origin

Uranquinty Power Station

NOx and Annual Stack Emission Monitoring Modification Report

Submission Report Supporting the UPS Development Consent Modification Request

15 October 2013

origin

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Definitions

Definitions of terms used in this report include:

TERM	DEFINITION
CEMS	Continuous Emissions Monitoring System
DA	Development Approval
DCS	Distributed Control System
DECC	Former NSW EPA Department of Environment and Climate Change
DOP&I	Department of Planning and Infrastructure
EPA	Environmental Protection Authority
MW	Mega Watts
NOx	Nitrogen Dioxide
Origin	Origin Energy Uranquinty Power Pty Limited
UPS	Uranquinty Power Station

1. Introduction

This report has been prepared to provide the Department of Planning & Infrastructure (DOP&I) with sufficient information to assess the Development Consent Modification request in regard to proposed changes to stack emission monitoring requirements for the Origin Energy Uranquinty Power Pty Ltd (Origin) Uranquinty Power Station (UPS).

Existing UPS stack air emission monitoring involves full time NOx monitoring via a Continuous Emission Monitoring System (CEMS), and annual stack emission testing for a suite of relevant emission parameters.

The last four (4) years of air emission monitoring at the UPS has shown a consistent emission quality. Based on this consistent data and the high maintenance and monitoring costs of emission monitoring, Origin is seeking an approval to modify the UPS air emission monitoring program.

To support the application to modify the emissions monitoring program for the UPS, this report provides a detailed summary of the following:

- UPS site and approval details
- Current UPS stack monitoring requirements
- Proposed modified stack monitoring program
- Justification for the proposed modified stack monitoring program
- Impact of the proposed modification on the local community:
    - Air Quality.

2. UPS Site and Approval Details

The UPS is a 600 MW gas-fired power station, situated at Uranquinty which is approximately 15 kilometres south west of Wagga Wagga. The UPS is owned and operated by Origin Energy Power Uranquinty Pty Ltd.

The UPS site (as shown in Figure 1) is on Uranquinty Cross Road, approximately 3 kilometres west of the town of Uranquinty and occupies 30 hectares of land.

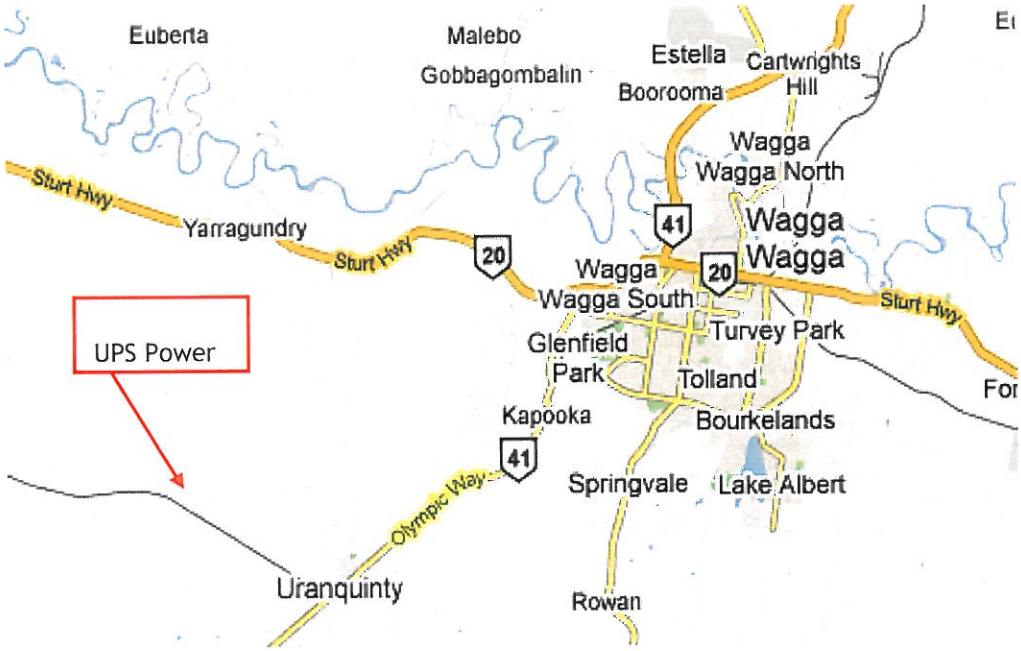

Figure 1. Location of UPS

The UPS is located within the Wagga Wagga City Council area and falls under the area zoned RU1: Primary Production of the Local Planning Instruments.

