

Date: 16 December 2013

Report No: 130637r

Page: 1 of 10

GridX Power Pty Ltd
GPO Box 4372
Sydney NSW 2001

Emission Testing – November 2013
DP1 and 2

Dear Mr Chris Smith,

Tests were performed 14 November 2013 to determine emissions to air from 2 locations at the Botany plant of GridX Power Pty Ltd.

EXECUTIVE SUMMARY	2
RESULTS	3
DP 1 – Unit 1	3
DP 2 – Unit 2	4
SAMPLING PLANE OBSERVATIONS	5
PLANT OPERATING CONDITIONS	5
TEST METHODS	6
DEFINITIONS	7
APPENDIX 1 – GRIDX DCS SCREENSHOT (UNIT 1)	9
APPENDIX 2 – GRIDX DCS SCREENSHOT (UNIT 2)	10

Yours faithfully
Emission Testing Consultants



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EXECUTIVE SUMMARY

Emission Testing Consultants (ETC) was engaged by GridX Power Pty Ltd to perform emission monitoring to satisfy conditions within NSW Environment Protection Licence 20246 in respect of the trigeneration facility located at Botany NSW. Monitoring was performed on Discharge Points 1 and 2 (DP1 and 2) and for the following parameters:

- Nitrogen oxides (NO_x);
- Volatile Organic Compounds (VOCs);
- Oxygen;

Testing was conducted on DP1 and DP2 on 14 November 2013 under maximum load conditions. Testing on DP1 was conducted with the Chilling Unit on, and testing on DP2 was conducted with the Chilling Unit off.

The methodologies chosen by ETC are those recommended by NSW EPA publication *The Approved Methods for Sampling and Analysis of Air Pollutants in NSW* January 2007.

RESULTS

DP 1 – Unit 1

14 November 2013



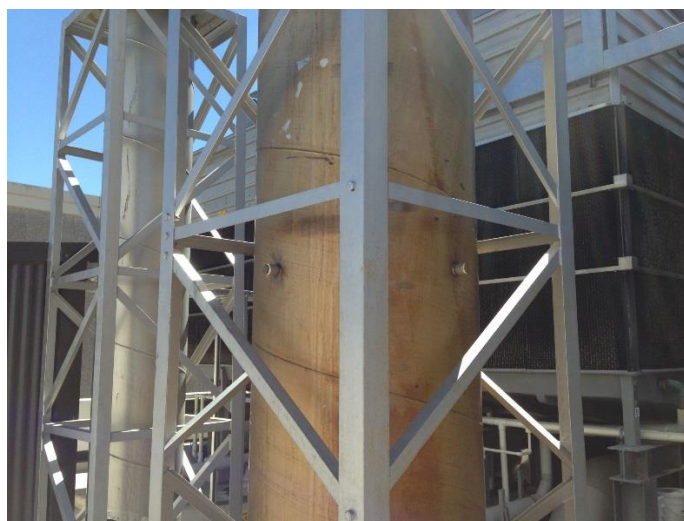
Flow Results		Measured MW	DP1- Engine 1130637
Date and time of flow test		14/11/2013 14:45	
Date and time of flow test		14/11/2012 16:15	
Stack dimensions at sampling plane		900	mm
Velocity at sampling plane		11	m/s
Average temperature		133	°C
Moisture content	Alt008	11	% v/v
Flow rate at discharge conditions		7.1	m³/sec
Flow rate at wet NTP conditions		4.8	m³/sec
Flow rate at dry NTP conditions		4.2	m³/sec

Continuous Analyser Results	DP1- Engine 1130637 250	Sampling Times	Concentration at NTP	Concentration at 3% O2	Mass rate
Oxygen (dry basis)		1504-1603	8.0 % v/v	-	-
Dry gas density		1504-1603	1.3 kg/m3	-	-
Molecular weight of stack gas, dry basis		1504-1603	29 g/g-mole	-	-
Nitrogen oxides as NO ₂		1504-1603	170 mg/m3	240 mg/m3	44 g/min

Volatile Organic Compound (VOC) Results	DP1- Engine 1130637 250	Sampling Times	Concentration at NTP	Concentration at 3% O2	Mass rate
Total VOC as n-propane		1501-1601	< 0.7 mg/m3	< 1.0 mg/m3	< 0.2 g/min

Refer to “**SAMPLING PLANE OBSERVATIONS**” on page 5.

