431	0.1562	0.1462	0.1058
Liquid analysis: SO_2										
Volume of liquid sample	ml	176	138	120	210	234	196	221	170	143
SOx concentration as SO_2	mg/l	3523	3523	3363	320	288	160	2082	2434	3043
Nett SOx quantity absorbed (stated as SO_2)	mg	620	486	404	67	67	31	460	414	435
Gaseous SO_2 concentration										
NTP conditions	**mg/Nm^3**	**3411**	**3231**	**2595**	**458**	**458**	**219**	**2946**	**2831**	**4111**
	ppm	1194	1131	908	160	160	77	1031	991	1439
Liquid analysis: SO_3										
Volume of liquid sample	ml	41	63	63	54	88	97	96	93	62
SOx concentration as SO_3	mg/l	160	96	161	80	7	7	192	449	112
Nett SOx quantity absorbed (stated as SO_3)	mg	7	6	10	4	1	1	18	42	7
Gaseous SO_3 concentration										
NTP conditions	**mg/Nm^3**	**36**	**40**	**65**	**30**	**4**	**4**	**118**	**285**	**66**
	ppm	10	11	18	8	1	1	33	80	18
Gaseous SO_x concentration as SO_2										
NTP conditions	**mg/Nm^3**	**3440**	**3264**	**2647**	**481**	**461**	**223**	**3040**	**3059**	**4164**
	ppm	1204	1142	926	168	161	78	1064	1070	1457
SO_x emission rate as SO_2	**kg/h**	846	835	705	149	153	67	711	777	998

NOx test Results Summary

	Unit	NOx								
		Boiler 4						Boiler 3		
		Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 1	Test 2	Test 3
Date										
Boiler		4	4	4	4	4	4	3	3	3
Time - Start		15:05	15:55	16:45	13:15	14:05	14:45	15:50	16:35	17:20
Barometric pressure	kPa	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0
Gas temperature	°C	118	121	125	123	123	123	111	111	111
Gas volumetric flow	Nm^3/s	68.3	71.1	73.9	86.0	92.4	83.4	65.0	70.5	66.6
	Am^3/s	117.2	123.1	129.0	148.0	158.1	142.9	109.6	118.2	115.8
SOx test data										
Gas meter data:										
Start	liter	18727.2	18771.2	18803.2	20142.4	20178.8	20215.8	19519.2	19553.4	19584.8
Stop	liter	18769.2	18802.0	18834.0	20175.4	20212.6	20242.4	19551.0	19582.6	19611.0
Volume sampled (meter reading)	liter	42.0	30.8	30.8	33.0	33.8	26.6	31.8	29.2	26.2
Gas meter temperature	°C	19	20	20	22	21	22	20	22	20
NTP Volume - dry	dNm^3	0.0341	0.0249	0.0249	0.0265	0.0273	0.0214	0.0257	0.0235	0.0212
H_2O content	%	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
NTP volume - wet	Nm^3	0.0361	0.0264	0.0264	0.0281	0.0289	0.0227	0.0273	0.0249	0.0225
Liquid analysis: SO_2										
Volume of liquid sample	ml	202	192	252	182	372	337	397	412	297
NOx concentration	mg/l	36.956	14.98	9.689	3.255	1.392	1.601	8.436	3.976	14.479
Nett NOx quantity absorbed	mg	7.47	2.88	2.44	0.59	0.52	0.54	3.35	1.64	4.30
Gaseous SO_2 concentration										
NTP conditions	**mg/Nm^3**	**207**	**109**	**92**	**21**	**18**	**24**	**123**	**66**	**191**
	ppm	72	38	32	7	6	8	43	23	67
NO_x emission rate	**kg/h**	51	28	25	7	6	7	29	17	46

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Certificate / Report

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COMPANY NAME	:	**CONSULTO ENVIRO**	**Ref. No:**	**09/1784M**
ADDRESS	:	**P O Box 8530 CENTURION 0046**	**Issued at:**	**Middelburg**
SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**1 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160782**		

SAMPLE MARKS : **COAL BOILER 4**
14/07
160782

ANALYSIS ON AS RECEIVED BASIS	METHOD	RESULTS OBTAINED
Total Moisture, %	C030-406-W (Based on ISO 589:2003)	5.2