The UPS consists of four (4) x 150 MW gas fired units - Units 1 to 4. The units run on natural gas only. The UPS operates generally as a peaking plant in that it does not run on a full time basis and generally operates only when there is an increased demand for electricity in the market. As a peaking plant, the UPS can commence operation relatively quickly - i.e. 15 minutes, and can be shut down as quickly again.

The UPS operation is administered by the Department of Planning and Infrastructure under Development Consent DA-31/2/2004i and the New South Wales Environmental Protection Authority under EPA Licence 12490.

The four (4) UPS gas fired units are relatively autonomous and generally only share Balance of Plant equipment. As illustrated in Figure 2, each Unit has its own exhaust stack and pollution monitoring equipment. Under the site NSW Environmental Licence the Air Emission Points are defined as:

UPS Unit	Emission Point Description
Unit 1	Emission Point 1
Unit 2	Emission Point 2
Unit 3	Emission Point 3
Unit 4	Emission Point 4

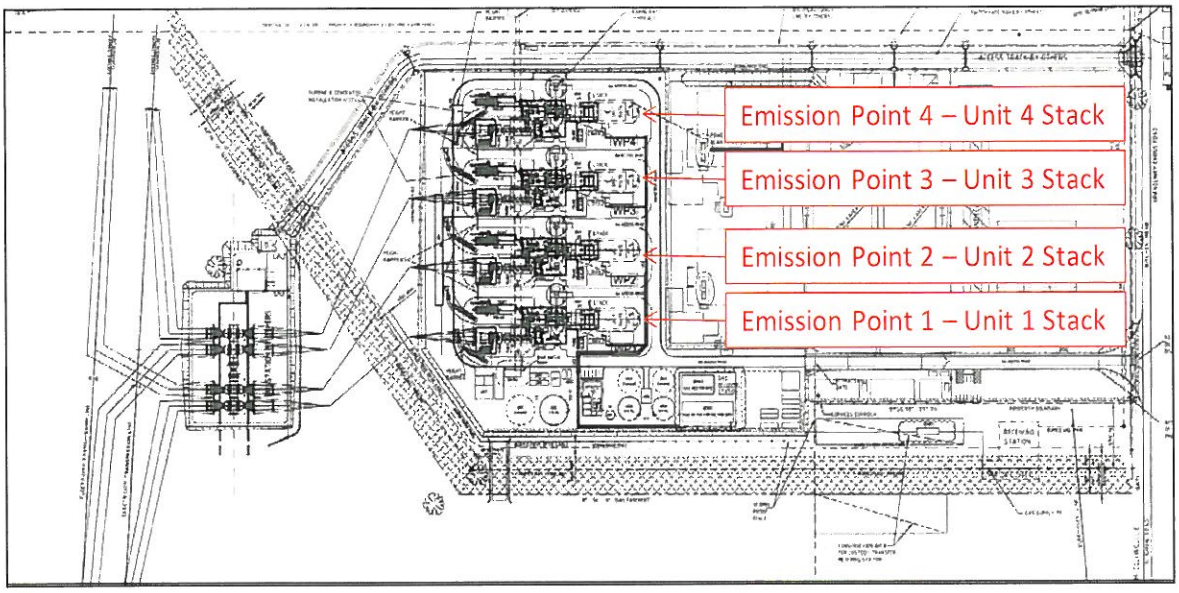

Figure 2. UPS Unit Layout

3. Current UPS Stack Emission Monitoring Requirements

The current UPS stack emission monitoring requirements are detailed in the UPS Development Consent (DA-31/2/2004i) and involves full time NOx monitoring via a Continuous Emission Monitoring System (CEMS) and annual stack emission testing for a range of other emission parameters.

The current conditions for stack emission monitoring for the UPS are detailed condition 4.2 of the site Development Consent (DA-31/2/2004i) which states:

Air Quality Monitoring

4.2 *The Applicant shall determine the pollutant concentrations and emission parameters specified in Table 4 below, at each of the turbine stack discharge points (established in strict accordance with the requirements of test method TM-1 as specified in Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (EPA, 2001). Monitoring shall be undertaken during operation of the development, at the frequency indicated in the Table, unless otherwise agreed by the EPA. 4The Applicant shall determine the pollutant concentrations and emission parameters specified in Table 4 - Periodic Pollutant and Parameter Monitoring (Air)*

Table 4 - Periodic Pollutant and Parameter Monitoring (Air)

Pollutant/ Parameter	*Units of Measure*	*Method*	*Frequency*
Nitrogen dioxide (NO_2) or nitric oxide (NO), or both (as NO_2)	*mgm-3*	*CEM-2*	*Continuous*
Velocity	*ms-1*	*TM-2*	*Post commissioning and annually*
Volumetric flow rate	*m3s-1*	*TM-2*	
Temperature	*oC*	*TM-2*	
Moisture content in stack gases	*%*	*TM-22*	
Dry gas density	*kgm-3*	*TM-23*	
Molecular weight of stack gases	*g.gmol-1*	*TM-23*	
Carbon dioxide	*%*	*TM-24*	
Oxygen	*%*	*TM-25*	