DP 2 – Unit 2
14 November 2013



Flow Results		Measured MW	DP2 - Engine 2 130637
Date and time of flow test		14/11/2013 13:05	
Date and time of flow test		14/11/2013 14:13	
Stack dimensions at sampling plane		900	mm
Velocity at sampling plane		22	m/s
Average temperature		417	°C
Moisture content	Alt008	12	% v/v
Flow rate at discharge conditions		14	m³/sec
Flow rate at wet NTP conditions		5.5	m³/sec
Flow rate at dry NTP conditions		4.8	m³/sec

Continuous Analyser Results	DP2 - Engine 2 130637 290	Sampling Times	Concentration at NTP	Concentration at 3% O2	Mass rate
Oxygen (dry basis)		1309-1408	7.9 % v/v	-	-
Dry gas density		1309-1408	1.3 kg/m3	-	-
Molecular weight of stack gas, dry basis		1309-1408	29 g/g-mole	-	-
Nitrogen oxides as NO ₂		1309-1408	180 mg/m3	240 mg/m3	50 g/min

Volatile Organic Compound (VOC) Results	DP2 - Engine 2 130637 290	Sampling Times	Concentration at NTP	Concentration at 3% O2	Mass rate
Total VOC as n-propane		1315-1415	< 0.7 mg/m3	< 1.0 mg/m3	< 0.2 g/min

Refer to "SAMPLING PLANE OBSERVATIONS" on page 5.

SAMPLING PLANE OBSERVATIONS

DP1

The sampling plane had 2 x 1 inch BSP Ports. The location was determined to be “non-ideal” as per AS4323.1. It was 4 duct diameters less than the required 6 duct diameters downstream from a junction. It was more than the required 2 duct diameters upstream from the exit. The number of sampling points was increased as per AS4323.1. The sampling plane passed the flow assessment (items (a) to (f) of AS4323.1) and was therefore “compliant”.

DP2

The sampling plane had 2 x 1 inch BSP Ports. The location was determined to be “non-ideal” as per AS4323.1. It was 4 duct diameters less than the required 6 duct diameters downstream from a junction. It was more than the required 2 duct diameters upstream from the exit. The number of sampling points was increased as per AS4323.1. The sampling plane passed the flow assessment (items (a) to (f) of AS4323.1) and was therefore “compliant”.

PLANT OPERATING CONDITIONS

Plant operating conditions were supplied by GridX personnel.

Testing was conducted on DP1 and DP2 on 14 November 2013 under maximum load conditions. Testing on DP1 was conducted with the Chilling Unit on, and testing on DP2 was conducted with the Chilling Unit off.

Screenshots from the GridX Distributed Control System (DCS) during sampling at each location have been appended in Appendices 1 and 2.

TEST METHODS

The following methods are accredited with the National Association of Testing Authorities (NATA) and are approved for the sampling and analysis of gases unless otherwise stated. Specific details of the methods are available on request.

All sampling and analysis was conducted in accordance with the test methods (TM) prescribed in NSW EPA's *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*, Jan 2007 and in accordance with the *Protection of the Environment Operations (Clean Air) Regulation 2010* unless otherwise specified.

All parameters are reported adjusted to dry NTP conditions unless otherwise stated.

Parameter	Sampling			Analysis			
	NATA	NSW TM Method	Sampling Method	NATA	Analytical Laboratory	Analytical Method	Analytical Laboratory Report Number(s)
Selection of sampling positions	Yes	TM-1	AS4323.1	Yes	Emission Testing Consultants	NA	130637r
Flow rate	Yes	TM-2	USEPA 2	Yes		NA	
Velocity	Yes	TM-2	USEPA 2	Yes		NA	
Temperature	Yes	TM-2	USEPA 2	Yes		NA	
Moisture	Yes	TM-22	USEPA ALT008	Yes		NA	
Dry gas Density	Yes	TM-23	USEPA 3A	Yes		USEPA 3A	
Molecular weight	Yes	TM-23	USEPA 3A	Yes		USEPA 3A	
Oxygen (O ₂)	Yes	TM-25	USEPA 3A	Yes		USEPA 3A	
Nitrogen oxides (NO _x) as NO ₂	Yes	TM-11	USEPA 7E	Yes		USEPA 7E	
Volatile organic compounds (VOC)	Yes	TM-34	USEPA 18	Yes	SGS Australia Pty Ltd	AN467	71576

