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Client Viridor Trident Park Limited	Client's Representative FICHTNER Consulting Engineers Limited
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EPC Contractor  18, rue Grange Dame Rose 78457 Vélizy Villacoublay Cedex FRANCE	 Rosemount House 21-23 Sydenham Road BELFAST BT3 9HA
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Subcontractor identification AIB-VINÇOTTE International sa Performance Measurements – 2NM10 Adresse de contact: Parc Créalys Rue Phocas Lejeune 11 5032 Gembloux Belgique Tél +32 (0)81 432 889 fax +32 (0)81 432 871 Internet: www.vincotte.com	Subcontractor logo 
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PERFORMANCE TESTS REPORT

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TEST REPORT

Guaranteed Performance Tests of the new
Waste to Energy plant in CARDIFF (UK)

TRIDENT PARK
GLASS AVENUE
CARDIFF CF24 5EN
(UNITED KINGDOM)

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- (4) Residence time T2S
- (5) Flue gas temperature inlet SH
- (6) Atmospheric measurements (specific report)
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- (8) Thermography survey
- (9) Temperature and noise measurements (specific reports AVI+CNIM/LAGAN)
- (10) Uncertainties calculation

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- (11) Test procedure
- (12) CEMS printout
- (13) Instrumentation list and calibration certificates
- (14) Electrical power – site's instrumentation validation
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- (16) Feed water and waste crane capacity demonstration
- (17) FGT continuous operation
- (18) Instrumentation and Control indicators
- (19) Raw data and spreadsheets
- (20) Accreditation certificates and team qualification

INTRODUCTION

The objective of the performance tests is to check that the incineration lines of the Waste To Energy Plant in CARDIFF (UK) and the associated combustion equipment meet the guaranteed performances stipulated in the contract.

Except when explicitly indicated in this report, the tests were performed according the test procedure agreed by the different parties (4702 0202 0102 / FF X 0001 Issue D - Performance test procedure with annexes) and provided in Annex 11.

When possible, the performances are verified by means of the site's instrumentation.

Some performances have been verified by AVI's instrumentation, specifically the following parameters :

- Furnace temperature (T2S model validation) and inlet superheater flue gas temperature
- Determinations with the reference methods in the flue gas at the FGT exhaust
- Bottom ash sampling and analyses
- Noise measurements

All the details related to the measurements methods can be found in the test procedure. Only additional details and deviations from this procedure are mentioned in this report.

The test period covers 14 days and 2 loads (atmospheric emission measurements 60/100%, FGT consumption, CIBSE evaluation), the other guarantees have been controlled within this period. A BAC test @ full load has been performed during 8 hours.

The characteristics of the BAC-test periods are given in the following table :

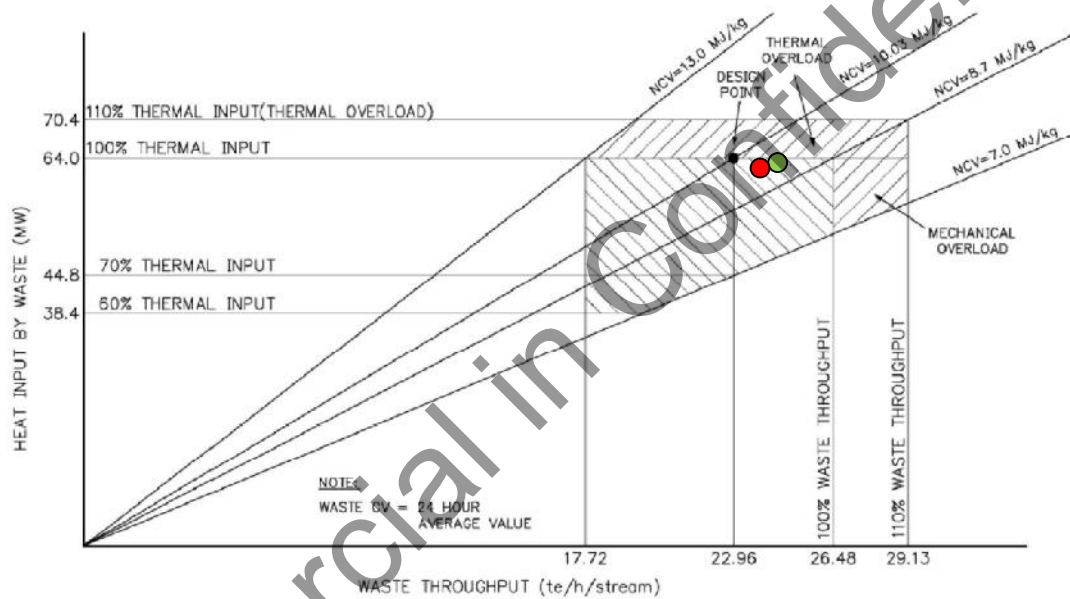
	L1 100% Thermal load	L2 100% Thermal load	L1 100% Thermal load	L2 100% Thermal load
Date	23/04/2015 8:00-16:00	23/04/2015 8:00-16:00	25/02/2016 8:45-16:45	25/02/2016 8:45-16:45
Waste NCV (kJ/kg)	9886	9930	9726	9449
Waste Throughput (kg/h)	23209	23126	23538	24350
Steam flow (t/h)	82.4	82.4	82.0	82.1
Steam flow (% of 82 t/h)	100.5%	100.5%	100%	100.1%
Thermal load (MW)	63.74	63.79	63.6	63.9
Thermal load (% of 64 MW)	99.6%	99.7%	99.4%	99.8%
Ambient temperature (°C)	10.5			

Remark(s):

- (1) The test points are represented on the Stoker capacity diagram (Line 1 ● & line 2 ●)
- (2) The tests conditions were agreed between the different parties before starting each BAC test. In particular:
 - a. The blow down was closed
 - b. The conditions were considered steady (steam flow, temperature...)
- (3) The performance tests were partially repeated in October and December 2015. The following reasons had led to repetition of some of the tests :
 - a. the plant was not operating in the respect of the permit during the first campaign in February 2015 (oxygen concentration in the flue gas at the outlet of the boiler).
 - b. Some tests didn't allow to demonstrate the performance of the installation (T2S)
 - c. By common agreement, the following tests were repeated begin 2016 :
 - i. Waste throughput
 - ii. Heat release (BAC test)
 - iii. Flue gas residence time at 850°C
 - iv. Maximum flue gas temperature
 - v. Temperature at the inlet of the first superheater
 - vi. FGT consumptions

- vii. Atmospheric emissions (partial)
- viii. Operating speed of ID fan

Still after agreement, the test procedure has been simplified. More measurements were taken from the site's instrumentation (based on the comparisons between AVI and site's instrumentation performed during the first test campaign in 2015 (see annex 3); the site's instrumentation can be considered as reliable and the measured deviations remain within the usual uncertainties) and some additional assumption were considered. AVI's instrumentation was only required to verify the residence time and the temperature at the inlet of the superheater. AVI also performed a calibration check for the FGT parameters (oxygen, flue gas flow, HCL/SOx/H2O at the outlet of the boiler). A full description of the program was given in the document with reference 2NM-15-205-DDE (CNIM) V06.



1. GUARANTEED PERFORMANCES AND CONDITIONS

The following tables give the guarantees that have been verified during the performance tests.

Remark(s):

- Unless otherwise specified, the average measured value is considered for the evaluation of the performance. The average is calculated during the complete test periods.
- For the verification of the guarantees, the measurements of AVI performed with calibrated instruments are used in priority when available.
- The measurement uncertainties (T) are taken in consideration in the evaluation of the guarantees. See the following drawing for illustration of the interpretation. Uncertainties are calculated when there are necessary for the evaluation of the guarantee (actual result not satisfying the guarantee without consideration of the uncertainty). Other values were estimated and are only presented in the next table coming from the test procedure.



N°	Performance Indicator	Units	Guaranteed performance Level	Action limit	Expected Uncertainties	Test configuration
Boiler/grate – Values are for each boiler/grate stream unless otherwise specified. Performance Test requirements are specified in Annex 16 (see appendix 1), unless otherwise stated.						
1	Continuous waste throughput at a net calorific value of 10.03 MJ/kg, averaged over a 6 hour period (100% waste throughput line on Firing Diagram)	Tonnes/h	22.96	<22.96	2%	100%
2	Guaranteed heat release from the use of waste as a fuel (100% heat release line on the Firing Diagram)	MWth	64.0	<64.0	3%	100%
<u>Reference design condition</u> for the waste heat release (3a to 3e)						
3a	Steam Flow at superheater outlet	t/h	82,0	n/a	1%	100%
3b	steam temperature at superheater outlet	°C	400	n/a	0.5	100%
3c	steam pressure at superheater outlet	Bara	60	n/a	0.3%	100%
3d	Feedwater temperature at the economiser inlet	°C	130	n/a	0.5	100%
3e	Air preheater heat input from the turbine extraction steam	MWth	5.4	n/a	2%	100%
4	Combustion chamber temperature maintained for at least two seconds after the last injection of combustion air and in the presence of sufficient oxygen to demonstrate BAT for all points within the Firing Diagram. To be demonstrated at the design stage by CFD modelling and during the Performance Tests to the satisfaction of the Environment Agency (EA) using an EA-approved technique as set out in "Review of BAT for New Waste Incineration Issues. Technical Report P4-100/TR – AEA Technology Report for the Environment Agency"	°C	850	<850	5°C	100% 60%
5a	Minimum temperature at start of run, 100% MCR, boiler clean, maximum 100 operating hours after manual boiler cleaning, at external economiser exit	°C	<140	>140	2%	100%
5b	Maximum temperature 100% MCR, boiler achieved steady state fouled condition, at external economiser exit	°C	<140	>140	2%	100%
5c	Maximum temperature 70% MCR, boiler achieved steady state fouled condition, at external economiser exit	°C	<140	>140	2%	70%
6a	Maximum unburnt matter in combined bottom ash and boiler ash, referred to dry weight of the material as specified in the Waste Incineration Directive EU/2000/76 as total organic carbon (excluding elemental carbon)	% w/w	3.0	3.0	20%	100%
7	Maximum flue gas temperature into superheater convective pass (average for any horizontal traverse) at MCR	°C	650	>650	5°	100%
8	Minimum boiler feedwater pump capacity without standby pump(s) expressed as percentage of boiler feedwater requirement at MCR of boiler	%	120%	<120	-	n/a
9	Maximum moisture content in bottom ash delivered to ash bunker	% w/w	20%	22%	20%	100%
10	Minimum guaranteed capacity of a crane to feed all streams with Design Waste from a near empty bunker (expressed as a percentage of the Design Waste throughput at MCR).	%	200%	<200%	-	100%
11	Maximum concentration of ammonia corrected to flue gas reference conditions per the design basis under all firing conditions on the Firing Diagram.	mg/Nm3	10	>10	20%	100% 60%
12	Maximum concentration of nitrous oxide (N2O) corrected to flue gas reference conditions.	mg/Nm3	20	>20	10%	100% 60%