4. Proposed Modification of UPS Stack Emission Monitoring Requirements

The proposed modification requested by Origin in regard to UPS stack emission monitoring involves the following changes to the UPS Development Consent (DA-31/2/2004i):

1. Replacing continuous stack NOx monitoring utilising CEMS (NSW EPA Method CEM-2) to NOx monitoring utilising NSW EPA Test Method TM-11 on a six (6) monthly frequency, and
2. Replacing annual stack emission monitoring to a five (5) yearly stack emission monitoring program.

A proposed re-wording of the UPS Development Consent (DA-31/2/2004i) reflecting the proposed stack emission modifications is provided below with alterations highlighted:

Air Quality Monitoring

4.2 *The Applicant shall determine the pollutant concentrations and emission parameters specified in Table 4 below, at each of the turbine stack discharge points (established in strict accordance with the requirements of test method TM-1 as specified in Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (EPA, 2001). Monitoring shall be undertaken during operation of the development, at the frequency indicated in the Table, unless otherwise agreed by the EPA.*

Table 4 - Periodic Pollutant and Parameter Monitoring (Air)

Pollutant/ Parameter	*Units of Measure*	*Method*	*Frequency*
Nitrogen dioxide (NO_2) or nitric oxide (NO), or both (as NO_2)	*mgm-3*	*TM-11*	*6 monthly*
Velocity	*ms-1*	*TM-2*	*Post commissioning and 5 Yearly*
Volumetric flow rate	*m3s-1*	*TM-2*	
Temperature	*oC*	*TM-2*	
Moisture content in stack gases	*%*	*TM-22*	
Dry gas density	*kgm-3*	*TM-23*	
Molecular weight of stack gases	*g.gmol-1*	*TM-23*	
Carbon dioxide	*%*	*TM-24*	
Oxygen	*%*	*TM-25*	

5. Justification for Proposed Modification of UPS Stack Emission Monitoring Program

As outlined in Section 1 above the key reasons for the application to modify the existing Development Approval is based on the consistency of air emission outputs recorded and the on-going costs of maintaining the emission monitoring program. The discussion points in the following sections are provided to support the request to modify the UPS emission monitoring requirements and include discussion on:

1. The consistent NOx emission monitoring results since UPS commissioning to date
2. The stability of gas fired power station operation
3. The low incidence of UPS unit operation with elevated NOx emissions
4. The on-going financial costs of maintaining and servicing a continuous CEMS NOx monitoring system and annual stack emission monitoring program
5. The consistent annual stack emission monitoring results since UPS commissioning to date
6. The on-going financial costs of undertaking the annual stack emission monitoring program.

5.1 Justification for the modification to the UPS NOx Emission Monitoring Requirements

CEMS NOx Monitoring

The UPS has continually monitored NOx emissions for all unit operation from commissioning to date. Table 5-1 provides an annual summary of collected NOx emissions data and also provides a comparison of the annual data against the UPS commissioning data for each unit. For more detailed NOx data please refer to Appendix 1 which provides monthly NOx data for each of the four (4) UPS units from 2009 to date.

As detailed in Table 5-1 and Table 5-2, average NOx emissions from all UPS units has remained consistent over the last five (5) years of monitoring from commissioning with little variation evidenced. The average difference in annual average NOx emissions for the four UPS units from commissioning to date is 1.3 mg/m^3.

Table 5-1 UPS Commissioning & Annual NOx Emissions Data

mg/m3		Commissioning	2009	2010	2011	2012	2013	Summary
Unit 11	Average	20.5	25	24	24	13	24	22
	Minimum		2	2	0	0	2	0
	Maximum		51	51	51	51	377	377
Unit 12	Average	26.0	26	26	29	27	30	27
	Minimum		2	2	0	0	2	0
	Maximum		51	51	102	51	58	102
Unit 13	Average	23.6	23	29	28	23	22	25
	Minimum		2	2	0	6	1	0
	Maximum		49	51	51	51	51	51
Unit 14	Average	28.3	23	28	29	27	30	27
	Minimum		2	2	2	0	3	0
	Maximum		49	51	51	51	51	51

Table 5-2 Average NOx Difference - Commissioning & Average Annual NOx Emissions

Unit	NOx Difference - Commissioning - Average NOx (mg/m^3)
11	+ 1.5
12	+ 1
13	+ 1.4
14	-1.3

5.2 Gas Fired Power Station Stability

The UPS gas fired turbines have an inherently stable operation that has lead to the consistent stack emissions detailed in Table 5-1. Gas fired unit stability is a result of -

- Consistent natural gas fuel quality and gas pressure

- Gas fired units that were tuned during commission to peak performance and those pre-set values are protected within the DCS control system
- The operational fuel/air ratio being set in DCS control system
- The units generally only having two modes of unit operation - 'Diffusion' and 'pre-mix' mode.