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Moisture, %	C030-403W (Based on SABS 925)	3.8
Volatiles, %	C030-404W (Based on ISO 562:1998)	23.9
Ash, %	C030-401W (Based on ISO 1171:1997E)	23.0
Fixed Carbon, %	*(By Difference)	49.3
Gross Calorific Value, MJ/kg	C030-405W (Based on ISO 1928:1995)	23.26
Gross Calorific Value, kcal/kg	C030-405W (Based on ISO 1928:1995)	5557
Total Sulphur, %	C030-402W (Based on ASTM D4239:04a) (Method B)	1.55

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
Compliant to ISO 17025
Analysis marked with * NOT SANAS ACCREDITED
Results Reported Relate Only To Items Tested

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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**2 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160782**		

SAMPLE MARKS	:	**COAL BOILER 4** **14/07** **160782**

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Moisture, %	C030-403W (Based on SANS 5925)	3.8
Ash, %	C030-401W (Based on ISO 1171:1997)	23.0
Total Sulphur, %	C030-402W (Based on ASTM D4239:04a)	1.55
Total Carbon , %	C030-408-W (Based on ASTM D5373:08)	59.74
Hydrogen , %	*C030-407-W (Based on ISO 609:1996)	3.87
Nitrogen , %	* ASTM D3179-02	1.59
Oxygen , %	*(By Difference)	6.45

Note: **The Tests were performed in a laboratory which is accredited by SANAS Compliant to ISO 17025**
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*** Concentration range for Carbon is 54.9-84.7 % (m/m)**

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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**3 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160782**		

SAMPLE MARKS	:	**COAL BOILER 4** **14/07** **160782**

	METHOD	RESULTS OBTAINED
ANALYSIS OF THE ASH	* In House X-Ray Fluorescence	
Calcium as CaO, %	:	8.79
Magnesium as MgO, %	:	1.65
Potassium as K_2O, %	:	0.91
Sodium as Na_2O, %	:	0.52
Total Iron as Fe_2O_3, %	:	7.53
Titanium as TiO_2, %	:	1.73
Aluminium as Al_2O_3, %	:	26.9
Total Silica as SiO_2, %	:	44.7
Manganese as MnO, %	:	0.03
Sulphur as SO_3, %	:	4.34
Phosphorus as P_2O_5, %	:	0.82

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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SUBJECT	:	Sample for analysis	Date:	02/09/09
SAMPLE DESCRIPTION	:	Coal Sample (Securely closed)	Page:	4 of 18
INSTRUCTED BY	:	Luther Els		
RECEIVED ON	:	31/07/09		
LAB NO(S)	:	160782		

SAMPLE MARKS : COAL BOILER 4
14/07
160782

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
	ISO 1953 : 1995	

PARTICAL SIZE DISTRIBUTION

SIZE FRACTION (mm)			Yield %
	+25	:	0.0
-25	+13	:	7.5
-13	+6	:	29.0
-6	+3	:	20.0
-3		:	43.5
Total			100.0

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**5 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160783**		

SAMPLE MARKS	:	**COAL BOILER 3** **15/07** **160783**

ANALYSIS ON AS RECEIVED BASIS	**METHOD**	**RESULTS OBTAINED**
Total Moisture, %	C030-406-W (Based on ISO 589:2003)	6.2

ANALYSIS ON AIR DRIED BASIS	**METHOD**	**RESULTS OBTAINED**
Moisture, %	C030-403W (Based on SABS 925)	4.1
Volatiles, %	C030-404W (Based on ISO 562:1998)	25.4
Ash, %	C030-401W (Based on ISO 1171:1997E)	24.2
Fixed Carbon, %	*(By Difference)	46.3
Gross Calorific Value, MJ/kg	C030-405W (Based on ISO 1928:1995)	22.68
Gross Calorific Value, kcal/kg	C030-405W (Based on ISO 1928:1995)	5418
Total Sulphur, %	C030-402W (Based on ASTM D4239:04a) (Method B)	1.28

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
Compliant to ISO 17025
Analysis marked with * NOT SANAS ACCREDITED
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COMPANY NAME	:	**CONSULTO ENVIRO**	**Ref. No:**	**09/1784M**
ADDRESS	:	**P O Box 8530 CENTURION 0046**	**Issued at:**	**Middelburg**
SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**6 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160783**		