N°	Performance Indicator	Units	Guaranteed performance Level	Action limit	Expected Uncertainties	Test configuration
Steam turbine generation set – values are for the turbine with steam supply at 100% MCR.						
13a	Gross power production measured at the generator terminals in fully condensing mode at 100% MCR steam flow from all boilers at reference conditions (at DSG point: 22.96t/h and 10.03MJ/kg).	MWe	34.3	90%	1%	100%
	Reference <u>design conditions</u> for the gross power (13b to 13e)					
13b	steam flow at the turbine inlet stop valve	t/hour	163.8	n/a	1%	100%
13c	Steam temperature at the turbine inlet stop valve	°C	397	n/a	0,5	100%
13d	Steam pressure at the turbine inlet stop valve	Bar-a	58,0	n/a	0,3%	100%
13e	Ambient dry bulb temperature (air condenser)	°C	15,0	n/a	0,2	100%
14	Maximum continuous parasitic power consumption of the EFW at Design Point: 22.96t/h and 10.03MJ/kg	MWe	5.1	110%	4%	100%
15	Steam swallowing capacity of STG	t/h		110 % of all boilers at 110% MCR	-	n/a
16a	Maximum consumption of hydrated lime with 95% CaO (each line)	kg/h	257	n/a	10%	100%
16b	Maximum consumption of PAC (each line)	kg/h	7.9	n/a	10%	100%
16c	Maximum consumption of urea (site)	kg/h	120	n/a	10%	100%
16d	Maximum APC residue production (each line)	kg/h	746	n/a	10%	100%
16e	Maximum consumption of towns water	kg/h	n/a	n/a	10%	n/a
17	Maximum emission concentrations of pollutants as specified in the Waste Incineration Directive (EU/2000/76) under the full range of firing conditions shown on the firing diagram and under the full range of input conditions.		(1)	> (1)	(1)	100% 60%
18	Operating speed of ID fan at MCR expressed as percentage of the maximum speed when operating at the maximum design input conditions	%	<80	80%	-	100%
19	FGT in continuous operation with all compartments on-line and normal reverse jet cleaning as determined by differential pressure control.		Compliance	Non compliance	-	n/a

N°	Performance Indicator	Units	Guaranteed performance Level Action limit	Expected Uncertainties	Test configuration
Facility start-up					
20	Auxiliary fuel consumption to start the boiler from cold to the point at which it is operating at 100% MCR considering NCV of the auxiliary fuel to be 42.3MJ/kg	kg	22900/ stream	105%	n/a
21	Maximum time (excluding pre-heating period for fabric filter) to start each boiler and associated systems from cold to full load and without unacceptable thermal stress and without cross-over of boiler water from one boiler to another	hours	16	16h 30min	n/a
Noise – Performance Test requirements					
22	Compliance with noise emission prescribed in the Planning Permission and Environmental Permit		Compliance	Non compliance	
Maximum noise emissions					
2a	Maximum sound pressure level measured anywhere within the Facility which is not more than two meters away from any item of plant which is a source of noise (excluding areas identified in sections 22b to 22f)	dB(A)	80	85	100%
2b	Maximum sound pressure measured at not more than 1m from the following equipment: a) turbine b) feedwater pump c) emergency diesel	dB(A)	95 85 95	100 90 100	100%
22c	Maximum sound pressure level measured at not more than 1m from the following equipment which will have intermittent operation: a) mechanical rapping equipment b) bag filter pulsing c) turbine bypass station d) Diesel fire water pump	dB(A)	90 100 115 105	95 105 120 110	100%
22e	Maximum sound pressure level measured within control room and other amenities in administrative building	dB(A)	Compliance with CIBSE guide A recommend'n s	Higher than CIBSE guide A recomm's	100%
22f	Maximum sound pressure level measured within offices and visitor centre	dB(A)	35	Higher than CIBSE guide A recomm's	100%
22g	Heating, ventilation and air conditioning temperature	°C	Compliance with CIBSE guide B recommend'n s and Annex 20B (appendix 7)	Higher than CIBSE guide B recomm's and Annex 20B (appendix 7)	100%
23	Maximum temperature in boiler and turbine house with external ambient air temperature of 36°C with the boiler stream operating at 100% MCR and all louvres in the fully open position	°C	50	50	100%
24	Minimum temperature in workshops	°C	15	<15	100%
25	Climatic conditions in offices, control room and other amenities in the administrative building.		Compliance with CIBSE guide recomm's	Non- compliance with CIBSE guide recom m's	100%

(1) Detailed guaranteed emissions (concentrations expressed on db and at 11%O₂):

	1/2 hour average	day average	Uncertainty
- NO _x (mgNO ₂ /Nm ³)	400	200	10%
- CO (mg/Nm ³)	100*	50	10%
- SO ₂ (mg/Nm ³)	200	50	20%
- Dust (mg/Nm ³)	30	10	30%
- Hg (mg/Nm ³)	0.05 (1h)	-	40%
- PCDD (ng/Nm ³)	0.1 (6 h)	-	40%
- Heavy metals (mg/Nm ³)	(0.5) (2h)	-	40%
- Cd + Tl	0.05 (2h)	-	40%
- COT (mgC/Nm ³)	20	10	30%
- HCl	60	10	40%
- HF	2 (1h period)	-	40%
- NH ₃	10	-	20%
- N ₂ O	20	-	10%

	Performance Indicator	Units	Guaranteed performance Level Action limit	Expected Uncertainties	Test configuration
Instrumentation and Control guaranteed performance indicators					
IC1	UPS - minimum operation period with all control systems functioning normally in the absence of a mains power supply. Bumpless change-over.	Minutes	60	-	-
IC2	Tolerance to spikes - the systems shall remain unaffected by spikes or other disturbances to the mains power supply.	-	Compliance	-	-
IC3	Maximum time to display new screen from moment of request on console	Seconds	1	-	-
IC4	Maximum refresh time for tagged value on screen (applies to critical values defined by Contractor)	Seconds	0.5	-	-
IC5	Bumpless change-over to stand-by control for redundant systems in the event of failure	-	Compliance	-	-

2. PERFORMANCE TEST RESULTS - SUMMARY

The following table presents the summary of the test results. In this tables, the guarantees and the results presented are corrected when a correction has to be applied. More details about the corrections and the confidence interval are presented in the following sections.

Remarks:

(1) Details of the results are presented in the annex for each line.

Commercial in Confidence

LINE 1							
N°	Performance Indicator	Units	Guaranteed performance Level	Guaranteed performance corrected at test condition	Uncertainties	Result	Conclusion
Boiler/grate – Values are for each boiler/grate stream unless otherwise specified.							
1	Continuous waste throughput at a net calorific value of 10.03 MJ/kg, averaged over a 6 hour period (100% waste throughput line on Firing Diagram)	Tonnes/h	22.96	>23.68	2%	23.54	Ok
2	Guaranteed heat release from the use of waste as a fuel (100% heat release line on the Firing Diagram)	MWth	64.00		1.35%	63.6	Ok
<u>Reference design condition</u> for the waste heat release (3a to 3e)							
3a	Steam Flow at superheater outlet	t/h	82.0		1%	82.0	n/a
3b	steam temperature at superheater outlet	°C	400		0.5	397	n/a
3c	steam pressure at superheater outlet	Bara	60		0.3%	59.6	n/a
3d	Feedwater temperature at the economiser inlet	°C	130		0.5	132	n/a
3e	Air preheater heat input from the turbine extraction steam	MWth	5.4		2%	5.08	n/a
4	Combustion chamber temperature maintained for at least two seconds after the last injection of combustion air and in the presence of sufficient oxygen to demonstrate BAT for all points within the Firing Diagram.	°C	850		5°C	100% 981 60% 1042	Ok
5a	Minimum temperature at start of run, 100% MCR, boiler clean, maximum 100 operating hours after manual boiler cleaning, at external economiser exit	°C	140		2%	140	Ok
5b	Maximum temperature 100% MCR, boiler achieved steady state fouled condition at external economiser exit	°C	140		2%	147	Nok
5c	Maximum temperature 70% MCR, boiler achieved steady state fouled condition, at external economiser exit	°C	140		2%	141	Ok
6a	Maximum unburnt matter in combined bottom ash and boiler ash, referred to dry weight of the material as specified in the Waste Incineration Directive EU/2000/76 as total organic carbon (excluding elemental carbon)	% w/w	3.0		20%	0.37	Ok
7	Maximum flue gas temperature into superheater convective pass (average for any horizontal traverse) at MCR	°C	650		11°	628 636	Ok
8	Minimum boiler feedwater pump capacity without standby pump(s) expressed as percentage of boiler feedwater requirement at MCR of boiler	%	120%		-	n/a	Ok
9	Maximum moisture content in bottom ash delivered to ash bunker	% w/w	20%		20%	8	Ok
10	Minimum guaranteed capacity of a crane to feed all streams with Design Waste from a near empty bunker (expressed as a percentage of the Design Waste throughput at MCR).	%	200%		-	-	Ok
11	Maximum concentration of ammonia corrected to flue gas reference conditions per the design basis under all firing conditions on the Firing Diagram.	mg/Nm3	10		20%	See 5.17	Ok
12	Maximum concentration of nitrous oxide (N2O) corrected to flue gas reference conditions.	mg/Nm3	20		10%	See 5.17	Ok

LINE 1							
N°	Performance Indicator	Units	Guaranteed performance Level	Guaranteed performance corrected at test condition	Uncertainties	Result	Conclusion
16a	Maximum consumption of hydrated lime with 95% CaO (each line)	kg/h	257	248	15%	322	Nok
16b	Maximum consumption of PAC (each line)	kg/h	7.9	7.59	10%	6.86	Ok
16c	Maximum consumption of urea (site)	kg/h	120	133.7	10%	62.2	Ok
16d	Maximum APC residue production (each line)	kg/h	746	716	10%	556	Ok
16e	Maximum consumption of towns water	kg/h	n/a		10%	n/a	
17	Maximum emission concentrations of pollutants as specified in the Waste Incineration Directive (EU/2000/76) under the full range of firing conditions shown on the firing diagram and under the full range of input conditions.		(1)		(1)	See 5.17	Ok
18	Operating speed of ID fan at MCR expressed as percentage of the maximum speed when operating at the maximum design input conditions	%	<80		-	76.1	Ok
19	FGT in continuous operation with all compartments on-line and normal reverse jet cleaning as determined by differential pressure control.		Compliance		-		Ok