The main variables in gas fired unit operation that may affect unit emissions are changes in daily temperature and humidity conditions, mode of operation, megawatt output settings and equipment failure.

5.3 Elevated NOx Emissions Experienced

As detailed in Table 5-1, since commissioning to date there have been three NOx exceedances that have occurred at the UPS during normal operating conditions (refer to Table 5-1 above). The exceedance in 2011 was reported in the UPS Annual Environmental Report to the DOP&I and in the UPS Annual Return for the NSW EPA. The two exceedances in 2013 will be reported in the 2013 Annual Report and Return.

In relation to UPS operational hours to date, operational run time with elevated NOx emissions is a very low portion of UPS normal operating. These three NOx exceedances involved a total of 5.75 hours of run time under elevated NOx conditions. In comparison, the UPS to date has operated for 11,472 hours and involved 2,203 unit starts. NOx exceedances under normal operating conditions in comparison to plant operation are 0.05% of plant operating hours and 0.14% of unit starts.

A summary of the NOx exceedances from 2009 to date is provided below in Table 5-3.

Table 5-3 NOx exceedances from 2009 to date

Date	Operating Hours under Elevated NOx Emissions	Reason
3 May 2011	5 hours	Gas analyser providing incorrect gas quality reading affecting Gas Pilot Valve position
30 April 2013	0.5 hour	Failed unit start - unit did not change over from diffusion to pre-mix mode of operation
21 June 2013	0.25 hour	Unit brought down to less than 50% operational output
Total	**5.75 Hours**	

5.4 Financial Cost of Maintaining and Servicing UPS CEMS.

The financial cost of repairing, maintaining and servicing the UPS NOx monitoring CEMS is detailed in Table 5-3. On average (excluding internal costs) for the last five (5) years since commissioning the UPS CEMS have cost approximately $83,000 per annum to maintain and service. In 2013, internal UPS labour costs were also captured in relation to CEMS maintenance and servicing costs and to date the 2013 cost to maintain the UPS CEMS during this year is $175,159.

Table 5-3 Financial Cost of Maintaining and Servicing UPS CEMS

CEMS Cost Areas	2009 - 2013	2013 to date
Consumables	$92,163	$41,121
External Repair Provider	$49,398	$28,515
External Service Provider	$116,261	$46,273
Internal Maintenance & Serving - hours / Costs	Only 2013 Available	395 hours
		$115,909
Totals	**$ 373,731**	**$175,159**

5.5 Summary of Justification for UPS NOx Emission Monitoring Modification

Based on the on-going costs of operating and maintaining the UPS NOx emission monitoring program against the relatively constant UPS operation and NOx emissions of the UPS as well as the low amount of UPS NOx exceedances, there is a perceived lack of environmental benefit of on-going continuous NOx monitoring utilising a CEMS.

In this regard the proposed Development Consent Modification is requesting a change to the existing continuous NOx emission program using a CEMS to a six (6) monthly program utilising a portable NOx analyser following NSW EPA Test Method TM-11.

5.6 Justification of the request for modification to the UPS Annual Stack Emission Monitoring Requirements

Annual Stack Monitoring

The UPS has undertaken annual stack monitoring by external consultants for all units from commissioning to date in accordance with regulatory requirements. Table 5-4 details the annual stack emission data from UPS commissioning to 2012. (Note - 2013 UPS annual stack emission testing was completed in October 2013 but the results were not available for this report).

Table 5-4 provided below provides a summary of the stack emission monitoring results from all UPS units for across all emission parameters. As can be seen from the data, the emissions have remained consistent over the last four (4) years of testing since UPS commissioning.

For more detailed emission monitoring data please refer to Appendix 1which provides a comparison of annual stack monitoring results for each of the four (4) UPS units from 2009 to 2012.

