

## Report for Periodic Monitoring of Emissions to Atmosphere

Part 1: **Executive Summary**

Permit Number: **BR9383 & Variation NP3835SW**

Operator: **Knauf Insulation Limited**

Installation: **Queensferry**

Emission Points: **C, F, G, Downwind Boundary & Upwind Boundary**

Monitoring Dates: **5<sup>th</sup> – 7<sup>th</sup> October and 2<sup>nd</sup> December 2015**



Contract Reference: FTBS 35216

Operator: Knauf Insulation Limited

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Queensferry  
Flintshire  
CH5 2DB

Monitoring Organisation: RPS Consultants

Address: Noble House, Capital Drive, Linford  
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Report Date: 25<sup>th</sup> April 2016

Report Approved By: Carl Redgrove

Position: Senior Consultant

MCERTS Registration Number: MM 03 173

MCERTS Certification Level: 2

Technical Endorsements: TE1, TE2, TE3, TE4

Signature:

A handwritten signature in black ink, appearing to read 'Carl Redgrove', enclosed within a rectangular box.

RPS Consultants has produced this report within the term of the contract with the client and taking account of the resources devoted to it by agreement with the client.

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## Monitoring Objectives

At the request of Claire Hensley of Knauf Insulation Limited, RPS Consultants conducted stack emission monitoring at the Queensferry site in October 2015.

The monitoring programme at this installation was carried out to provide data on emissions to atmosphere for comparison with the limits specified in the air emission criteria for this site.

The following tables detail the parameters requested for monitoring at each emission point and the actual monitoring conducted.

**Table 1.1**

| Parameters Requested to be Monitored | Emission Point         |
|--------------------------------------|------------------------|
|                                      | C                      |
|                                      | Mainline Forming Stack |
| Volatile Organic Compounds           | ✓                      |
| Total Particulate Matter             | ✓                      |
| Ammonia                              | ✓                      |
| Formaldehyde                         | ✓                      |
| Amines                               | ✓                      |
| Phenol                               | ✓                      |
| <b>Specific Requirements</b>         | Normal                 |

Notes:

✓ Represents pollutants sampled

**Table 1.2**

| Parameters Requested to be Monitored | Emission Point         |
|--------------------------------------|------------------------|
|                                      | F                      |
|                                      | Mainline Oven Oxidiser |
| Phenols                              | ✓                      |
| Total Particulate Matter             | ✓                      |
| Ammonia                              | ✓                      |
| Formaldehyde                         | ✓                      |
| Amines                               | ✓                      |
| Volatile Organic Compounds           | ✓                      |
| Nitrogen Dioxide                     | ✓                      |
| Nitric Oxide                         | ✓                      |
| Nitrous Oxide                        | ✓                      |
| <b>Specific Requirements</b>         | Normal                 |

Notes:

✓ Represents pollutants sampled

**Table 1.3**

| Parameters Requested to be Monitored | Emission Point        |
|--------------------------------------|-----------------------|
|                                      | G                     |
|                                      | Mainline Cooling Zone |
| Total Particulate Matter             | ✓                     |
| Ammonia                              | ✓                     |
| Formaldehyde                         | ✓                     |
| Phenols                              | ✓                     |
| Amines                               | ✓                     |
| Volatile Organic Compounds           | ✓                     |
| <b>Specific Requirements</b>         | Normal                |

Notes:

✓ Represents pollutants sampled

**Table 1.4**

| Parameters Requested to be Monitored | Emission Point    |
|--------------------------------------|-------------------|
|                                      | Downwind Boundary |
|                                      |                   |
| Ammonia                              | ✓                 |
| Formaldehyde                         | ✓                 |
| Phenol                               | ✓                 |
| <b>Specific Requirements</b>         | Normal            |

Notes:

✓ Represents pollutants sampled

**Table 1.5**

| Parameters Requested to be Monitored | Emission Point  |
|--------------------------------------|-----------------|
|                                      | Upwind Boundary |
|                                      |                 |
| Ammonia                              | ✓               |
| Formaldehyde                         | ✓               |
| Phenol                               | ✓               |
| <b>Specific Requirements</b>         | Normal          |