LINE 1								
No.	Description of Performance	Unit	Guaranteed Performance	Guaranteed Performance corrected at test condition	T	Test result		Conclusion
						100%	60%	
17	<u>Maximum emission concentrations of pollutants as specified in the Waste Incineration Directive under the full range of firing conditions shown on the firing diagram and under the full range of input conditions.</u>							
			Half hourly / Daily average values					
	NOx	mgNO2/N m3	400/200	-	10%	See 5.17	See 5.17	Ok
	Carbon Monoxide	mg/Nm3	100/50	-	10%			Ok
	Sulphur Dioxide	mg/Nm3	200/50	-	20%			Ok
	Dust	mg/Nm3	30/10	-	30%			Ok
	Hg	mg/Nm3	0.05 (1h)/-	-	40%			Ok
	PCDD	ng/Nm3	0.1 (6h)/-	-	40%			Ok
	Heavy metals	mg/Nm3	0.5 (2h)/-	-	40%			Ok
	Cd + Tl	mg/Nm3	0.05 (2h)/-	-	40%			Ok
	COT	mg/Nm3	20/10	-	30%			Ok
	HCl	mg/Nm3	60/10	-	40%			Ok
	HF	mg/Nm³	2/-	-	40%			Ok

LINE 2							
N°	Performance Indicator	Units	Guaranteed performance Level	Guaranteed performance corrected at test condition	Uncertainties	Result	Conclusion
Boiler/grate – Values are for each boiler/grate stream unless otherwise specified.							
1	Continuous waste throughput at a net calorific value of 10.03 MJ/kg, averaged over a 6 hour period (100% waste throughput line on Firing Diagram)	Tonnes/h	22.96	>24.37	2%	24.35	Ok
2	Guaranteed heat release from the use of waste as a fuel (100% heat release line on the Firing Diagram)	MWth	64.00		1.35%	63.9	Ok
<u>Reference design condition</u> for the waste heat release (3a to 3e)							
3a	Steam Flow at superheater outlet	t/h	82,0		1%	82.1	n/a
3b	steam temperature at superheater outlet	°C	400		0.5	399	n/a
3c	steam pressure at superheater outlet	Bara	60		0.3%	59.6	n/a
3d	Feedwater temperature at the economiser inlet	°C	130		0.5	132	n/a
3e	Air preheater heat input from the turbine extraction steam	MWth	5.4		2%	5.08	n/a
4	Combustion chamber temperature maintained for at least two seconds after the last injection of combustion air and in the presence of sufficient oxygen to demonstrate BAT for all points within the Firing Diagram.	°C	850		5°C	100% 1002 60% 960	Ok
5a	Minimum temperature at start of run, 100% MCR, boiler clean, maximum 100 operating hours after manual boiler cleaning, at external economiser exit	°C	140		2%	140	Ok
5b	Maximum temperature 100% MCR, boiler achieved steady state fouled condition, at external economiser exit	°C	140		2%	148	Nok
5c	Maximum temperature 70% MCR, boiler achieved steady state fouled condition, at external economiser exit	°C	140		2%	144	Nok
6a	Maximum unburnt matter in combined bottom ash and boiler ash, referred to dry weight of the material as specified in the Waste Incineration Directive EU/2000/76 as total organic carbon (excluding elemental carbon)	% w/w	3.0		20%	0.55	Ok
7	Maximum flue gas temperature into superheater convective pass (average for any horizontal traverse) at MCR	°C	650		12° 11°	657 636	Ok
8	Minimum boiler feedwater pump capacity without standby pump(s) expressed as percentage of boiler feedwater requirement at MCR of boiler	%	120%		-	n/a	Ok
9	Maximum moisture content in bottom ash delivered to ash bunker	% w/w	20%		20%	14.1	Ok
10	Minimum guaranteed capacity of a crane to feed all streams with Design Waste from a near empty bunker (expressed as a percentage of the Design Waste throughput at MCR).	%	200%		-	-	Ok
11	Maximum concentration of ammonia corrected to flue gas reference conditions per the design basis under all firing conditions on the Firing Diagram.	mg/Nm3	10		20%	See 5.17	Ok
12	Maximum concentration of nitrous oxide (N2O) corrected to flue gas reference conditions.	mg/Nm3	20		10%	See 5.17	Ok

LINE 2							
N°	Performance Indicator	Units	Guaranteed performance Level	Guaranteed performance corrected at test condition	Uncertainties	Result	Conclusion
16a	Maximum consumption of hydrated lime with 95% CaO (each line)	kg/h	257	255	15%	293	Ok
16b	Maximum consumption of PAC (each line)	kg/h	7.9	7.52	10%	6.86	Ok
16c	Maximum consumption of urea (site)	kg/h	120	133.7	10%	62.2	Ok
16d	Maximum APC residue production (each line)	kg/h	746	735	10%	541	Ok
16e	Maximum consumption of towns water	kg/h	n/a		10%	n/a	
17	Maximum emission concentrations of pollutants as specified in the Waste Incineration Directive (EU/2000/76) under the full range of firing conditions shown on the firing diagram and under the full range of input conditions.		(1)		(1)	See 5.17	Ok
18	Operating speed of ID fan at MCR expressed as percentage of the maximum speed when operating at the maximum design input conditions	%	<80		-	76.4	Ok
19	FGT in continuous operation with all compartments on-line and normal reverse jet cleaning as determined by differential pressure control.		Compliance		-		Ok

LINE 2								
No.	Description of Performance	Unit	Guaranteed Performance	Guaranteed Performance corrected at test condition	T	Test result		Conclusion
						100%	60%	
17	<u>Maximum emission concentrations of pollutants as specified in the Waste Incineration Directive under the full range of firing conditions shown on the firing diagram and under the full range of input conditions.</u>							
			Half hourly / Daily average values					
	NOx	mgNO2/N m3	400/200	-	10%	See 5.17	See 5.17	Ok
	Carbon Monoxide	mg/Nm3	100/50	-	10%			Ok
	Sulphur Dioxide	mg/Nm3	200/50	-	20%			Ok
	Dust	mg/Nm3	30/10	-	30%			Ok
	Hg	mg/Nm3	0.05 (1h)/-	-	40%			Ok
	PCDD	ng/Nm3	0.1 (6h)/-	-	40%			Ok
	Heavy metals	mg/Nm3	0.5 (2h)/-	-	40%			Ok
	Cd + Tl	mg/Nm3	0.05 (2h)/-	-	40%			Ok
	COT	mg/Nm3	20/10	-	30%			Ok
	HCl	mg/Nm3	60/10	-	40%			Ok
	HF	mg/Nm³	2/-	-	40%			Ok

Common part							
N°	Performance Indicator	Units	Guaranteed performance Level	Guaranteed performance corrected at test condition	Uncertainties	Result	Conclusion
Steam turbine generation set – values are for the turbine with steam supply at 100% MCR.							
13a	Gross power production measured at the generator terminals in fully condensing mode at 100% MCR steam flow from all boilers at reference conditions (at DSG point: 22.96t/h and 10.03MJ/kg).	MWe	34.3	32.6	1%	33.8	Ok
	Reference <u>design conditions</u> for the gross power (13b to 13e)						
13b	steam flow at the turbine inlet stop valve	t/hour	163.8	-	1%	145.2	n/a (1)
13c	Steam temperature at the turbine inlet stop valve	°C	397	-	0,5	398.4	n/a
13d	Steam pressure at the turbine inlet stop valve	Bar-a	58,0	-	0,3%	58	n/a
13e	Ambient dry bulb temperature (air condenser)	°C	15,0	-	0,2	10.5	n/a
14	Maximum continuous parasitic power consumption of the EfW at Design Point: 22.96t/h and 10.03MJ/kg	MWe	5.1	5.08	4%	3.25	Ok
15	Steam swallowing capacity of STG	t/h	na		-	n/a	Ok
Facility start-up							
20	Auxiliary fuel consumption to start the boiler from cold to the point at which it is operating at 100% MCR considering NCV of the auxiliary fuel to be 42.3MJ/kg	kg	22900/stream	-	-	11269	Ok
21	Maximum time (excluding pre-heating period for fabric filter) to start each boiler and associated systems from cold to full load and without unacceptable thermal stress and without cross-over of boiler water from one boiler to another	hours	16	-	-	14h11	Ok

(1) The turbine by pass was open during the tests @full load. The sum of the steam flows produced by the 2 boilers equals 164.8 t/h.

(2)

Common part							
N°	Performance Indicator	Units	Guaranteed performance Level	Guaranteed performance corrected at test condition	Uncertainties	Result	Conclusion
Maximum noise emissions							
22	Compliance with noise emission prescribed in the Planning Permission and Environmental Permit		Compliance	Non compliance	-		n/a
22a	Maximum sound pressure level measured anywhere within the Facility which is not more than two meters away from any item of plant which is a source of noise (excluding areas identified in sections 22b to 22f)	dB(A)	80	-	-		Ok (1)
22b	Maximum sound pressure measured at not more than 1m from the following equipment: a) turbine b) feedwater pump c) emergency diesel	dB(A)	95 85 95	-	-		Ok Ok Nok
22c	Maximum sound pressure level measured at not more than 1m from the following equipment which will have intermittent operation: a) mechanical rapping equipment b) bag filter pulsing c) turbine bypass station d) Diesel fire water pump	dB(A)	90 100 115 105	-	-		Ok Ok Ok Ok
22e	Maximum sound pressure level measured within control room and other amenities in administrative building	dB(A)	Compliance with CIBSE guide A recommendations	-	-		Ok
22f	Maximum sound pressure level measured within offices and visitor centre	dB(A)	35	-	-		Ok
22g	Heating, ventilation and air conditioning temperature	°C	Compliance with CIBSE guide B recommendations and Annex 20B	-	-		Ok
23	Maximum temperature in boiler and turbine house with external ambient air temperature of 36°C with the boiler stream operating at 100% MCR and all louvres in the fully open position	°C	50	-	-		Ok
24	Minimum temperature in workshops	°C	15	-	-		Ok
25	Climatic conditions in offices, control room and other amenities in the administrative building.		Compliance with CIBSE guide recommendations	-	-		Ok

(1) Economizer vibrating system is not compliant

	Performance Indicator	Units	Guaranteed performance Level Action limit	Result	Conclusion
Instrumentation and Control guaranteed performance indicators					
IC1	UPS - minimum operation period with all control systems functioning normally in the absence of a mains power supply. Bumpless change-over.	Minutes	60		Ok
IC2	Tolerance to spikes - the systems shall remain unaffected by spikes or other disturbances to the mains power supply.	-	Compliance	(1)	OK
IC3	Maximum time to display new screen from moment of request on console	Seconds	1		OK
IC4	Maximum refresh time for tagged value on screen (applies to critical values defined by Contractor)	Seconds	0.5	(2)	n/a
IC5	Bumpless change-over to stand-by control for redundant systems in the event of failure		Compliance		Ok

(1) There is no specific site test to be done to ascertain this tolerance to spikes. This is part of the guarantees brought by the manufacturer. The UPS Chloride 80 NET provide the full galvanic isolation and it is conform to the following standards : Immunity to Electrical interference : IEC/ EN 62040-2 & EMC class standard : IEC / EN 62040-2 class 3.