Table 5-4 UPS Annual Stack Monitoring

UPS Stack Monitoring - Commissioning to 2012																							
Year	Commissioning				2009				2010				2011				2012				Comparison		
Units	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	Average	Min	Max
Moisture	6.8	5.9	4.5	4.2	2.4	2.4	2.5	2.4	2.9	2.8	3.4	2.9	2.6	2.7	2.8	2.9	2.9	2.7	2.3	2.9	3.2	2.3	6.77
Gas Weight	29.2	29.1	29.1	29.1	29	29.1	29	29	29	28.9	28.9	28.9	29	29	29	29	28.9	29	29	28.9	29.0	28.9	29.1
Gas Density					1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.3	1.31	1.31
Temperature (C)	524	533	539	537	518	521	523	522	522	520	524	523	520	522	523	523	521	522	521	526	524.2	518	526
Velocity	46.4	46.1	44.3	45	40	41	43	45	41	41	41	43	42	42	42	43	43	42	42	42	42.7	40	45
Volumetric Discharge Flow Rate	1400	1390	1340	1370	1200	1200	1300	1400	1200	1200	1200	1300	1300	1300	1300	1300	1300	1300	1300	1300	1295.0	1200	1400
Flow Rate (Wet)	447	444	428	441	410	420	440	450	420	420	440	470	430	440	430	440	440	440	430	420	435.0	410	470
Flow Rate (Dry)					400	410	430	440	400	410	430	450	420	420	420	430	430	420	420	410	421.3	400	450
CO2 - Av. Min. Max	3.5	3.4	3.4	3.4	3.6	3.9	3.6	3.6	3.7	3.4	3.5	3.5	3.5	3.8	3.8	3.8	3.5	3.8	3.6	3.6	3.6	3.4	3.9
					3.5	3.8	3.6	3.5	3.6	3.4	3.5	3.5	2.7	3.3	3.8	3.7	3.4	3.3	3.5	3.5	3.5	2.7	3.8
					3.6	3.8	3.6	3.6	3.7	3.4	3.6	3.5	3.6	3.9	3.8	3.9	3.5	3.9	3.6	3.6	3.7	3.4	3.9
Oxygen - Av. Min. Max	14.9	15.1	15	15	15.3	15.2	15	15.1	14.7	15	14.7	14.7	15.5	15	15	14.9	14.8	15	14.9	14.7	15.0	14.7	15.5
					15.2	15.1	14.9	15	14.6	15	14.7	14.7	15.2	14.9	15	14.8	14.7	14.9	14.7	14.6	14.9	14.6	15.2
					15.3	15.2	15	15.2	14.8	15.1	14.8	14.8	16.7	15.7	15.1	15	14.9	15.7	14.9	14.8	15.2	14.8	16.7

5.7 Gas Fired Power Station Stability

The consistent stack emissions detailed in Table 5-4 above show that UPS gas fired turbines have an inherently stable operation. A discussion on UPS gas fired turbines stability is provided in Section 5.2 above.

5.8 Financial Cost of Annual Stack Emission Monitoring.

The financial cost of undertaking UPS annual stack emission testing is detailed in Table 5-5. The largest portion of the cost is the two (2) hour standalone run of each unit to undertake the emission test.

This is a standalone cost as the UPS is a peaking plant in a regional area. To assist in planning the annual stack testing program with an external stack monitoring contractor, the UPS units need to be specifically scheduled to operate in line with the availability of monitoring contractors and equipment. In this regard, the testing generally occurs in off-peak times when demand for electricity would not normally facilitate the running of the UPS.

An example of the financial costs of the monitoring program on the UPS can be demonstrated during the recent October 2013 stack emission testing which was undertaken during an eight (8) hour period of non-peak electricity demand. This stack emission testing program used approximately 16,000 GJ of natural gas and was a nett cost to the UPS of approximately $130,000 (excluding internal man-hour costs).

Table 5-5 2013 Financial Cost of Annual Stack Emission Testing

2013 Annual Stack Testing Cost	**4 Unit Cost**
Gross Stack Testing Costs	
External Stack Testing Consultants	$6,900
Gas usage - 2 hour run / Unit	16,000 GJ
Gas Cost - 2 hour run / Unit	$72,000
Start Costs - Major maintenance fee	$49,600
Total Gross Costs - 2 hour run / Unit	$193,600
Gross Stack Testing Operation Income	
Total estimated non-peak operation gross income - 2 hour run / Unit @ average electricity price - $50/MW Hour	$64,000
Total Nett Cost of Annual Stack Testing	**$129,600**

Summary of Justification for UPS Annual Stack Emission Monitoring Modification

Based on both the amount of natural gas used during annual stack emission monitoring and the on-going costs of this monitoring against the consistent unit operation and emission characteristics of the UPS, there is a perceived lack of environmental benefit from on-going UPS annual stack emission monitoring.

In this regard the proposed Development Consent Modification is requesting a change to the existing annual stack testing program to a five (5) yearly program.