SAMPLE MARKS : **COAL BOILER 3**
15/07
160783

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Moisture, %	C030-403W (Based on SANS 5925)	4.1
Ash, %	C030-401W (Based on ISO 1171:1997)	24.2
Total Sulphur, %	C030-402W (Based on ASTM D4239:04a)	1.28
Total Carbon , %	C030-408-W (Based on ASTM D5373:08)	58.94
Hydrogen , %	*C030-407-W (Based on ISO 609:1996)	3.42
Nitrogen , %	* ASTM D3179-02	1.52
Oxygen , %	*(By Difference)	6.54

Note: **The Tests were performed in a laboratory which is accredited by SANAS Compliant to ISO 17025**
Analysis marked with * NOT SANAS ACCREDITED
Results Reported Relate Only To Items Tested
*** Concentration range for Carbon is 54.9-84.7 % (m/m)**

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SUBJECT	:	Sample for analysis	Date:	02/09/09
SAMPLE DESCRIPTION	:	Coal Sample (Securely closed)	Page:	7 of 18
INSTRUCTED BY	:	Luther Els		
RECEIVED ON	:	31/07/09		
LAB NO(S)	:	160783		

SAMPLE MARKS : COAL BOILER 3
15/07
160783

ANALYSIS ON AIR DRIED BASIS **METHOD** **RESULTS OBTAINED**

ISO 1953 : 1995

PARTICAL SIZE DISTRIBUTION

SIZE FRACTION (mm)			Yield %
	+25	:	0.0
-25	+13	:	6.1
-13	+6	:	19.8
-6	+3	:	22.1
-3		:	52.0
Total			100.0

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
Compliant to ISO 17025
Analysis marked with * NOT SANAS ACCREDITED
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**8 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160783**		

SAMPLE MARKS	:	**COAL BOILER 3** **15/07** **160783**

ANALYSIS ON AIR DRIED BASIS	**METHOD**	**RESULTS OBTAINED**
ANALYSIS OF THE ASH	* In House X-Ray Fluorescence	
Calcium as CaO, %	:	10.7
Magnesium as MgO, %	:	2.43
Potassium as K_2O, %	:	1.35
Sodium as Na_2O, %	:	0.87
Total Iron as Fe_2O_3, %	:	5.39
Titanium as TiO_2, %	:	1.76
Aluminium as Al_2O_3, %	:	28.9
Total Silica as SiO_2, %	:	41.6
Manganese as MnO, %	:	0.03
Sulphur as SO_3, %	:	4.13
Phosphorus as P_2O_5, %	:	0.85

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**9 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160784**		

SAMPLE MARKS	:	**COAL BOILER 4** **16/07** **160784**

ANALYSIS ON AS RECEIVED BASIS	**METHOD**	**RESULTS OBTAINED**
Total Moisture, %	C030-406-W (Based on ISO 589:2003)	4.5

ANALYSIS ON AIR DRIED BASIS	**METHOD**	**RESULTS OBTAINED**
Moisture, %	C030-403W (Based on SABS 925)	3.4
Volatiles, %	C030-404W (Based on ISO 562:1998)	23.0
Ash, %	C030-401W (Based on ISO 1171:1997E)	24.7
Fixed Carbon, %	*(By Difference)	48.9
Gross Calorific Value, MJ/kg	C030-405W (Based on ISO 1928:1995)	23.20
Gross Calorific Value, kcal/kg	C030-405W (Based on ISO 1928:1995)	5542
Total Sulphur, %	C030-402W (Based on ASTM D4239:04a) (Method B)	0.89

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**10 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160784**		

SAMPLE MARKS	:	**COAL BOILER 4** **16/07** **160784**

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Moisture, %	C030-403W (Based on SANS 5925)	3.4
Ash, %	C030-401W (Based on ISO 1171:1997)	24.7
Total Sulphur, %	C030-402W (Based on ASTM D4239:04a)	0.89
Total Carbon , %	C030-408-W (Based on ASTM D5373:08	59.68
Hydrogen , %	*C030-407-W (Based on ISO 609:1996)	3.39
Nitrogen , %	* ASTM D3179-02	1.49
Oxygen , %	*(By Difference)	6.45

Note: **The Tests were performed in a laboratory which is accredited by SANAS Compliant to ISO 17025**
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*** Concentration range for Carbon is 54.9-84.7 % (m/m)**

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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**11 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160784**		

SAMPLE MARKS :