(2) Not applicable; No critical values.

3. OPERATING MODES

The test procedure presents for each guarantee the test method applied. The present report gives only the results of the test and the details of calculation in annexes. Only deviation from the test procedure are mentioned in this report in the remarks.

Remark(s):

- In the following section, when no information is given on the measurement duration, the measurement is continuous and automatic during the overall test period (data logging)
- The evaluation of the guarantee is based on the average value if no specific rule is mentioned.
- For the evaluation, the guaranteed figures are compared to the measured (or calculated) figures added with the corresponding tolerance presented in the guarantee table.
- Determinations followed by the mark (B) are performed under ISO 17025 accreditation
- Symbols (Ax) refer to sub-contractors:
 - o A1: AL-WEST, atmospheric emissions (heavy metals, PCDD/F, HCl, HF, NH₃, SO_x)
 - o A2: SOCOR, bottom ash analysis
 - o A3: MAS, atmospheric emissions, PCDD/F analysis only

4. DETAILED TEST RESULTS

4.1. CONTINUOUS WASTE THROUGHPUT

Performance Indicator No. 1 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

All information are extracted from the monitoring system (DCS) with consideration of the calibration of the crane to correct the waste throughput.

	Unit	L1 100%	L2 100%
Date/time		25/02/2016 8:45-16:45	25/02/2016 8:45-16:45
Measured calculated by DCS	kg/h	23538	24350
Offset	%	1	1
Corrected value	kg/h	23538	24350
Tolerance uncertainty (T)	%	2	2
Confidence interval	kg/h	[23067-24009]	[23863-24837]
Waste NCV calculated with DCS values	kJ/kg	9726	9449
Guarantee (LHV = 10 030 kJ/kg)	kg/h	>22960	>22960
Guarantee corrected to actual NCV	kg/h	>23677	>24371
Conclusion	-	Ok	Ok

Remark(s):

4.2. HEAT RELEASE

Performance Indicator No. 2 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1 100%	L2 100%
Date/time		25/02/2016 8:45-16:45	25/02/2016 8:45-16:45
Calculated value	MWth	63.6	63.9
Tolerance uncertainty (T)	%	1.35	1.35
Confidence interval	-	[62.7-64.5]	[63.0-64.8]
Guarantee	MWth	>64.0	>64.0
Conclusion	-	Ok	Ok

Remark(s):

- (1) Details of calculation can be found in annex 1.
- (2) The feed water flows are not used to calculate the useful power. This deviation from the agreed test procedure is justified by the discrepancies between the steam and the water flows in the DCS. The consideration of the mass balance gives an objective justification (see annex 15, comparison between steam flows outlet boiler and inlet turbine; in addition @ low load, 60%, (turbine by pass closed) shows also that the steam flows are more reliable (steam flow outlet boilers : 49.2+49.3=98.5 t/h when 97.2 t/h is measured @ the turbine inlet. The sum of the FW flows during the same period = 104 t/h). The useful power is therefore calculated by multiplying the steam flow by the enthalpy increase (feed water => superheated steam).
- (3) The calculation is performed with the results given by the DCS (see remark 3-c in the Introduction).

Measured/reference conditions :

Steam Flow at superheater outlet	Unit	L1 100%	L2 100%
Measured value	t/h	82.0	82.1
Tolerance uncertainty (T)	%	1%	1%
Reference	t/h	82.0	82.0
Conclusion	-		

Steam temperature at superheater outlet	Unit	L1 100%	L2 100%
Measured value	°C	397	399
Tolerance uncertainty (T)	°C	0.5	0.5
Reference	°C	400	400
Conclusion	-		

Steam pressure at superheater outlet	Unit	L1 100%	L2 100%
Measured value	bara	59.6	59.6
Tolerance uncertainty (T)	%	0.3%	0.3%
Reference	bara	60.0	60.0
Conclusion	-		

Feedwater temperature at the economiser inlet	Unit	L1 100%	L2 100%
Measured value	°C	132	132
Tolerance uncertainty (T)	°C	0.5	0.5
Reference	°C	130	130
Conclusion	-		

Air preheater heat input from the turbine extraction steam	Unit	L1 100%	L2 100%
Measured value	MWth	5.08	5.08
Tolerance uncertainty (T)	%	2%	2%
Reference	MWth	5.4	5.4
Conclusion	-		

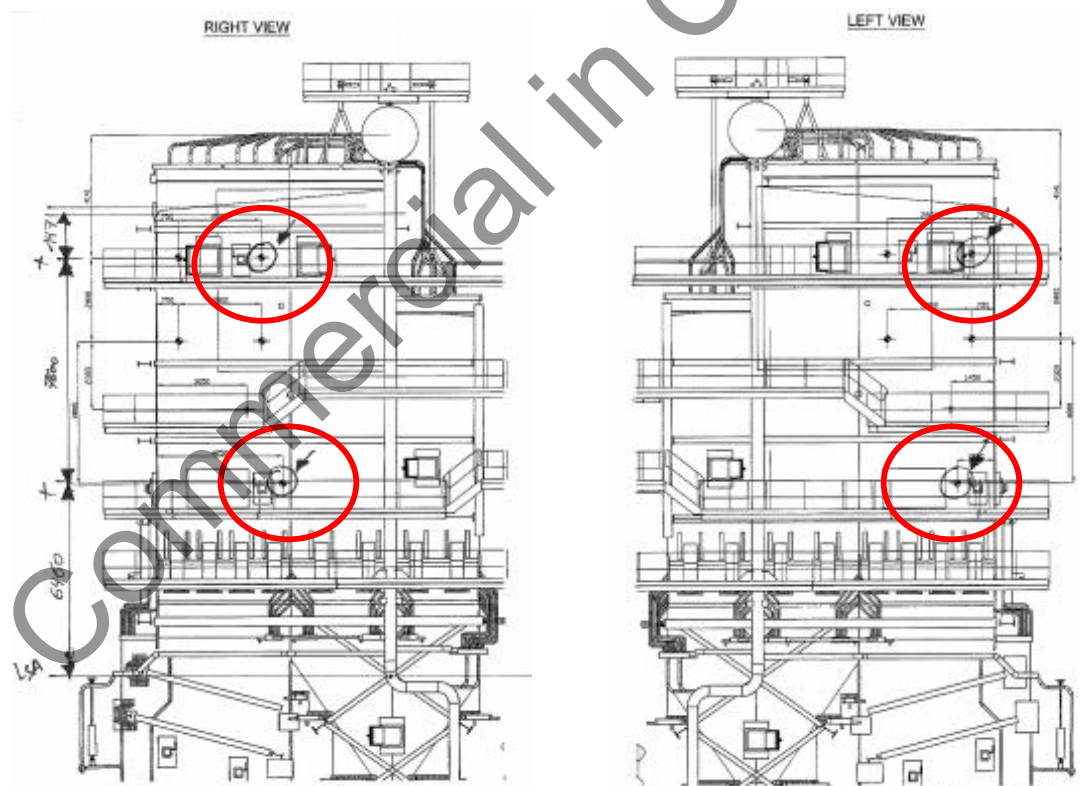
4.3. FLUE GAS RESIDENCE TIME

Performance Indicator No. 4 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

T2S	Unit	L1 100% 09/03/2016 11:15-13:15	L1 60% 23/03/2016 12:11-14:11	L2 100% 16/02/2016 13:50-15:50	L2 60% 17/02/2016 13:00-15:00
Measured/Calculated value	°C	981	1042	1002	960
DCS's value	°C	1026	990	1029	989
Guarantee	°C	>850	>850	>850	>850
Conclusion	-	Ok	Ok	Ok	Ok

Remark(s):

- (1) The residence time is always over the 850°C as required by the incineration conditions.
- (2) The residence times T2S presented in the table (line "Measured value") are calculated according the CNIM document (4702 1103/65 J 0004) and from the temperature measurements performed by AVI. The goal of the performance test was also to compare the T2S calculated by AVI and the value calculated by the DCS from the "corrected roof temperature". The result of the comparison doesn't show any significant deviation.
- (3) See below figure for location details of AVI's measurements (see annex 4 for the details).



4.4. MAXIMUM TEMPERATURE AT EXTERNAL ECONOMISER EXIT

4.4.1 Maximum temperature @100% MCR clean conditions (1)

Performance Indicator No. 5a of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Date/time		24/9 19:20 – 25/09/2016 0:50	24/9 19:20 – 25/09/2016 0:50
Measured value	°C	140	140
Tolerance uncertainty (T)	%	2	2
Confidence interval		[138-142]	[138-142]
Design data	°C	140	140
Conclusion (2)	-	Ok	Ok

4.4.2 Maximum temperature @100% MCR fouled conditions

Performance Indicator No. 5b of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Date/time		25/02/2016 8:45-16:45	25/02/2016 8:45-16:45
Measured value	°C	147	148
Tolerance uncertainty (T)	%	2	2
Confidence interval		[145-151]	[145-151]
Design data	°C	140	140
Conclusion (2)	-	Nok	Nok

4.4.3 Maximum temperature @70% MCR fouled conditions (2)

Performance Indicator No. 5c of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Date/time		(3)	(3)
Measured value	°C	141	144
Tolerance uncertainty (T)	%	2	2
Confidence interval		[138-144]	[141-147]
Design data	°C	140	140
Conclusion (2)	-	Ok	Nok

Remark(s):

- (1) 4.4.1 & 4.4.3 are based on DCS results (site instrumentation)
- (2) Given as design condition not as guarantee (no action limit). This temperature is not used to correct the FGT consumption as agreed in the protocol.
- (3) Because we didn't succeed to identify any representative period, the temperatures presented to verify the performance @70% are calculated by a linear interpolation between the measured value @60% (134°C on L1 23/03 12:11-14:11; 140°C on L2 17/02 13:00-15:00) and the temperature @100% (147°C on L1 9/03 11:15-13:15; 156°C on L2 16/02 13:50-15:50). All dates in 2016.