6. Impact on Existing Environment - Air Quality

Based on the collected UPS NOx emission data as presented in Table 5-1 and stack emission data as presented in Table 5-4, stack emission results show that the UPS has been relatively consistent in NOx and stack emission monitoring results since UPS commissioning to date.

As such, since emission monitoring data has remained consistent since commissioning, it should hold that the results and conclusion of the UPS Air Quality Verification Report (SKM 2009) submitted to the DOP&I remain valid. The key report results and conclusion are presented below but generally it stated that UPS emission dispersion modelling predicted that NOx concentrations are well below NSW EPA (formerly DECC) criteria.

In this regard, the proposed Development Consent Modification to modify the UPS NOx and stack emission monitoring requirements is not expected to impact on the existing receiving air quality.

UPS Air Quality Verification Report Extract -

UPS Air Quality Verification Report - Results

The results of the dispersion modelling are shown in Table 6-1. 100% of maximum predicted NOx concentrations were assumed to be NO_2. These concentrations were then added to the maximum background 1 hour (69.8 ug/m^3) and annual (12.3 ug/m^3) NO_2 concentrations. The resulting cumulative concentrations are presented parentheses in Table 6-1.

Table 6-1. Predicted Ground Level Concentrations of NO_2

Modelling	*Maximum 1 hour average (ug/m^3)*	*Annual average (ug/m^3)*
EIS	*46 (115.8)*	*0.4 (12.7)*
1998 meteorological data	*33.3 (103.1)*	*0.1 (12.4)*
2007/08 meteorological data	*29.2 (99.0)*	*0.1 (12.4)*
Criteria	***246***	***62***
N.B. values in parenthesise denote cumulative concentrations		

Maximum predicted concentrations of NO_2 resulting from the power station emissions for both the 1998 & 2007/08 data sets were lower than the predicted concentrations from the EIS for both the 1 hour and annual averaging periods.

All concentrations were, however, well below the DECC criteria.

Contour plots of the predicted concentrations are shown in Figures 6-1 and 6-2.

UPS Air Quality Verification Report - Conclusion

The purpose of this AQIA was to confirm the predictions of the EIS in terms of the ground level concentrations of NO^2 resulting from the operation of the Uranquinty Power Station under normal operating conditions. The NO_2 concentrations were then compared to the predictions made in the EIS and DECC air quality assessment criteria.

The dispersion modelling of the actual power station emissions using site meteorological conditions resulted in predicted ground level concentrations of NO_2 that were lower than those predicted in the EIS for both the short term (1 hour) and long term (annual) averaging periods. Concentrations of NO_2 were predicted to be well below the DECC criteria for power station operating all four turbines at full load using natural gas. As such, no remedial measures for the power station are required.

7. Attachment 1: Summary of UPS NOx Emission Results - 2009 to 2012

CEMS - Nox Records - 2008/09

mg/m3		Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Year End
Unit 11	Average	-	24	-	22	20	31	27	29	24	27	24	18	25
	Minimum	-	16	-	8	2	18	16	6	12	8	16	4	2
	Maximum	-	51	-	45	51	49	45	51	51	49	45	51	51
Unit 12	Average	-	27	22	24	22	29	29	27	31	24	27	22	26
	Minimum	-	4	4	6	4	2	16	16	27	12	18	4	2
	Maximum	-	45	51	45	51	51	47	47	43	51	47	51	51
Unit 13	Average	-	18	20	18	20	24	22	24	-	20	33	24	23
	Minimum	-	4	2	2	2	6	2	2	-	6	8	8	2
	Maximum	-	47	43	33	45	41	37	41	-	35	43	49	49
Unit 14	Average	-	31	24	31	29	43	31	35	33	31	33	22	31
	Minimum	-	24	2	16	22	31	12	20	24	14	6	6	2
	Maximum	-	49	43	37	43	49	45	49	49	45	51	47	51

Note: Blanks - No Operation

UPS Licence NOx Limit - 51mg/m3

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CEMS - Nox Records - 2009/10

mg/m3		Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Year End
Unit 11	Average	20	22	22	29	24	31	31	29	24	20	20	20	24
	Minimum	4	2	4	6	16	12	16	16	16	4	10	6	2
	Maximum	51	47	43	51	51	51	51	51	51	49	45	51	51
Unit 12	Average	18	22	20	27	24	27	31	33	29	27	31	27	26
	Minimum	6	6	2	2	18	10	10	18	16	4	8	6	2
	Maximum	41	47	47	49	47	51	51	51	47	43	51	51	51
Unit 13	Average	31	27	22	29	29	37	37	37	31	27	27	20	29
	Minimum	8	6	2	8	20	8	24	22	27	24	8	27	2
	Maximum	51	49	43	51	49	51	51	51	49	45	49	49	51
Unit 14	Average	27	27	22	29	27	31	33	29	31	27	24	27	28
	Minimum	4	22	4	2	18	12	22	22	8	16	10	2	2
	Maximum	49	37	51	45	47	51	51	51	51	49	43	47	51