		METHOD	RESULTS OBTAINED
ANALYSIS OF THE ASH		* In House X-Ray Fluorescence	
Calcium as CaO, %	:		3.34
Magnesium as MgO, %	:		0.75
Potassium as K_2O, %	:		0.38
Sodium as Na_2O, %	:		0.21
Total Iron as Fe_2O_3, %	:		4.84
Titanium as TiO_2, %	:		4.78
Aluminium as Al_2O_3, %	:		28.0
Total Silica as SiO_2, %	:		52.3
Manganese as MnO, %	:		0.04
Sulphur as SO_3, %	:		2.38
Phosphorus as P_2O_5, %	:		0.82

Note: The Tests were performed in a laboratory which is accredited by SANAS
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Coal Sample (Securely closed)**	**Page:**	**12 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160784**		

SAMPLE MARKS : **COAL BOILER 4**
16/07
160784

ANALYSIS ON AIR DRIED BASIS	**METHOD**	**RESULTS OBTAINED**
	ISO 1953 : 1995	

PARTICAL SIZE DISTRIBUTION

SIZE FRACTION (mm)			Yield %
	+25	:	0.0
-25	+13	:	12.8
-13	+6	:	24.8
-6	+3	:	17.4
-3		:	45.0
Total			100.0

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Ash Sample (Securely closed)**	**Page:**	**13 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160785**		

SAMPLE MARKS	:	**BOILER 4 TOP ASH 14/07 160785**

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Ash, %	C030-401W (Based on ISO 1171:1997E)	98.0
Total Carbon, %	C030-408-W (Based on ASTM D5373-02)	1.98

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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Analysis marked with * NOT SANAS ACCREDITED
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*** Concentration range for Carbon is 54.9-84.7 % (m/m)**

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SUBJECT	:	Sample for analysis	Date:	02/09/09
SAMPLE DESCRIPTION	:	Ash Sample (Securely closed)	Page:	14 of 18
INSTRUCTED BY	:	Luther Els		
RECEIVED ON	:	31/07/09		
LAB NO(S)	:	160786		

SAMPLE MARKS	:	**BOILER 4 BOTTOM ASH 14/07 160786**

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Ash, %	C030-401W (Based on ISO 1171:1997E)	98.0
Total Carbon, %	C030-408-W (Based on ASTM D5373-02)	1.97

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Ash Sample (Securely closed)**	**Page:**	**15 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160787**		

SAMPLE MARKS	:	**BOILER 3 TOP ASH 15/07 160787**

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Ash, %	C030-401W (Based on ISO 1171:1997E)	98.1
Total Carbon, %	C030-408-W (Based on ASTM D5373-02)	1.86

Note: **The Tests were performed in a laboratory which is accredited by SANAS Compliant to ISO 17025**
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*** Concentration range for Carbon is 54.9-84.7 % (m/m)**

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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Ash Sample (Securely closed)**	**Page:**	**16 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160788**		

SAMPLE MARKS	:	**BOILER 3 BOTTOM ASH** **15/07** **160788**

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Ash, %	C030-401W (Based on ISO 1171:1997E)	98.8
Total Carbon, %	C030-408-W (Based on ASTM D5373-02)	1.05

Note: **The Tests were performed in a laboratory which is accredited by SANAS Compliant to ISO 17025**
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Ash Sample (Securely closed)**	**Page:**	**17 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160789**		

SAMPLE MARKS	:	**BOILER 4 TOP ASH 16/07 160789**

ANALYSIS ON AIR DRIED BASIS	**METHOD**	**RESULTS OBTAINED**
Ash, %	C030-401W (Based on ISO 1171:1997E)	92.4
Total Carbon, %	C030-408-W (Based on ASTM D5373-02)	7.58

Note: **The Tests were performed in a laboratory which is accredited by SANAS Compliant to ISO 17025**
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SUBJECT	:	**Sample for analysis**	**Date:**	**02/09/09**
SAMPLE DESCRIPTION	:	**Ash Sample (Securely closed)**	**Page:**	**18 of 18**
INSTRUCTED BY	:	**Luther Els**		
RECEIVED ON	:	**31/07/09**		
LAB NO(S)	:	**160790**		

SAMPLE MARKS	:	**BOILER 4 BOTTOM ASH** **16/07** **160790**

ANALYSIS ON AIR DRIED BASIS	METHOD	RESULTS OBTAINED
Ash, %	C030-401W (Based on ISO 1171:1997E)	99.1
Total Carbon, %	C030-408-W (Based on ASTM D5373-02)	0.72

Note: **The Tests were performed in a laboratory which is accredited by SANAS**
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