4.5. MAXIMUM UNBURNT MATTER IN COMBINED BOTTOM ASH AND BOILER ASH
Performance Indicator No. 6a of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Date/time		23/04/2015 8:00-16:00	23/04/2015 8:00-16:00
Measured value	% w/w	0.60	0.61
Tolerance uncertainty (T)	%	20	20
Confidence interval	-	-	-
Guarantee	% w/w	3	3
Conclusion	-	Ok	Ok

Remark(s): See annex 2 for ash analysis details

Commercial in Confidence

4.6. FLUE GAS TEMPERATURE INTO SUPERHEATER CONVECTIVE PASS

Performance Indicator No. 7 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

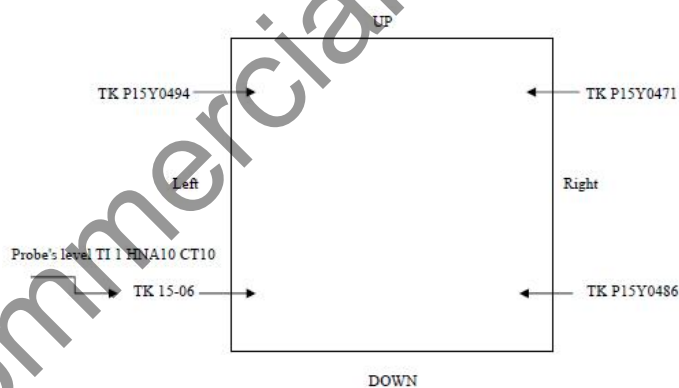
Values are given by AVI using thermocouple sensor in various opening in the boiler.

Upper level	Unit	L1 100%	L2 100%
Date/time		09/03/2016 10:00-18:00	16/02/2016 14:03-22:03
Measured value	°C	628	657
Tolerance uncertainty (T)	°C	11	12
Confidence interval	°C	[617-639]	[645-669]
Guarantee	°C	<650	<650
Conclusion	-	Ok	Ok

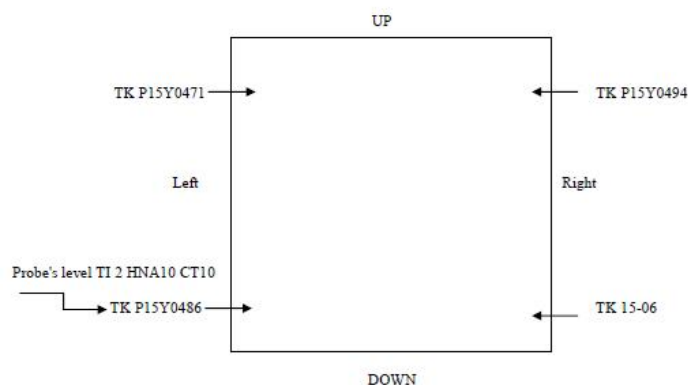
Lower level	Unit	L1 100%	L2 100%
Measured value	°C	636	636
Tolerance uncertainty (T)	°C	11	11
Confidence interval	°C	[625-647]	[625-647]
Guarantee	°C	<650	<650
Conclusion	-	Ok	Ok

Remark(s): See below figure for location details of measurements and in the annex 5 for the charts.

INFO TK's inlet SH boiler 1



INFO TK's inlet SH boiler 2



4.7. FEED WATER PUMP CAPACITY

Performance Indicator No. 8 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

Compliant, the verification is based on the DCS registration, see annex 16.

4.8. MAXIMUM MOISTURE CONTENT IN BOTTOM ASH DELIVERED TO ASH BUNKER

Performance Indicator No. 9 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Date/time		23/04/2015 10:00-18:00	23/04/2015 10:00-18:00
Measured value	% w/w	8.0	14.1
Tolerance uncertainty (T)	%	20	20
Confidence interval	-	-	-
Guarantee	% w/w	20	20
Conclusion	-	Ok	Ok

Remark(s): See annex 2 for ash details analysis

4.9. MINIMUM GUARANTEED CAPACITY OF A CRANE TO FEED ALL STREAMS

Performance Indicator No. 10 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

Test successful according the test procedure. Full description is presented in the annex 16.

4.10. MAXIMUM CONCENTRATION OF AMMONIA

Performance Indicator No. 11 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Date/time		(1)	(1)
Measured value	mg/Nm ³	<1	<1
Tolerance uncertainty (T)	%	10	10
Confidence interval	mg/Nm ³	-	-
Guarantee	mg/Nm ³	10	10
Conclusion	-	Ok	Ok

Remark(s):

(1) Given values are the averaged concentrations measured by AVI (3 measures); see 4.17 for more details. All the individual results comply with the guarantee.

4.11. MAXIMUM CONCENTRATION OF NITROUS OXIDE (N₂O)

Performance Indicator No. 12 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Date/time		(1)	(1)
Measured value	mg/Nm ³	4.6	6.0
Tolerance uncertainty (T)	%	5	5
Confidence interval	mg/Nm ³	[4.4-4.9]	[5.6-6.4]
Guarantee	mg/Nm ³	20	20
Conclusion	-	Ok	Ok

Remark(s):

- (1) Given values are the averaged concentrations measured by AVI (3 measures); see 4.17 for more details. All the individual results comply with the guarantee.

4.12. GROSS POWER PRODUCTION (SITE PERFORMANCE)

Performance Indicator No. 13a of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	Site (100%)
Date/time		23/04/2015 8:00-16:00
Measured value (1)	MW	33.8
Tolerance uncertainty (T)	%	1
Confidence interval	-	-
Guarantee	MW	>34.3
Corrected guarantee (2)	MW	>32.6
Conclusion	-	Ok

Remark(s) :

- (1) Value issued from DCS data sheet TAG : Avg (0BBA03GS001XQ19:av) from 8:00 to 16:00. See annex 14 for the instrumentation validation details.
- (2) Corrective factors are used to determine the guaranteed gross electrical power at operating test conditions:
Gross power guarantee at test conditions = Gross power guarantee at reference conditions / [(1 + k₁ + k₂) * k₃ * k₄ * k₅]. The calculation of the corrective factors are presented in the next table:

<i>f(turbine inlet temperature)</i>		
Turbine inlet temperature	<u>398.4</u>	°C
X = Turb. inlet T - 397	<u>1.4</u>	°C
k1	-0.0020	
<i>f(turbine inlet pressure)</i>		
Turbine inlet pressure	<u>57</u>	bara
X = Turb. inlet P / 58	<u>0.9828</u>	
k2	0.0014082	
<i>f(ambient temperature)</i>		
Ambient temperature < 15°C	<u>10.5</u>	°C
k3	1.0014	
<i>f(turbine inlet steam flow)</i>		
Turbine inlet steam flow	<u>145200</u>	kg/h
k4	1.0000	na
<i>f(by pass flow)</i>		
By pass flow	<u>19.6</u>	t/h
k5	1.0515	
Gross power guarantee at reference conditions		
34.300 MWe		
Gross power guarantee at test conditions		
32.594 MWe		

Measured/reference conditions :

Steam Flow at the turbine inlet	Unit	Turbine 100%
Measured value	t/h	145.2
Tolerance uncertainty (T)	%	1%
Confidence interval		
Reference	t/h	163.8
Conclusion	-	

Steam temperature at the turbine inlet	Unit	Turbine 100%
Measured value	°C	398.4
Tolerance uncertainty (T)	°C	0.5
Confidence interval		
Reference	°C	397
Conclusion	-	

Steam pressure at the turbine inlet	Unit	Turbine 100%
Measured value	bara	58
Tolerance uncertainty (T)	%	0.3%
Confidence interval		
Reference	bara	58
Conclusion	-	na

Ambient dry bulb temperature	Unit	Turbine 100%
Measured value	°C	10.5
Tolerance uncertainty (T)	°C	0.5
Confidence interval		
Reference	°C	15
Conclusion	-	

Remark(s):

4.13. MAXIMUM CONTINUOUS PARASITIC POWER CONSUMPTION AT DESIGN POINT

Performance Indicator No. 14 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	Site (100%)
Date/time		23/04/2015 8:00-16:00
Measured value (1)	MW	3.25
Tolerance uncertainty (T)	%	4
Confidence interval	-	-
Guarantee	MW	<5.10
Corrected guarantee (2)	MW	<5.08
Conclusion	-	Ok

Remark(s):

- (1) Value issued from 8:00 to 16:00 from DCS data sheet TAG (see annex 14 for the instrumentation validation details):
0BBA09GS001XQ19:av
+0BBA08GS001XQ19:av
+0BBA07GS001XQ19:av
+0BBA06GS001XQ19:av
+0BBA05GS001XQ19:av
+0BBA04GS001XQ19:av
- (2) The following corrective factors are used to determine the guaranteed parasitic load at operating test conditions.
$$\text{Parasitic load guarantee at test conditions} = \text{Parasitic load guarantee at reference conditions} / K$$

$f(\text{heat input})$		
Heat input (thermal load)	127.49	MW
Nominal heat input	127.94	MW
x	0.996483	
K	1.0046	
Parasitic load guarantee at reference conditions	5.100	MWe
Parasitic load guarantee at test conditions	5.077	MWe

4.14. MAXIMUM CONSUMPTION OF HYDRATED LIME

Performance Indicator No. 16a of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Measured value	Kg/h	322	293
Tolerance uncertainty (T)	%	15	15
Confidence interval	Kg/h	[274-370]	[250-337]
Guarantee	Kg/h	<257	<257
Guarantee corrected at test conditions	Kg/h	<259	<265
Conclusion	-	Nok	Ok

Remark(s): see tables below for calculation details (see annex 19 for the supporting raw data).