DEFINITIONS

The following symbols and abbreviations are used in test reports:

BSP	British standard pipe.
Concentration	Mass of analyte per cubic metre expressed at NTP dry conditions (ng, µg or mg/m ³).
Dioxins & furans	2,3,7,8-substituted polychlorinated dibenzo- <i>p</i> -dioxins (PCDD) and polychlorinated dibenzofurans PCDF
Dioxin & furan TEQ values	Toxic equivalent. The TEQ values have been calculated using the toxicity equivalence factors (TEF) according to the World Health Organisation (2005)
Flow rate at discharge conditions	Volume of gas flow per unit time expressed at discharge temperature, pressure and moisture content (m ³ /min).
Flow rate at wet NTP conditions	Volume of gas flow per unit time expressed at 0°C, an absolute pressure of 101.325 kPa and discharge moisture content (m ³ /min).
Flow rate at dry NTP conditions	Volume of gas flow per unit time expressed at 0°C, an absolute pressure of 101.325 kPa and 0% moisture content (m ³ /min).
Lowerbound	(Lower) results do not include any limit of detection values (< values).
Mass rate	Mass of analyte per unit time (µg, mg or g/min).
Mediumbound	(Medium) results include half limit of detection values (< values).
Moisture content	Percentage of gaseous moisture in the gas expressed on a volume / volume percentage basis. This does not include moisture in the gas stream that is in the liquid phase (free moisture).
NA	Not applicable.
NTP	Normal temperature and pressure. Gas volumes and concentrations are expressed on a dry (wet in the case of odour only) basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Odour concentration	Number of odour units (ou).
Odour flux rate	Odour emission rate per unit surface area per unit time (ou/m ² /min).