Notes:

✓ Represents pollutants sampled

## Monitoring Results

**Table 2.1 Monitoring results for emission point C, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Substance Monitored | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|---------------------|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Amines (Run 1)      | 20                   | < 0.24                     | mg/m <sup>3</sup> | +/- 0.050                               | 273K, 101.3kPa, Wet  | 5/10/2015     | 15:55 – 16:55  | BS EN13649                  | MCERTS               | Normal           |
| Amines (Run 2)      | 20                   | < 0.27                     | mg/m <sup>3</sup> | +/- 0.057                               | 273K, 101.3kPa, Wet  | 6/10/2015     | 09:05 – 10:05  | BS EN13649                  | MCERTS               | Normal           |
| Amines (Run 3)      | 20                   | < 0.19                     | mg/m <sup>3</sup> | +/- 0.040                               | 273K, 101.3kPa, Wet  | 6/10/2015     | 10:07 – 11:47  | BS EN13649                  | MCERTS               | Normal           |
| Ammonia (Run 1)     | 50                   | 46                         | mg/m <sup>3</sup> | +/- 3.9                                 | 273K, 101.3kPa, Wet  | 5/10/2015     | 14:37 – 15:55  | BS EN 14791                 | MCERTS               | Normal           |
| Ammonia (Run 2)     | 50                   | <b>50</b>                  | mg/m <sup>3</sup> | +/- 4.3                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:10 – 13:15  | BS EN 14791                 | MCERTS               | Normal           |
| Ammonia (Run 3)     | 50                   | 36                         | mg/m <sup>3</sup> | +/- 3.1                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 15:24 – 16:29  | BS EN 14791                 | MCERTS               | Normal           |

*\* Result in bold type is equal to the Emission Limit Value*

**Table 2.1 (Cont..) Monitoring results for emission point C, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Substance Monitored              | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|----------------------------------|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Phenol (Run 1)                   | 10                   | 5.1                        | mg/m <sup>3</sup> | +/- 1.1                                 | 273K, 101.3kPa, Wet  | 6/11/2015     | 13:29 – 14:29  | BS EN 13649:2002            | MCERTS               | Normal           |
| Phenol (Run 2)                   | 10                   | 2.2                        | mg/m <sup>3</sup> | +/- 0.47                                | 273K, 101.3kPa, Wet  | 7/11/2015     | 09:50 – 10:50  | BS EN 13649:2002            | MCERTS               | Normal           |
| Phenol (Run 3)                   | 10                   | 2.3                        | mg/m <sup>3</sup> | +/- 0.49                                | 273K, 101.3kPa, Wet  | 7/11/2015     | 11:00 – 12:00  | BS EN 13649:2002            | MCERTS               | Normal           |
| Total Particulate Matter (Run 1) | 50                   | <b>79</b>                  | mg/m <sup>3</sup> | +/- 2.5                                 | 273K, 101.3kPa, Wet  | 5/10/2015     | 14:37 – 15:55  | BS EN 13284-1:2002          | MCERTS               | Normal           |
| Total Particulate Matter (Run 2) | 50                   | <b>122</b>                 | mg/m <sup>3</sup> | +/- 3.8                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:10 – 13:15  | BS EN 13284-1:2002          | MCERTS               | Normal           |
| Total Particulate Matter (Run 3) | 50                   | 19                         | mg/m <sup>3</sup> | +/- 0.69                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 15:24 – 16:29  | BS EN 13284-1:2002          | MCERTS               | Normal           |