FGT consumptions - calculation from deliveries and silos level's variation		
Mesure		Lime
Unit		
Time		Avg (0HT110CW001XQ02:av)
	Silo levels (tons)	
3/8/16 14:00	Start	58.62
3/22/16 13:59	End	72.56
	Deliveries (tons)	220.56
	Consumptions (tons)	206.62
	Consumptions (kg/h)	615.0
	Consumptions (kg/h)	
	Line 1	322.3
	Line 2	292.7
	Screw speed, line 1	52%
	Screw speed, line 2	48%
	Sum	100%

Efw Cardiff - [08/03 14:00 --> 22/03 14:00] - Correction curves for the consumables					
LINE 1			LINE 2		
Hydrated lime			Hydrated lime		
HCl DCS (1HTD10CQ902:av)	893	mg/Nm3 db 11 % O2	HCl DCS (1HTD10CQ902:av)	879	mg/Nm3 db 11 % O2
Ratio AVI/DCS	1.000		Ratio AVI/DCS	1.000	
HCl corrected	893	mg/Nm3 db 11 % O2	HCl corrected	879	mg/Nm3 db 11 % O2
SO2 DCS (1HTD10CQ903:av)	123	mg/Nm3 db 11 % O2	SO2 DCS (1HTD10CQ903:av)	145	mg/Nm3 db 11 % O2
Ratio AVI/DCS	1.000		Ratio AVI/DCS	1.000	
SO2 corrected	123	mg/Nm3 db 11 % O2	SO2 corrected	145	mg/Nm3 db 11 % O2
Corrective factor @ 200mgSO2/Nm3	0.941		Corrective factor @ 200mgSO2/Nm3	0.928	
Corrective factor @ 40mgSO2/Nm3	0.835		Corrective factor @ 40mgSO2/Nm3	0.824	
K0 (135mgSO2/Nm3)	0.890	linear interpolation	K0 (135mgSO2/Nm3)	0.892	linear interpolation
Qf(N) DCS (1HTA30CF001ZQ02:av)	144413	Nm3/h dry gas 11 % O2	Qf(N) DCS (1HTA30CF001ZQ02:av)	147432	Nm3/h dry gas 11 % O2
Ratio AVI/DCS	1.000		Ratio AVI/DCS	1.000	
Qf(N) corrected	144413	Nm3/h dry gas 11 % O2	Qf(N) corrected	147432	Nm3/h dry gas 11 % O2
Qf0(N)	127421	Nm3/h dry gas 11 % O2	Qf0(N)	127421	Nm3/h dry gas 11 % O2
K1	1.133		K1	1.157	
Qfi DCS calculated at outlet boiler	125315	Nm3/h wet	Qfi DCS calculated at outlet boiler	128741	Nm3/h wet
Ratio AVI/DCS	1.000		Ratio AVI/DCS	1.000	
Qfi corrected	125315	Nm3/h wet	Qfi corrected	128741	Nm3/h wet
Qf0	129170	Nm3/h wet	Qf0	129170	Nm3/h wet
K3	1.000		K3	1.000	
Additional corrective factor	1.000		Additional corrective factor	1.000	
Guarantee	257	kg/h	Guarantee	257	kg/h
Guarantee corrected	259	kg/h	Guarantee corrected	265	kg/h

4.15. MAXIMUM CONSUMPTION OF ACTIVATED CARBON

Performance Indicator No. 16b of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Measured value	Kg/h	6.86	6.86
Tolerance uncertainty (T)	%	10	10
Confidence interval	-	-	-
Guarantee	Kg/h	<7.9	<7.9
Guarantee corrected at test conditions	Kg/h	<7.66	<7.87
Conclusion	-	Ok	Ok

Remark(s): See table below for calculation details (see annex 19 for the supporting raw data).

FGT consumptions - calculation from deliveries and silos level's variation		
Mesure		Activated carbon
Unit		
Time		Avg (OHRJ10CW001XQ02:av)
	Silo levels (tons)	
3/8/16 14:00	Start	16.27
3/22/16 13:59	End	11.66
	Deliveries (tons)	
	Consumptions (tons)	4.61
	Consumptions (kg/h)	13.7
	Consumptions (kg/h)	
	Line 1	6.86
	Line 2	6.86
	Screw speed, line 1	
	Screw speed, line 2	
	Sum	

Efw Cardiff - [08/03 14:00 --> 22/03 14:00] - Correction curves for the consumables					
LINE 1			LINE 2		
Activated Carbon			Activated Carbon		
Guarantee	7.90	kg/h	Guarantee	7.90	kg/h
Qfi DCS calculated at outlet boiler	125315	Nm³/h wet	Qfi DCS calculated at outlet boiler	128741	Nm³/h wet
Ratio AVI/DCS	1		Ratio AVI/DCS	1	
Qfi corrected	125315	Nm³/h wet	Qfi corrected	128741	Nm³/h wet
Guarantee corrected	7.66	kg/h	Guarantee corrected	7.87	kg/h

4.16. MAXIMUM CONSUMPTION OF UREA

Performance Indicator No. 16c of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	Site
Measured value (site)	Kg/h	62.2
Tolerance uncertainty (T)	%	10
Confidence interval	-	-
Guarantee (L1+L2)	Kg/h	<120
Guarantee corrected at test conditions	Kg/h	<137
Conclusion	-	OK

Remark(s): See table below for calculation details (see annex 19 for the supporting raw data).

FGT consumptions - calculation from deliveries and silos level's variation		
Mesure		Urea
Unit		
Time		Avg (0HQJ10CW001XQ02:av)
	Silo levels (tons)	
3/8/16 14:00	Start	23.24
3/22/16 13:59	End	22.07
	Deliveries (tons)	
		19.74
	Consumptions (tons)	20.91
	Consumptions (kg/h)	62.2
	Consumptions (kg/h)	
	Line 1	31.1
	Line 2	31.1
	Screw speed, line 1	
	Screw speed, line 2	
	Sum	

Efw Cardiff - [08/03 14:00 --> 22/03 14:00] - Correction curves for the consumables					
LINE 1			LINE 2		
Urea			Urea		
Qf(N) DCS (1HTA30CF001ZQ02:av)	144413	Nm3/h dry gas 11 % O2	Qf(N) DCS (1HTA30CF001ZQ02:av)	147432	Nm3/h dry gas 11 % O2
Ratio AVI/DCS	1		Ratio AVI/DCS	1	
Qf(N) corrected	144413	Nm3/h dry gas 11 % O2	Qf(N) corrected	147432	Nm3/h dry gas 11 % O2
Qf0(N)	127421	Nm3/h dry gas 11 % O2	Qf0(N)	127421	Nm3/h dry gas 11 % O2
K1	1.133		K1	1.157	
Guarantee	60.0	kg/h	Guarantee	60.0	kg/h
Guarantee corrected	68.0	kg/h	Guarantee corrected	69.4	kg/h

4.17. MAXIMUM APC RESIDUE PRODUCTION

Performance Indicator No. 16d of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Measured value	Kg/h	556	541
Tolerance uncertainty (T)	%	10	10
Confidence interval	-	-	-
Guarantee	Kg/h	<746	<746
Guarantee corrected at test conditions	Kg/h	<748	<766
Conclusion	-	Ok	Ok

Remark(s): See table below for calculation details (see annex 19 for the supporting raw data).

FGT consumptions - calculation from deliveries and silos level's variation			
Mesure		Residue L2	Residue L1
Unit			
Time		Avg (2HTP30CW001XQ02:av)	Avg (1HTP30CW001XQ02:av)
	Silo levels (tons)		
3/8/16 14:00	Start	8.64	11.58
3/22/16 13:59	End	16.14	20.70
	Deliveries (tons)		
		385.16	
	Consumptions (tons)	368.54	
	Consumptions (kg/h)	1096.8	
	Consumptions (kg/h)		
	Line 1	556.0	
	Line 2	540.8	
	Screw speed, line 1	190.9	
	Screw speed, line 2	185.7	
	Sum	tons/14 days	

Efw Cardiff - [08/03 14:00 --> 22/03 14:00] - Correction curves for the consumables					
LINE 1			LINE 2		
APC residue production			APC residue production		
HCl DCS (1HTD10CQ902:av)	893	mg/Nm3 db 11 % O2	HCl DCS (1HTD10CQ902:av)	879	mg/Nm3 db 11 % O2
Ratio AVI/DCS	1.000		Ratio AVI/DCS	1.000	
HCl corrected	893	mg/Nm3 db 11 % O2	HCl corrected	879	mg/Nm3 db 11 % O2
SO2 DCS (1HTD10CQ903:av)	123	mg/Nm3 db 11 % O2	SO2 DCS (1HTD10CQ903:av)	145	mg/Nm3 db 11 % O2
Ratio AVI/DCS	1.000		Ratio AVI/DCS	1.000	
SO2 corrected	123	mg/Nm3 db 11 % O2	SO2 corrected	145	mg/Nm3 db 11 % O2
Corrective factor @ 200mgSO2/Nm3	0.938		Corrective factor @ 200mgSO2/Nm3	0.926	
Corrective factor @ 40mgSO2/Nm3	0.827		Corrective factor @ 40mgSO2/Nm3	0.815	
K0 (135mgSO2/Nm³)	0.885	linear interpolation	K0 (135mgSO2/Nm³)	0.888	linear interpolation
Qf(N) DCS (1HTA30CF001ZQ02:av)	144413	Nm3/h dry gas 11 % O2	Qf(N) DCS (1HTA30CF001ZQ02:av)	147432	Nm3/h dry gas 11 % O2
Ratio AVI/DCS	1		Ratio AVI/DCS	1	
Qf(N) corrected	144413	Nm3/h dry gas 11 % O2	Qf(N) corrected	147432	Nm3/h dry gas 11 % O2
Qf0(N)	127421	Nm3/h dry gas 11 % O2	Qf0(N)	127421	Nm3/h dry gas 11 % O2
K1	1.133		K1	1.157	
Additional corrective factor	1.000		Additional corrective factor	1.000	
Guarantee	746	kg/h	Guarantee	746	kg/h
Guarantee corrected	748	kg/h	Guarantee corrected	766	kg/h

4.18. EMISSIONS TO ATMOSPHERE

Performance Indicator No. 17 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

Summary of the results are presented in the following tables, detailed report can be found in the annexe 6 for each line.

Guarantee half hour

The results presented in the 4 following tables are given by the AVI's measurements with the reference methods (see specific report in annex 6).

Remark(s):

- (1) Results and guarantees are corrected to flue gas reference conditions (db, 0°C, 1013 hPa and 11%O₂)
- (2) ½ hour ELV can only be compared with AVI's ½ hour measurements in the case of automatic determinations (CO, NO_x, TOC, N₂O). The sampling time for the other compounds is generally required to be longer to get accurate determinations.
- (3) Most of the determinations were also done at the inlet of the flue gas treatment, the results are presented in the annex 6.

