Report Number R004119

Emission Testing Report
Supagas, Ingleburn
Document Information

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Report Number: R004119
Date of Issue: 7 March 2017
Attention: Reza Pourdarvish
Address: 5 Benson Road
          Ingleburn NSW 2565
Testing Laboratory: Ektimo (ETC) ABN 74 474 273 172

Report Status

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<th>Prepared By</th>
<th>Reviewed By (1)</th>
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<td>7/03/2017</td>
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Amendment Record

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Report Authorisation

Steven Cooper
Client Manager

NATA Accredited Laboratory
No. 14601

Accredited for compliance with ISO/IEC 17025. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.
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1 EXECUTIVE SUMMARY

Ektimo was engaged by Supagas to perform annual emission testing pursuant to their Environment Protection Licence 20022.

Monitoring was performed as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Test Date</th>
<th>Test Parameters*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ Production Plant &amp; Absorber Tower Stack</td>
<td>3 March 2017</td>
<td>Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen</td>
</tr>
</tbody>
</table>

* Flow rate, velocity, temperature and moisture were determined unless otherwise stated

The sampling methodologies chosen by Ektimo are those recommended by the NSW Office of Environment and Heritage (as specified in the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007).

All results are reported on a dry basis at STP. Unless otherwise indicated, the methods cited in this report have been performed without deviation.

Plant operating conditions have been noted in the report.

2 LICENCE COMPARISON

The following licence comparison table shows that all analytes highlighted in green are below the licence limit set by the NSW EPA as per licence 20022 (last amended on 10/07/14).

<table>
<thead>
<tr>
<th>EPA No.</th>
<th>Location Description</th>
<th>Pollutant</th>
<th>Units</th>
<th>Licence limit</th>
<th>Detected values 03/03/2017</th>
<th>Detected values (corrected to 3% O₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CO₂ Production Plant &amp; Absorber Tower Stack</td>
<td>Nitrogen Oxides</td>
<td>mg/m³</td>
<td>230</td>
<td>100</td>
<td>97</td>
</tr>
</tbody>
</table>
3 RESULTS

3.1 CO₂ Production Plant Absorber Tower Stack

<table>
<thead>
<tr>
<th>Date</th>
<th>Client</th>
<th>Report</th>
<th>Stack ID</th>
<th>Location</th>
<th>Supagas, Ingleburn</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/03/2017</td>
<td>Ektimo Staff</td>
<td>R004119</td>
<td>CO₂ Production Plant Absorber Tower Stack</td>
<td>NSW</td>
<td></td>
</tr>
<tr>
<td>Licence No.</td>
<td></td>
<td>20022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sampling Plane Details

- Sampling plane dimensions: 1140 mm
- Sampling plane area: 1.02 m²
- Access & height of ports: Elevated work platform 10 m
- Duct orientation & shape: Vertical, Circular
- Downstream disturbance: Exit 0.3 D
- Upstream disturbance: Junction 0 D
- No. traverses & points sampled: 2 20
- Sample plane compliance to AS4323.1: Non-compliant

Comments

Sampling was conducted via a ½ inch stainless steel duct secured permanently at the sampling plane. Flow rate, velocity, temperature and moisture measurements were taken from the exit of this discharge point as no removable ports at the sample plane are evident.

The sampling plane is deemed to be non-ideal or non-compliant due to the following reasons:

- The gas velocity at some or all sampling points is less than 3 m/s
- The downstream disturbance is <1D from the sampling plane
- The upstream disturbance is <2D from the sampling plane

Stack Parameters

- Moisture content, %v/v: 12
- Gas molecular weight, g/g mole: 27.0 (wet), 28.3 (dry)
- Gas density at STP, kg/m³: 1.21 (wet), 1.26 (dry)
- % Oxygen correction & Factor: 3 %, 0.93

Gas Flow Parameters

- Flow measurement time(s) (hh:mm): 1045 & 1205
- Temperature, K: 324
- Velocity at sampling plane, m/s: <2
- Volumetric flow rate, discharge, m³/s: <2
- Volumetric flow rate (wet STP), m³/s: <1
- Volumetric flow rate (dry STP), m³/s: <1
- Mass flow rate (wet basis), kg/hour: 6000
- Velocity difference, %: <1

Gas Analyser Results

<table>
<thead>
<tr>
<th>Sampling time</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ Production Plant Absorber Tower Stack</td>
<td>104-1203</td>
<td>104-1203</td>
<td>104-1203</td>
</tr>
<tr>
<td>Concentration</td>
<td>% O₂</td>
<td>g/min</td>
<td>% O₂</td>
</tr>
<tr>
<td>Nitrogen oxides (as NO₃)</td>
<td>100</td>
<td>97</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>70</td>
<td>66</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>0.4</td>
<td>&lt;0.3</td>
<td>0.7</td>
</tr>
</tbody>
</table>
4 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See Supagas’s records for complete process conditions.