Note: Blanks - No Operation

UPS Licence NOx Limit - 51mg/m3

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CEMS - Nox Records - 2011/12

mg/m3		Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Year End
Unit 11	Average	-	22	19	33	-	24	24	31	24	27	20	12	24
	Minimum	-	2	0	22	-	0	8	14	67	12	4	2	0
	Maximum	-	51	51	45	-	49	51	51	51	49	43	45	51
Unit 12	Average	-	22	24	41	-	37	29	33	29	-	27	20	29
	Minimum	-	2	4	35	-	0	10	6	14	-	6	4	0
	Maximum	-	49	51	45	-	102	47	51	51	-	47	51	102
Unit 13	Average	-	22	20	-	-	35	29	33	33	-	29	24	28
	Minimum	-	2	0	-	-	0	10	14	10	-	20	2	0
	Maximum	-	49	51	-	-	51	51	51	51	-	49	51	51
Unit 14	Average	-	23	24	-	-	33	31	33	31	-	35	20	29
	Minimum	-	6	6	-	-	24	6	24	14	-	6	2	2
	Maximum	-	51	49	-	-	47	49	51	49	-	39	51	51

Note: Blanks - No Operation

UPS Licence NOx Limit - 51mg/m3

origin

CEMS - Nox Records - 2011/12

mg/m3		Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Year End
Unit 11	Average	16	14	-	10	8	16	12	12	14	6	18	12	13
	Minimum	8	0	-	0	0	4	2	2	0	0	-	2	0
	Maximum	45	37	-	43	43	49	49	51	51	49	49	43	51
Unit 12	Average	-	24	-	24	-	31	31	29	29	24	27	22	27
	Minimum	-	4	-	12	-	24	24	0	0	0	-	-	0
	Maximum	-	49	-	47	-	45	49	51	51	51	51	41	51
Unit 13	Average	27	20	-	24	24	27	29	27	24	24	14	10	23
	Minimum	29	6	-	6	0	18	8	16	0	12	-	-	6
	Maximum	22	47	-	47	49	49	51	51	49	51	51	41	51
Unit 14	Average	-	24	24	24	31	33	31	29	27	22	24	22	27
	Minimum	-	0	20	6	6	18	8	6	0	0	-	4	0
	Maximum	-	33	41	47	51	49	51	51	51	51	51	41	51

Note: Blanks - No Operation

UPS Licence NOx Limit - 51mg/m3

CEMS - Nox Records - 2012/13

mg/m3		Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Year End
Unit 11	Average	16	12	12	23	49	20	24	26	30	-	-	-	24
	Minimum	10	-	2	10	20	6	2	9	7	-	-	-	2
	Maximum	45	45	41	51	377	50	49	51	51	-	-	-	377
Unit 12	Average	31	22	27	27	35	34	33	30	29	-	-	-	30
	Minimum	22	2	4	7	-	18	19	11	12	-	-	-	2
	Maximum	51	49	47	49	49	51	58	50	50	-	-	-	58
Unit 13	Average	10	12	20	16	20	21	22	24	22	-	-	-	22
	Minimum	-	-	-	1	4	2	2	1	8	-	-	-	1
	Maximum	41	51	45	49	49	36	46	50	49	-	-	-	51
Unit 14	Average	35	20	29	27	31	32	30	32	33	-	-	-	30
	Minimum	27	6	6	3	14	3	16	16	16	-	-	-	3
	Maximum	41	45	49	50	49	51	50	51	51	-	-	-	51

Note: Blanks - No Operation

UPS Licence NOx Limit - 51mg/m3

8. Attachment 2: UPS Annual Stack Emission Results - 2009 to 2012

UPS Annual Stack Emission Results - Unit 1

Unit	1				Comparison			
Year	2009	2010	2011	2012	Average	Min	Max	Difference
Moisture	2.4	2.9	2.6	2.9	2.7	2.4	2.9	0.5
Gas Weight	29	29	29	28.9	29.0	28.9	29	0.1
Gas Density	1.31	1.31	1.31	1.31	1.3	1.31	1.31	0
Temperature (C)	518	522	520	521	520.3	518	522	4
Velocity	40	41	42	43	41.5	40	43	3
Volumetric Discharge Flow Rate	1200	1200	1300	1300	1250	1200	1300	100
Flow Rate (Wet)	410	420	430	440	425	410	440	30
Flow Rate (Dry)	400	400	420	430	412.5	400	430	30
CO2 - Av.	3.6	3.7	3.5	3.5	3.6	3.5	3.7	0.2
Min.	3.5	3.6	2.7	3.4	3.3	2.7	3.6	0.9
Max	3.6	3.7	3.6	3.5	3.6	3.5	3.7	0.2
Oxygen - Av.	15.3	14.7	15.5	14.8	15.1	14.7	15.5	0.8
Min.	15.2	14.6	15.2	14.7	14.9	14.6	15.2	0.6
Max	15.3	14.8	16.7	14.9	15.4	14.8	16.7	1.9