Line 1 – 100 % (AVI's measurements)

Parameter	Units (1)	Measured value	Measurement's date (2015)	Guarantee half hour	Conclusion
NO _x	mgNO ₂ /Nm ³	222 230	22/04 12:41-13:11 23/04 8:30-9:00	400	Ok
Carbon Monoxide	mg/Nm ³	1.9 3.4	22/04 12:41-13:11 23/04 8:30-9:00	100	Ok
Sulphur Dioxide	mg/Nm ³	5.7 3.0	25/04 13:38-14:08 28/04 10:26-10:56	200	Ok
Dust	mg/Nm ³	1.8 0.8	22/04 12:42-14:42 25/04 8:11-10:11	30	Ok
Hg	mg/Nm ³	0.01 0.02	22/04 15:18-16:18 23/04 16:45-17:45	0.05 (1h)	Ok
PCDD	ng/Nm ³	<0.03 <0.03	25/04 11:45-17:45 28/04 8:00-14:00	0.1 (6h)	Ok
Heavy metals	mg/Nm ³	0.07 0.04	22/04 12:42-14:42 23/04 14:20-16:20	0.5 (2h)	Ok
Cd + Tl	mg/Nm ³	<0.001 <0.001	22/04 12:42-14:42 23/04 14:20-16:20	0.05 (2h)	Ok
COT	mg/Nm ³	<1.9 <1.9	22/04 11:31-12:35 24/04 10:05-11:45	20	Ok
HCl	mg/Nm ³	3.3 10.3	25/04 12:28-13:28 28/04 9:17-10:17	60	Ok
HF	mg/Nm ³	<0.1 <0.1	22/04 12:42-13:42 25/04 12:28-13:28	4	Ok
NH ₃	mg/Nm ³	<0.21 0.54	22/04 14:17-14:47 28/04 10:57-11:27	10	Ok
N ₂ O	mg/Nm ³	4.4 3.1	22/04 12:41-13:11 27/04 9:45-10:15	20	Ok

Line 2 – 100 % (AVI's measurements)

Parameter	Units (1)	Measured value	Measurement's date (2015)	Guarantee half hour	Conclusion
NOx	mgNO2/N m3	222 234	22/04 8:49-9:19 23/04 9:00-9:30	400	Ok
Carbon Monoxide	mg/Nm3	2.2 3.8	22/04 8:49-9:19 23/04 9:00-9:30	100	Ok
Sulphur Dioxide	mg/Nm3	1.7 <1.1	24/04 14:00-14:30 27/04 13:53-14:23	200	Ok
Dust	mg/Nm3	1.3 0.9	22/04 8:48-10:48 24/04 8:13-10:13	30	Ok
Hg	mg/Nm3	0.01 0.01	22/04 11:14-12:14 24/04 9:30-10:30	0.05 (1h)	Ok
PCDD	ng/Nm3	<0.01 <0.01	24/04 11:42-17:42 27/04 11:45-17:45	0.1 (6h)	Ok
Heavy metals	mg/Nm3	0.08 0.05	22/04 8:48-10:48 24/04 8:13-10:13	0.5 (2h)	Ok
Cd + Tl	mg/Nm3	<0.001 <0.001	22/04 8:48-10:48 24/04 8:13-10:13	0.05 (2h)	Ok
COT	mg/Nm3	5.4 <1.8	22/04 10:26-11:27 24/04 8:50-10:00	20	Ok
HCl	mg/Nm3	13.6 0.4	24/04 12:50-13:50 27/04 12:42-13:42	60	Ok
HF	mg/Nm3	<0.1 <0.1	24/04 12:50-13:50 27/04 12:42-13:42	4	Ok
NH3	mg/Nm3	0.9 0.3	22/04 10:19-10:49 27/04 14:24-14:54	10	Ok
N2O	mg/Nm3	4.5 3.8	22/04 8:49-9:19 23/04 9:00-9:30	20	Ok

Line 1 – 60 % (AVI's measurements)

Parameter	Units (1)	Measured value	Measurement's date (2015)	Guarantee half hour	Conclusion
NOx	mgNO ₂ /Nm ³	209	16/04 9:11-9:41	400	Ok
Carbon Monoxide	mg/Nm ³	1.5	16/04 9:11-9:41	100	Ok
Sulphur Dioxide (2)	mg/Nm ³	<1.3	16/04 10:45-11:15	200	Ok
Dust	mg/Nm ³	5.2	15/04 14:55-16:55	30	Ok
Hg	mg/Nm ³	<0.01	15/04 17:15-18:15	0.05 (1h)	Ok
PCDD	ng/Nm ³	0.04	16/04 8:50-14:50	0.1 (6h)	Ok
Heavy metals	mg/Nm ³	0.09	15/04 14:55-16:55	0.5 (2h)	Ok
Cd + Tl	mg/Nm ³	<0.001	15/04 14:55-16:55	0.05 (2h)	Ok
HCl (2)	mg/Nm ³	7.9	16/04 9:43-10:43	60	Ok
HF (2)	mg/Nm ³	<0.1	16/04 9:43-10:43	4	Ok
NH ₃	mg/Nm ³	<0.7	16/04 11:17-11:47	10	Ok
N ₂ O	mg/Nm ³	6.2	16/04 9:11-9:41	20	Ok

Line 2 – 60 % (AVI's measurements)

Parameter	Units (1)	Measured value	Measurement's date (2015)	Guarantee half hour	Conclusion
NOx	mgNO ₂ /Nm ³	177	17/04 8:30-9:00	400	Ok
Carbon Monoxide	mg/Nm ³	0.9	17/04 8:30-9:00	100	Ok
Sulphur Dioxide (2)	mg/Nm ³	<1.2	17/04 9:31-10:31	200	Ok
Dust	mg/Nm ³	3.1	15/04 11:10-13:10	30	Ok
Hg	mg/Nm ³	0.01	15/04 13:40-14:40	0.05 (1h)	Ok
PCDD	ng/Nm ³	<0.01	17/04 8:10-14:10	0.1 (6h)	Ok
Heavy metals	mg/Nm ³	0.07	15/04 11:10-13:30	0.5 (2h)	Ok
Cd + Tl	mg/Nm ³	<0.001	15/04 11:10-13:30	0.05 (2h)	Ok
HCl (2)	mg/Nm ³	0.8	17/04 8:30-9:30	60	Ok
HF (2)	mg/Nm ³	<0.1	17/04 8:30-9:30	4	Ok
NH ₃	mg/Nm ³	<0.2	17/04 10:01-11:01	10	Ok
N ₂ O	mg/Nm ³	9.9	17/04 8:30-9:00	20	Ok

Guarantee on daily averages

The results presented in the 2 following tables are given by the CEMS values on 24 hours during the 14 days.

Line 1 (CEMS values)

	HCl	HF	CO	SO2	Nox	COT	NH3
DATE	mg/Nm ³ dry 11% O ₂						
09 03 2016	8.36	0.28	3.68	5.78	175	0.32	0.34
10 03 2016	8.47	0.23	5.14	5.32	176	0.34	0.93
11 03 2016	8.48	0.25	5.80	4.85	175	0.36	0.54
12 03 2016	8.59	0.29	3.10	5.22	176	0.34	0.27
13 03 2016	8.37	0.24	4.37	5.17	176	0.33	0.38
14 03 2016	8.04	0.29	7.34	4.23	178	0.34	0.81
15 03 2016	8.58	0.28	5.70	4.43	180	0.32	0.25
16 03 2016	8.28	0.28	18.80	4.27	179	0.32	0.30
17 03 2016	8.62	0.26	6.60	4.33	179	0.31	0.01
18 03 2016	8.69	0.26	6.35	4.75	180	0.31	0.39
19 03 2016	8.69	0.27	6.74	4.32	172	0.31	1.37
20 03 2016	8.58	0.26	7.05	4.45	184	0.31	0.76
21 03 2016	8.39	0.26	5.76	4.93	183	0.31	0.12
22 03 2016	8.17	0.28	4.99	5.7	168	0.32	0.16
Uncertainty (1)	-	-	-	-	-	-	-
Guarantee Daily	10	1	50	50	200	10	10
Conclusion	Ok	Ok	Ok	Ok	Ok	Ok	Ok

Line 2 (CEMS values)

	HCl	HF	CO	SO2	Nox	COT	NH3
DATE	mg/Nm ³ dry 11% O ₂						
09 03 2016	8.50	0.29	7.43	3.50	185	0.35	0.91
10 03 2016	8.54	0.31	7.18	3.35	176	0.36	0.69
11 03 2016	8.56	0.29	7.17	3.1	175	0.34	0.65
12 03 2016	8.59	0.28	6.96	3.22	176	0.33	0.99
13 03 2016	8.56	0.28	7.02	3.74	176	0.33	0.91
14 03 2016	8.19	0.29	9.11	3.20	180	0.34	1.21
15 03 2016	8.54	0.29	6.18	2.81	180	0.35	0.50
16 03 2016	8.30	0.29	9.53	2.6	178	0.33	0.39
17 03 2016	8.34	0.29	8.78	2.9	175	0.34	0.44
18 03 2016	8.53	0.30	18.16	3.6	175	0.35	0.75
19 03 2016	8.44	0.29	6.72	3.4	179	0.34	0.87
20 03 2016	8.51	0.29	7.50	3.7	182	0.33	0.57
21 03 2016	8.40	0.29	8.51	3.4	185	0.35	0.30
22 03 2016	8.22	0.41	na	4.2	177	0.22	0.59
Uncertainty (1)	-	-	-	-	-	-	-
Guarantee Daily	10	1	50	50	200	10	10
Conclusion	Ok	Ok	Ok	Ok	Ok	Ok	Ok

Remark(s) :

(1) Uncertainties are already deducted from the concentrations reported in the CEMS.

4.19. OPERATING SPEED OF ID FAN AT MCR

Performance Indicator No. 18 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L1	L2
Measured value	%	76.1	76.4
Guarantee	%	<80	<80
Guarantee corrected at test conditions	-	-	-
Conclusion	-	Ok	Ok

Remark(s): Averaged value from DCS's datas on 25/02/2016 from 8:45 to 16:45 (see annex 19 for the supporting raw data; April 2015; Raw data DCS).

4.20. FGT IN CONTINUOUS OPERATION WITH ALL COMPARTMENTS ON-LINE AND NORMAL REVERSE JET CLEANING AS DETERMINED BY DIFFERENTIAL PRESSURE CONTROL

Performance Indicator No. 19 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

The verification of this guarantee is based on the DCS registration by collecting the following tags during 14 days :

Concentrations in the flue gas :

SO₂ HTA30CQ002XQ01
HCL HTA30CQ009XQ01
Dust HTA31CQ001XQ01

Load on the FGT

Delta P on filter HTA10CP901
Flue gas flow HTA30CF001ZQ01

Actilab operating conditions

Charts in annex 17 demonstrate the continuous working of the installation.

4.21. MAXIMUM TEMPERATURE IN BOILER AND TURBINE HOUSE

Performance Indicator No. 23 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

The following table presents the average/min/max temperature and RH during the test period. Chart are presented in the annex 7 for each point. During the test period, the external temperature was 10.5 °C.

Measurements from 22/04/2015 at 12:04 to 23/04/2015 at 00:04.