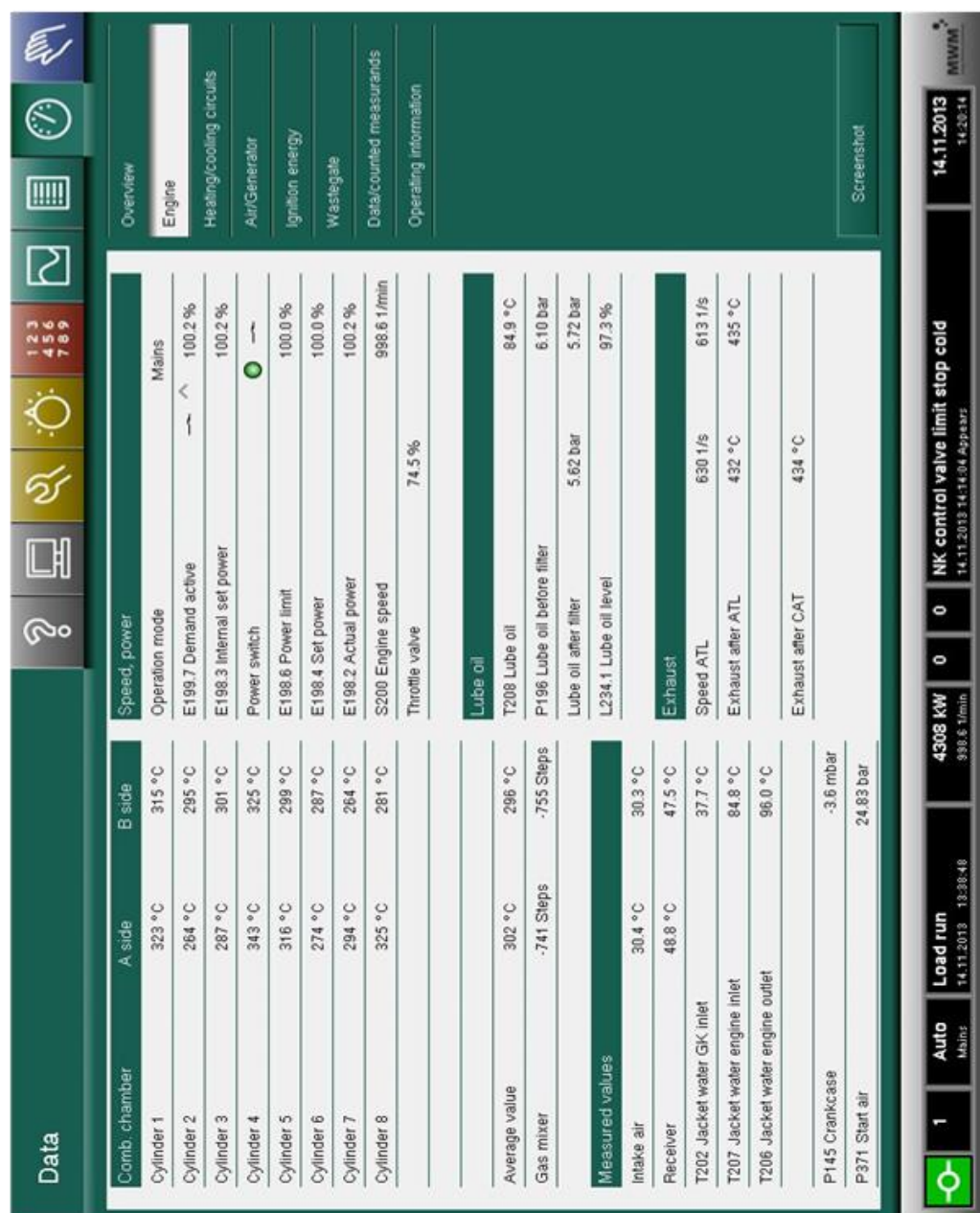
Odour mass rate	Odour emission rate per unit time (ou/min).
Odour unit	One odour unit (ou) is that concentration of odorant(s) at standard concentrations that elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PAH's	Polycyclic aromatic hydrocarbons.
PAH's TEQ values	The TEQ values have been calculated using the toxicity equivalence factors (TEF's) relative to Benzo(a)pyrene, as reported by Larsen & Larsen (1998) (TEF factors reported in the 2003 World Health Organisation (WHO) report E78963 - HEALTH RISKS OF PERSISTENT ORGANIC POLLUTANTS FROM LONG-RANGE TRANSBOUNDARY AIR POLLUTION).
ppm	Parts per million expressed on a volume / volume wet basis.
Sampling plane	Location at which measurements were conducted.
TOC	Total Organic Compounds. Total gaseous organic concentration of vapours consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons) The concentration can be expressed in terms of propane, hexane (or other appropriate organic calibration gas) or in terms of methane.
Velocity	Gas velocity expressed at discharge temperature, pressure and moisture content (m/s)
VOC	Any chemical compound based on carbon in the boiling range 36 to 126°C, with a vapour pressure of at least 0.010kPa at 25°C (or having a corresponding volatility under the particular conditions of use) that adsorb onto activated charcoal and desorb into CS ₂ , or that can be collected in a tedlar bag and be quantitatively recovered, and that are detected by GCMS. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are CO, CO ₂ , carbonic acid, metallic carbides and carbonate salts.
>	Greater than.
<	Less than the minimum limit of detection using the specified method.
~	Approximately.

APPENDIX 1 – GRIDX DCS SCREENSHOT (UNIT 1)

Comment: Qantas Sydney Airport
PLC date = 14.11.2013 14:20:14
Number: 2209648 PLC release = 2.50.11
Engine type: TCG2032V16 Visualisation = 2.7.4
Number of faults = 0 Actual power = 4308 kW
Number of alarms = 0 Actual speed = 998.6 1/min
State = Load run Operation hours = 2288
Operation mode = Mains Starts = 321

Screenshot

Engine type: TCG2032V16 Visualisation = 2.7.4
Number of faults = 0 Actual power = 4308 kW



APPENDIX 2 – GRIDX DCS SCREENSHOT (UNIT 2)

Comment: Qantas Sydney Airport
PLC date = 14.11.2013 12:16:12
Number: 2209615 PLC release = 2.50.11
Engine type: TCG2032V16 Visualisation = 2.7.4
Number of faults = 0 Actual power = 4295 kW
Number of alarms = 1 Actual speed = 999.6 1/min
State = Load run Operation hours = 2834
Operation mode = Mains Starts = 312

Screenshot

12.2012

Engine type: TCG2032V16

Visualisation = 2.7.4

Number of faults = 0

Actual power = 4295 kW