5 TEST METHODS

All sampling and analysis was performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sampling Method</th>
<th>Analysis Method</th>
<th>Method Detection Limit</th>
<th>Uncertainty*</th>
<th>NATA Accredited</th>
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<tbody>
<tr>
<td>Sample plane criteria</td>
<td>NSW TM-1</td>
<td>NA</td>
<td>NA</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Moisture content</td>
<td>NSW TM-22</td>
<td>NSW TM-22</td>
<td>1.0%</td>
<td>19%</td>
<td>✓</td>
</tr>
<tr>
<td>Temperature</td>
<td>NSW TM-2</td>
<td>NA</td>
<td>0°C</td>
<td>2%</td>
<td>✓</td>
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<tr>
<td>Flow rate</td>
<td>NSW TM-2</td>
<td>NA</td>
<td>Location specific</td>
<td>8%</td>
<td>✓</td>
</tr>
<tr>
<td>Velocity</td>
<td>NSW TM-2</td>
<td>NA</td>
<td>2m/s</td>
<td>7%</td>
<td>✓</td>
</tr>
<tr>
<td>Nitrogen oxides</td>
<td>USEPA 7E</td>
<td>USEPA 7E</td>
<td>4mg/m³</td>
<td>12%</td>
<td>✓</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>USEPA 10</td>
<td>USEPA 10</td>
<td>3 mg/m³</td>
<td>12%</td>
<td>✓</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>USEPA 3A</td>
<td>USEPA 3A</td>
<td>0.1%</td>
<td>13%</td>
<td>✓</td>
</tr>
<tr>
<td>Oxygen</td>
<td>USEPA 3A</td>
<td>USEPA 3A</td>
<td>0.1%</td>
<td>13%</td>
<td>✓</td>
</tr>
</tbody>
</table>

* Uncertainty values cited in this table are calculated at the 95% confidence level (coverage factor = 2)

6 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

Ektimo (EML) and Ektimo (ETC) are accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA’s website www.nata.com.au.

Ektimo (EML) and Ektimo (ETC) are accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025. – General Requirements for the Competence of Testing and Calibration Laboratories. ISO/IEC 17025 requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Compliance Manager.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised world-wide.

A formal Quality Control program is in place at Ektimo to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.
7 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

**STP**  
Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.

**Disturbance**  
A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.

**VOC**  
Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.

**TOC**  
The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.

**OU**  
The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).

**PM$_{2.5}$**  
Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).

**PM$_{10}$**  
Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).

**BSP**  
British standard pipe

**NT**  
Not tested or results not required

**NA**  
Not applicable

**D$_{50}$**  
‘Cut size’ of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D$_{50}$ method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D$_{50}$ of that cyclone and less than the D$_{50}$ of the preceding cyclone.

**D**  
Duct diameter or equivalent duct diameter for rectangular ducts

<  
Less than

>  
Greater than

≥  
Greater than or equal to

~  
Approximately

**CEM**  
Continuous Emission Monitoring

**CEMS**  
Continuous Emission Monitoring System

**DER**  
WA Department of Environment & Regulation

**DECC**  
Department of Environment & Climate Change (NSW)

**EPA**  
Environment Protection Authority

**FTIR**  
Fourier Transform Infra Red

**NATA**  
National Association of Testing Authorities

**RATA**  
Relative Accuracy Test Audit

**AS**  
Australian Standard

**USEPA**  
United States Environmental Protection Agency

**Vic EPA**  
Victorinan Environment Protection Authority

**ISC**  
Intersociety committee, Methods of Air Sampling and Analysis

**ISO**  
International Organisation for Standardisation

**APHA**  
American public health association, Standard Methods for the Examination of Water and Waste Water

**CARB**  
Californian Air Resources Board

**TM**  
Test Method

**OM**  
Other approved method

**CTM**  
Conditional test method

**VDI**  
Verein Deutscher Ingenieure (Association of German Engineers)

**NIOSH**  
National Institute of Occupational Safety and Health

**XRD**  
X-ray Diffractometry