**\* Results in bold type have exceeded the Emission Limit Value**



**Table 2.1 (Cont..) Monitoring results for emission point C, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Substance Monitored                            | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|--|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Formaldehyde (Run 1)                           | 10                   | 0.79                       | mg/m <sup>3</sup> | +/- 0.06                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 09:45 – 10:50  | USEPA M316                  | MCERTS               | Normal           |
| Formaldehyde (Run 2)                           | 10                   | 0.040                      | mg/m <sup>3</sup> | +/- 0.0032                              | 273K, 101.3kPa, Wet  | 7/10/2015     | 10:55 - 12:00  | USEPA M316                  | MCERTS               | Normal           |
| Formaldehyde (Run 3)                           | 10                   | 2.0                        | mg/m <sup>3</sup> | +/- 0.16                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 12:00 – 13:04  | USEPA M316                  | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 1) | 50                   | 28                         | mg/m <sup>3</sup> | +/- 1.1                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:30 – 13:30  | BS EN 12619                 | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 2) | 50                   | 22                         | mg/m <sup>3</sup> | +/- 0.87                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 13:30 – 14:30  | BS EN 12619                 | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 3) | 50                   | 17                         | mg/m <sup>3</sup> | +/- 0.68                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 14:30 – 15:30  | BS EN 12619                 | MCERTS               | Normal           |

**Table 2.2 Monitoring results for emission point F, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October & 2<sup>nd</sup> December 2015**

| Substance Monitored | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|---------------------|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Amines (Run 1)      | 5                    | < 1.2                      | mg/m <sup>3</sup> | +/- 0.25                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 11:58 – 12:58  | BS EN 13649                 | MCERTS               | Normal           |
| Amines (Run 2)      | 5                    | < 0.41                     | mg/m <sup>3</sup> | +/- 0.085                               | 273K, 101.3kPa, Wet  | 6/10/2015     | 13:45 – 14:45  | BS EN 13649                 | MCERTS               | Normal           |
| Amines (Run 3)      | 5                    | < 1.3                      | mg/m <sup>3</sup> | +/- 0.26                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 15:18 – 16:50  | BS EN 13649                 | MCERTS               | Normal           |
| Ammonia (Run 1)     | 10                   | 1.3                        | mg/m <sup>3</sup> | +/- 0.11                                | 273K, 101.3kPa, Wet  | 2/12/2015     | 13:55 – 14:55  | BS EN 14791                 | MCERTS               | Normal           |
| Ammonia (Run 2)     | 10                   | 1.2                        | mg/m <sup>3</sup> | +/- 0.10                                | 273K, 101.3kPa, Wet  | 2/12/2015     | 15:02 – 16:02  | BS EN 14791                 | MCERTS               | Normal           |
| Ammonia (Run 3)     | 10                   | 1.3                        | mg/m <sup>3</sup> | +/- 0.12                                | 273K, 101.3kPa, Wet  | 2/12/2015     | 16:04 – 17:04  | BS EN 14791                 | MCERTS               | Normal           |
| Phenols (Run 1)     | 5                    | < 0.54                     | mg/m <sup>3</sup> | +/- 0.11                                | 273K, 101.3kPa, Wet  | 5/10/2015     | 15:09 – 16:09  | BS EN 13649:2002            | MCERTS               | Normal           |
| Phenols (Run 2)     | 5                    | < 0.56                     | mg/m <sup>3</sup> | +/- 0.12                                | 273K, 101.3kPa, Wet  | 5/10/2015     | 16:15 – 17:15  | BS EN 13649:2002            | MCERTS               | Normal           |
| Phenols (Run 3)     | 5                    | < 0.73                     | mg/m <sup>3</sup> | +/- 0.15                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 09:22 – 10:22  | BS EN 13649:2002            | MCERTS               | Normal           |