Maximum temperature allowed : 50°C

Boiler Hall		Average	Min	Max	Conclusion
Ground floor near the lift	[%RH]	58.1	49.4	70.0	n/a
	[°C]	16.8	14.9	18.5	Ok
Level 22meter, boiler 2 near the steam diaphragm	[%RH]	33.1	27.5	37.3	n/a
	[°C]	27.2	25.2	28.9	Ok
Ground floor between Boiler1 and 2 flue gas fan	[%RH]	56.5	50.5	62.5	n/a
	[°C]	17.4	15.5	19.0	Ok
Level 28m near the lift	[%RH]	45.0	38.2	51.0	n/a
	[°C]	21.4	20.0	22.6	Ok
Level 22meter, boiler 1 near the steam diaphragm	[%RH]	26.9	22.4	30.1	n/a
	[°C]	30.6	28.6	32.1	Ok
Level 7.5m between secondary air heater boiler 1 and boiler 2	[%RH]	51.9	42.9	64.6	n/a
	[°C]	18.6	16.6	20.2	Ok
Level 22m between flue gas outlet final eco of boiler 1 and 2	[%RH]	44.3	37.8	49.6	n/a
	[°C]	20.7	18.9	21.8	Ok
Level 35m near the lift	[%RH]	34.1	30.7	35.7	n/a
	[°C]	25.9	23.6	26.8	Ok
Level 7.5m between flue gas duct boiler 1 and 2	[%RH]	52.7	45.0	61.5	n/a
	[°C]	17.5	15.9	19.1	Ok
Level 28m between final eco chamber of boiler 1 and 2	[%RH]	44.0	38.3	48.3	n/a
	[°C]	21.8	19.8	22.9	Ok
Level 12m near the lift	[%RH]	54.2	46.3	62.8	n/a
	[°C]	19.1	17.6	20.5	Ok
Outside conditions	[%RH]	60.8	46.0	75.0	n/a
	[°C]	15.7	12.9	18.2	n/a

Turbine Hall		Average	Min	Max	Conclusion
Ground floor near to 11000V cubicle/alternator	[%RH]	57.9	45.4	68.0	n/a
	[°C]	16.2	14.2	17.4	Ok
First floor near the condensate tank	[%RH]	41.7	34.9	47.5	n/a
	[°C]	21.6	19.9	24.6	Ok
Ground floor, near the turbine exhaust	[%RH]	51.1	43.1	56.7	n/a
	[°C]	19.0	17.7	20.5	Ok
Level 10m above deaerator	[%RH]	40.6	34.1	44.8	n/a
	[°C]	23.7	22.1	28.4	Ok
Level 17m near the condensate reheater	[%RH]	37.4	30.9	41.9	n/a
	[°C]	23.4	22.1	26.6	Ok
Level 7.5m near the deaerator	[%RH]	45.0	36.4	50.3	n/a
	[°C]	21.5	19.7	25.8	Ok

Remark(s): See Charts in annex 7.

4.22. THERMOGRAPHIC SURVEY

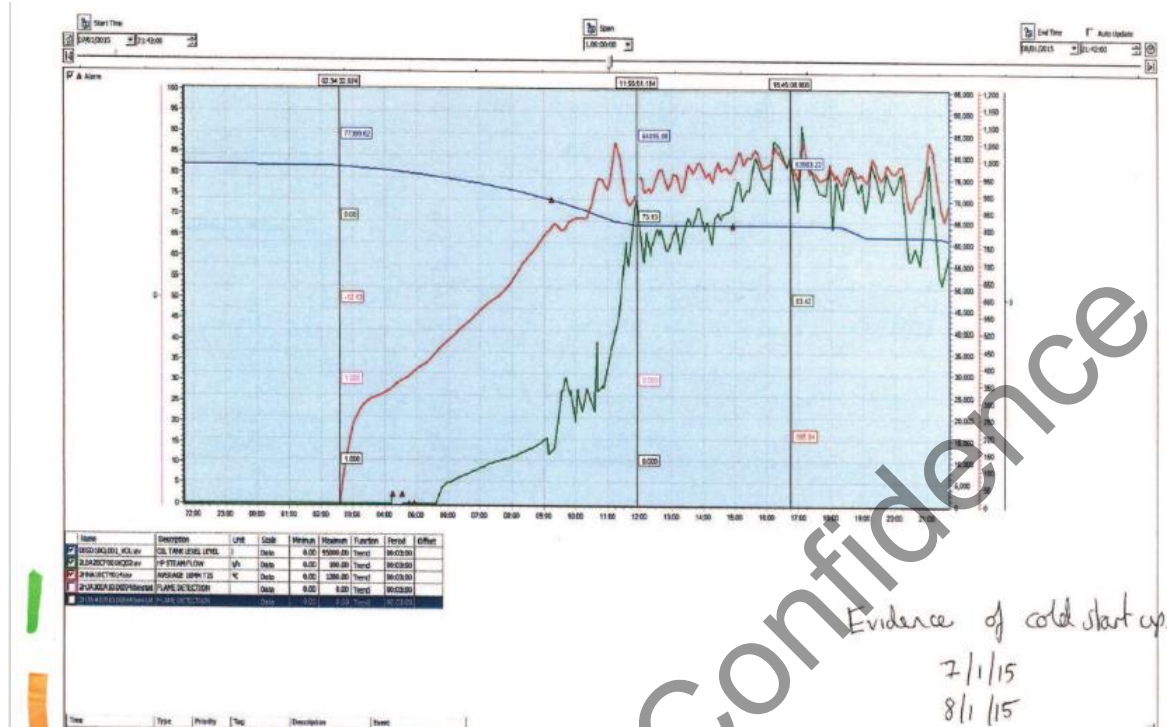
See specific report in annex 8.

4.23. FACILITY START-UP

Performance Indicator No. 20 and 21 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

	Unit	L2
Measured value	liter Kg	13416 11269
Start time on 8/01/2015 End time on 08/01/2015	-	2:34 am 4:45 pm
Start-up duration	hh:mm	14:11
Guarantees	Kg/start up hour	<22900 <16
Conclusion	-	Ok OK

The following print screen gives the raw data used to demonstrate this guarantee.



4.24. MAXIMUM NOISE EMISSIONS

Performance Indicator No. 22 of table 17.1, Annex 17, Schedule 2 of the EPC Contract.

		Conclusion	Details in annex 9
22a	Maximum sound pressure level measured anywhere within the Facility which is not more than two meters away from any item of plant which is a source of noise (excluding areas identified in sections 22b to 22f)	Ok (with exception of vibrating system)	Report AVI Section 4.1.1
22b	Maximum sound pressure measured at not more than 1m from the following equipment: a) turbine b) feedwater pump c) emergency diesel	Ok Ok Nok	a) AVI, section 4.1.2 b) AVI, section 4.1.2 c) AVI, section 4.1.2
22c	Maximum sound pressure level measured at not more than 1m from the following equipment which will have intermittent operation: a) mechanical rapping equipment b) bag filter pulsing c) turbine bypass station d) Diesel fire water pump	Ok	a) AVI, section 4.1.2 b) AVI, section 4.1.2 c) Annex 9, last 2 pages d) open (Lagan)
22e	Maximum sound pressure level measured within control room and other amenities in administrative building	Ok	Report LAGAN
22f	Maximum sound pressure level measured within offices and visitor centre	Ok	Report LAGAN
22g	Heating, ventilation and air conditioning temperature	Ok	Report LAGAN

See specific report in annex 9 (AVI and CNIM-LAGAN).

4.25. MINIMUM TEMPERATURE IN WORKSHOP

Performance Indicator No. 24 of table 17.1, Annex 17, Schedule 2 of the EPC Contract .

See specific report in annex 9 (CNIM-LAGAN).

4.26. CLIMATIC CONDITIONS IN ADMINISTRATIVE BUILDINGS

Performance Indicator No. 25 of table 17.1, Annex 17, Schedule 2 of the EPC Contract .

See specific report in annex 9 (CNIM-LAGAN).

4.27. INSTRUMENTATION AND CONTROL GUARANTEED PERFORMANCE INDICATORS

Performance Indicators in table 17.2, Annex 17, Schedule 2 of the EPC Contract.

	Performance Indicator	Units	Guaranteed performance Level Action limit	Result	Conclusion
IC1	UPS - minimum operation period with all control systems functioning normally in the absence of a mains power supply. Bumpless change-over.	Minutes	60	(3)	Ok
IC2	Tolerance to spikes - the systems shall remain unaffected by spikes or other disturbances to the mains power supply.	-	Compliance	(1)	OK
IC3	Maximum time to display new screen from moment of request on console	Seconds	1	(3)	OK
IC4	Maximum refresh time for tagged value on screen (applies to critical values defined by Contractor)	Seconds	0.5	(2)	n/a
IC5	Bumpless change-over to stand-by control for redundant systems in the event of failure	-	Compliance	(3)	Ok

(1) There is no specific site test to be done to ascertain this tolerance to spikes. This is part of the guarantees brought by the manufacturer. The UPS Chloride 80 NET provide the full galvanic isolation and it is conform to the following standards : Immunity to Electrical interference : IEC/ EN 62040-2 & EMC class standard : IEC / EN 62040-2 class 3.

(2) Not applicable: No critical values.

(3) See specific tests reports in annex 18.

5. CONCLUSIONS

5.1. Continuous Waste throughput	Ok
5.2. Heat release	Ok
5.3. Flue gas residence time	Ok
5.4. Maximum temperature at external economiser exit.....	Nok (1)
5.5. Maximum unburnt matter in combined bottom ash and boiler ash	Ok
5.6. Flue gas temperature into superheater convective pass	Ok
5.7. Maximum moisture content in bottom ash delivered to ash bunker	Ok
5.8. Feed water pump capacity	Ok
5.9. Minimum guaranteed capacity of a crane to feed all streams.....	Ok
5.10. Maximum concentration of ammonia.....	Ok
5.11. Maximum concentration of nitrous oxide (N ₂ O)	Ok
5.12. Gross power production (Site performance)	Ok
5.13. Maximum continuous parasitic power consumption at design point.....	Ok
5.14. Maximum consumption of hydrated lime	Ok (2)
5.15. Maximum consumption of activated carbon	Ok
5.16. Maximum consumption of urea.....	Ok
5.17. Maximum APC residue production.....	Ok
5.18. Emissions to atmosphere.....	Ok
5.19. Operating speed of ID fan at MCR	Ok
5.20. FGT continuous operating result	Ok
5.21. Maximum temperature in boiler and turbine house.....	Ok
5.22. Thermographic survey.....	n/a
5.23. Facility start up.....	Ok
5.24. Maximum noise emissions	Ok (3)
5.25. Minimum temperature in workshop.....	Ok
5.26. Climatic conditions in administrative buildings.....	Ok
5.27. Instrumentation and Control guaranteed performance indicators	Ok

Remark(s):

- (1) The guarantee is met with boilers clean but not in fouled conditions.
- (2) Line 1 is not compliant, but line 2 and the site's consumption are compliant.
- (3) See exceptions in the report's details

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David Detry
Activity Manager
"Performance Measurements"