UPS Annual Stack Emission Results - Unit 2

Unit	2				Comparison			
Year	2009	2010	2011	2012	Average	Min	Max	Difference
Moisture	2.4	2.8	2.7	2.7	2.7	2.4	2.8	0.4
Gas Weight	29.1	28.9	29	29	29.0	28.9	29.1	0.2
Gas Density	1.31	1.31	1.31	1.31	1.3	1.31	1.31	0
Temperature (C)	521	520	522	522	521.3	520	522	2
Velocity	41	41	42	42	41.5	41	42	1
Volumetric Discharge Flow Rate	1200	1200	1300	1300	1250	1200	1300	100
Flow Rate (Wet)	420	420	440	440	430.0	420	440	20
Flow Rate (Dry)	410	410	420	420	415.0	410	420	10
CO2 - Av.	3.9	3.4	3.8	3.8	3.7	3.4	3.9	0.5
Min.	3.8	3.4	3.3	3.3	3.5	3.3	3.8	0.5
Max	3.8	3.4	3.9	3.9	3.8	3.4	3.9	0.5
Oxygen - Av.	15.2	15	15	15	15.1	15	15.2	0.2
Min.	15.1	15	14.9	14.9	15.0	14.9	15.1	0.2
Max	15.2	15.1	15.7	15.7	15.4	15.1	15.7	0.6

UPS Annual Stack Emission Results - Unit 3

Unit	3				Comparison			
Year	2009	2010	2011	2012	Average	Min	Max	Difference
Moisture	2.5	3.4	2.8	2.3	2.8	2.3	3.4	1.1
Gas Weight	29	28.9	29	29	29.0	28.9	29	0.1
Gas Density	1.31	1.31	1.31	1.31	1.3	1.31	1.31	0
Temperature (C)	523	524	523	521	522.8	521	524	3
Velocity	43	41	42	42	42	41	43	2
Volumetric Discharge Flow Rate	1300	1200	1300	1300	1275	1200	1300	100
Flow Rate (Wet)	440	440	430	430	435	430	440	10
Flow Rate (Dry)	430	430	420	420	425	420	430	10
CO2 - Av.	3.6	3.5	3.8	3.6	3.6	3.5	3.8	0.3
Min.	3.6	3.5	3.8	3.5	3.6	3.5	3.8	0.3
Max	3.6	3.6	3.8	3.6	3.7	3.6	3.8	0.2
Oxygen - Av.	15	14.7	15	14.9	14.9	14.7	15	0.3
Min.	14.9	14.7	15	14.7	14.8	14.7	15	0.3
Max	15	14.8	15.1	14.9	15.0	14.8	15.1	0.3

UPS Annual Stack Emission Results - Unit 4

Unit	4				Comparison			
Year	2009	2010	2011	2012	Average	Min	Max	Difference
Moisture	2.4	2.9	2.9	2.9	2.8	2.4	2.9	0.5
Gas Weight	29	28.9	29	28.9	29.0	28.9	29	0.1
Gas Density	1.31	1.31	1.31	1.31	1.3	1.31	1.31	0
Temperature (C)	522	523	523	526	523.5	522	526	4
Velocity	45	43	43	42	43.3	42	45	3
Volumetric Discharge Flow Rate	1400	1300	1300	1300	1325	1300	1400	100
Flow Rate (Wet)	450	470	440	420	445	420	470	50
Flow Rate (Dry)	440	450	430	410	432.5	410	450	40
CO2 - Av.	3.6	3.5	3.8	3.6	3.6	3.5	3.8	0.3
Min.	3.5	3.5	3.7	3.5	3.6	3.5	3.7	0.2
Max	3.6	3.5	3.9	3.6	3.7	3.5	3.9	0.4
Oxygen - Av.	15.1	14.7	14.9	14.7	14.9	14.7	15.1	0.4
Min.	15	14.7	14.8	14.6	14.8	14.6	15	0.4
Max	15.2	14.8	15	14.8	15.0	14.8	15.2	0.4