**Table 2.2 (Cont..) Monitoring results for emission point F, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Substance Monitored              | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|----------------------------------|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Formaldehyde (Run 1)             | 5                    | 0.058                      | mg/m <sup>3</sup> | +/- 0.0045                              | 273K, 101.3kPa, Wet  | 7/10/2015     | 11:18 – 12:18  | USEPA M316                  | MCERTS               | Normal           |
| Formaldehyde (Run 2)             | 5                    | 0.035                      | mg/m <sup>3</sup> | +/- 0.0027                              | 273K, 101.3kPa, Wet  | 7/10/2015     | 12:46 – 13:46  | USEPA M316                  | MCERTS               | Normal           |
| Formaldehyde (Run 3)             | 5                    | 0.033                      | mg/m <sup>3</sup> | +/- 0.0025                              | 273K, 101.3kPa, Wet  | 7/10/2015     | 13:55 – 14:55  | USEPA M316                  | MCERTS               | Normal           |
| Total Particulate Matter (Run 1) | 10                   | 0.57                       | mg/m <sup>3</sup> | +/- 0.30                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 14:35 – 16:10  | BS EN 13284-1:2002          | MCERTS               | Normal           |
| Total Particulate Matter (Run 2) | 10                   | 0.59                       | mg/m <sup>3</sup> | +/- 0.31                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 16:21 – 17:21  | BS EN 13284-1:2002          | MCERTS               | Normal           |
| Total Particulate Matter (Run 3) | 10                   | 0.45                       | mg/m <sup>3</sup> | +/- 0.23                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 09:14 – 10:14  | BS EN 13284-1:2002          | MCERTS               | Normal           |

**Table 2.2 (Cont..) Monitoring results for emission point F, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Substance Monitored                            | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|--|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Volatile Organic Compounds (as Carbon) (Run 1) | 10                   | 4.5                        | mg/m <sup>3</sup> | +/- 0.14                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 10:30 – 11:30  | BS EN 12619                 | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 2) | 10                   | 4.9                        | mg/m <sup>3</sup> | +/- 0.15                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 11:30 – 12:30  | BS EN 12619                 | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 3) | 10                   | 5.5                        | mg/m <sup>3</sup> | +/- 0.17                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 12:30 – 13:30  | BS EN 12619                 | MCERTS               | Normal           |
| Nitric Oxide - NO (Run 1)                      | No Limit             | 116                        | mg/m <sup>3</sup> | +/- 5.8                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 11:47 – 12:47  | BS EN 14792                 | MCERTS               | Normal           |
| Nitric Oxide - NO (Run 2)                      | No Limit             | 109                        | mg/m <sup>3</sup> | +/- 5.7                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:47 – 13:47  | BS EN 14792                 | MCERTS               | Normal           |
| Nitric Oxide - NO (Run 3)                      | No Limit             | 100                        | mg/m <sup>3</sup> | +/- 5.5                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 13:47 – 14:47  | BS EN 14792                 | MCERTS               | Normal           |

**Table 2.2 (Cont..) Monitoring results for emission point F, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Substance Monitored                           | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|---|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Nitrogen Dioxide – NO <sub>2</sub><br>(Run 1) | No Limit             | 14                         | mg/m <sup>3</sup> | +/- 0.70                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 11:47 – 12:47  | TGN M22                     | MCERTS               | Normal           |
| Nitrogen Dioxide – NO <sub>2</sub><br>(Run 2) | No Limit             | 20                         | mg/m <sup>3</sup> | +/- 1.0                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:47 – 13:47  | TGN M22                     | MCERTS               | Normal           |
| Nitrogen Dioxide – NO <sub>2</sub><br>(Run 3) | No Limit             | 22                         | mg/m <sup>3</sup> | +/- 1.1                                 | 273K, 101.3kPa, Wet  | 6/10/2015     | 13:47 – 14:47  | TGN M22                     | MCERTS               | Normal           |
| Nitrous Oxide - N <sub>2</sub> O<br>(Run 1)   | No Limit             | 286                        | mg/m <sup>3</sup> | +/- 17                                  | 273K, 101.3kPa, Wet  | 6/10/2015     | 11:47 – 12:47  | TGN M22                     | None                 | Normal           |
| Nitrous Oxide - N <sub>2</sub> O<br>(Run 2)   | No Limit             | 318                        | mg/m <sup>3</sup> | +/- 19                                  | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:47 – 13:47  | TGN M22                     | None                 | Normal           |
| Nitrous Oxide - N <sub>2</sub> O<br>(Run 3)   | No Limit             | 368                        | mg/m <sup>3</sup> | +/- 22                                  | 273K, 101.3kPa, Wet  | 6/10/2015     | 13:47 – 14:47  | TGN M22                     | None                 | Normal           |

**Table 2.3 Monitoring results for emission point G, Carried out on 5<sup>th</sup> to 7<sup>th</sup> October 2015.**

| Substance Monitored                            | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|--|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Ammonia (Run 1)                                | 10                   | 8.3                        | mg/m <sup>3</sup> | +/- 0.75                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 09:48 – 10:48  | BS EN 14791                 | MCERTS               | Normal           |
| Ammonia (Run 2)                                | 10                   | <b>15</b>                  | mg/m <sup>3</sup> | +/- 1.4                                 | 273K, 101.3kPa, Wet  | 7/10/2015     | 11:14 – 12:14  | BS EN 14791                 | MCERTS               | Normal           |
| Ammonia (Run 3)                                | 10                   | <b>22</b>                  | mg/m <sup>3</sup> | +/- 2.0                                 | 273K, 101.3kPa, Wet  | 7/10/2015     | 12:34 – 13:34  | BS EN 14791                 | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 1) | 10                   | 0.34                       | mg/m <sup>3</sup> | +/- 0.010                               | 273K, 101.3kPa, Wet  | 6/10/2015     | 11:55 – 12:55  | BS EN 12619                 | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 2) | 10                   | 0.85                       | mg/m <sup>3</sup> | +/- 0.026                               | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:55 – 13:55  | BS EN 12619                 | MCERTS               | Normal           |
| Volatile Organic Compounds (as Carbon) (Run 3) | 10                   | 0.46                       | mg/m <sup>3</sup> | +/- 0.014                               | 273K, 101.3kPa, Wet  | 6/10/2015     | 13:55 – 14:55  | BS EN 12619                 | MCERTS               | Normal           |

\* Figures in bold have exceeded the ELV

**Table 2.3 (Cont..) Monitoring results for emission point G, Carried out on 5<sup>th</sup> to 7<sup>th</sup> October 2015.**

| Substance Monitored              | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|----------------------------------|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Formaldehyde (Run 1)             | 5                    | 4.6                        | mg/m <sup>3</sup> | +/- 0.36                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 09:48 – 10:48  | USEPA M316                  | MCERTS               | Normal           |
| Formaldehyde (Run 2)             | 5                    | 4.6                        | mg/m <sup>3</sup> | +/- 0.36                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 11:14 – 12:14  | USEPA M316                  | MCERTS               | Normal           |
| Formaldehyde (Run 3)             | 5                    | 4.6                        | mg/m <sup>3</sup> | +/- 0.36                                | 273K, 101.3kPa, Wet  | 7/10/2015     | 12:34 – 13:34  | USEPA M316                  | MCERTS               | Normal           |
| Total Particulate Matter (Run 1) | 10                   | <b>12</b>                  | mg/m <sup>3</sup> | +/- 0.41                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 09:10 – 10:10  | BS EN 13284-1:2002          | MCERTS               | Normal           |
| Total Particulate Matter (Run 2) | 10                   | <b>17</b>                  | mg/m <sup>3</sup> | +/- 0.57                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 11:53 – 12:53  | BS EN 13284-1:2002          | MCERTS               | Normal           |
| Total Particulate Matter (Run 3) | 10                   | <b>17</b>                  | mg/m <sup>3</sup> | +/- 0.56                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 13:08 – 14:08  | BS EN 13284-1:2002          | MCERTS               | Normal           |

*\* Figures in bold have exceeded the ELV*

**Table 2.3 (Cont..) Monitoring results for emission point G, Carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015.**

| Substance Monitored | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|---------------------|----------------------|----------------------------|-------------------|---|----------------------|---------------|----------------|-----------------------------|----------------------|------------------|
| Amines (Run 1)      | 5                    | < 0.17                     | mg/m <sup>3</sup> | +/- 0.035                               | 273K, 101.3kPa, Wet  | 5/10/2015     | 13:20 – 14:20  | BS EN 13649:2002            | MCERTS               | Normal           |
| Amines (Run 2)      | 5                    | < 0.15                     | mg/m <sup>3</sup> | +/- 0.030                               | 273K, 101.3kPa, Wet  | 5/10/2015     | 14:24 – 15:24  | BS EN 13649:2002            | MCERTS               | Normal           |
| Amines (Run 3)      | 5                    | < 0.14                     | mg/m <sup>3</sup> | +/- 0.029                               | 273K, 101.3kPa, Wet  | 5/10/2015     | 15:25 – 16:25  | BS EN 13649:2002            | MCERTS               | Normal           |
| Phenols (Run 1)     | 5                    | < 0.65                     | mg/m <sup>3</sup> | +/- 0.13                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 08:52 – 09:52  | BS EN 13649:2002            | MCERTS               | Normal           |
| Phenols (Run 2)     | 5                    | < 0.73                     | mg/m <sup>3</sup> | +/- 0.15                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 09:53 – 12:28  | BS EN 13649:2002            | MCERTS               | Normal           |
| Phenols (Run 3)     | 5                    | <0.67                      | mg/m <sup>3</sup> | +/- 0.14                                | 273K, 101.3kPa, Wet  | 6/10/2015     | 12:29 – 13:29  | BS EN 13649:2002            | MCERTS               | Normal           |



**Table 2.4 Monitoring results for emission point Downwind Boundary, Carried out on 7<sup>th</sup> October 2015**

| Substance Monitored | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions<br>273K, 101.3kPa | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|---------------------|----------------------|----------------------------|-------------------|---|--|---------------|----------------|-----------------------------|----------------------|------------------|
| Ammonia             | No Limit             | <0.0022                    | mg/m <sup>3</sup> | Not Calculated                          | 273K, 101.3kPa, Wet                    | 02/12/2015    | 10:40 – 14:40  | Based on MDHS Methods       | None                 | Normal           |
| Formaldehyde        | No Limit             | 0.029                      | mg/m <sup>3</sup> | Not Calculated                          | 273K, 101.3kPa, Wet                    | 07/10/2015    | 09:55 – 13:55  | Based on MDHS Methods       | None                 | Normal           |
| Phenol              | No Limit             | <0.027                     | mg/m <sup>3</sup> | Not Calculated                          | 273K, 101.3kPa, Wet                    | 07/10/2015    | 09:55 – 13:55  | Based on MDHS Methods       | None                 | Normal           |

**Table 2.5 Monitoring results for emission point Upwind Boundary, Carried out on 7<sup>th</sup> October 2015**

| Substance Monitored | Emission Limit Value | Periodic Monitoring Result | Units             | Uncertainty<br>(Expressed expanded k=2) | Reference Conditions<br>273K, 101.3kPa | Sampling Date | Sampling Times | Monitoring Reference Method | Accreditation Status | Operating Status |
|---------------------|----------------------|----------------------------|-------------------|---|--|---------------|----------------|-----------------------------|----------------------|------------------|
| Ammonia             | No Limit             | <0.0022                    | mg/m <sup>3</sup> | Not Calculated                          | 273K, 101.3kPa, Wet                    | 02/12/2015    | 10:40 – 14:40  | Based on MDHS Methods       | None                 | Normal           |
| Formaldehyde        | No Limit             | 0.0011                     | mg/m <sup>3</sup> | Not Calculated                          | 273K, 101.3kPa, Wet                    | 07/10/2015    | 09:55 – 13:55  | Based on MDHS Methods       | None                 | Normal           |
| Phenol              | No Limit             | <0.027                     | mg/m <sup>3</sup> | Not Calculated                          | 273K, 101.3kPa, Wet                    | 07/10/2015    | 09:55 – 13:55  | Based on MDHS Methods       | None                 | Normal           |

**Table 2.6 Comparison of Emissions Monitoring Results Referenced on a Dry and a Wet Gas Basis**

| Substance Monitored      | Run | Stack C   |             | Stack F   |             | Stack G   |             |
|--------------------------|-----|---|-------------|---|-------------|---|-------------|
|                          |     | Periodic Monitoring Result (mg/m <sup>3</sup> ) |             | Periodic Monitoring Result (mg/m <sup>3</sup> ) |             | Periodic Monitoring Result (mg/m <sup>3</sup> ) |             |
|                          |     | S.T.P., Dry                                     | S.T.P., Wet | S.T.P., Dry                                     | S.T.P., Wet | S.T.P., Dry                                     | S.T.P., Wet |
| Amines                   | 1   | 0.55  | 0.53        | 1.3   | 1.2         | <0.1  | <0.1        |
|                          | 2   | 0.57  | 0.55        | 0.43  | 0.4         | < 0.1   | < 0.1       |
|                          | 3   | 0.75  | 0.73        | 1.4   | 1.3         | < 0.1   | < 0.1       |
| Ammonia                  | 1   | 49  | 48          | 1.4   | 1.3         | 8.6   | 8.3         |
|                          | 2   | 54  | 52          | 1.3   | 1.2         | 15.6  | 15          |
|                          | 3   | 39  | 38          | 1.4   | 1.3         | 22.8  | 22          |
| Formaldehyde             | 1   | 0.82  | 0.79        | <0.1  | <0.1        | 5   | 4.8         |
|                          | 2   | 0.041   | 0.040       | < 0.1   | < 0.1       | 5   | 4.8         |
|                          | 3   | 2.17  | 2.11        | < 0.1   | < 0.1       | 5   | 4.8         |
| Phenol                   | 1   | 5.4   | 5.1         | 0.57  | 0.53        | <0.1  | <0.1        |
|                          | 2   | 2.4   | 2.2         | 0.59  | 0.55        | < 0.1   | < 0.1       |
|                          | 3   | 2.4   | 2.3         | 0.78  | 0.73        | < 0.1   | < 0.1       |
| Total Particulate Matter | 1   | 82  | <b>79</b>   | 0.66  | 0.61        | 12.4  | 12          |
|                          | 2   | 127   | <b>122</b>  | 0.69  | 0.64        | 17.6  | 17          |
|                          | 3   | 20  | 19          | 0.52  | 0.48        | 17.6  | 17          |

**Table 2.6 (Cont...) Comparison of Emissions Monitoring Results Referenced on a Dry and a Wet Gas Basis**

| Substance Monitored        | Run | Stack C   |             | Stack F   |             | Stack G   |             |
|----------------------------|-----|---|-------------|---|-------------|---|-------------|
|                            |     | Periodic Monitoring Result (mg/m <sup>3</sup> ) |             | Periodic Monitoring Result (mg/m <sup>3</sup> ) |             | Periodic Monitoring Result (mg/m <sup>3</sup> ) |             |
|                            |     | S.T.P., Dry                                     | S.T.P., Wet | S.T.P., Dry                                     | S.T.P., Wet | S.T.P., Dry                                     | S.T.P., Wet |
| Volatile Organic Compounds | 1   | 28  | N/A         | 4.8   | 4.5         | 0.35  | 0.34        |
|                            | 2   | 22  | N/A         | 5.3   | 4.9         | 0.88  | 0.85        |
|                            | 3   | 17  | N/A         | 5.9   | 5.5         | 0.49  | 0.46        |
| Nitric Oxide               | 1   |   |             | 125   | 116         |   |             |
|                            | 2   |   |             | 118   | 109         |   |             |
|                            | 3   |   |             | 109   | 100         |   |             |
| Nitrous Oxide              | 1   |   |             | 308   | 286         |   |             |
|                            | 2   |   |             | 343   | 318         |   |             |
|                            | 3   |   |             | 400   | 368         |   |             |
| Nitrogen Dioxide           | 1   |   |             | 15  | 14          |   |             |
|                            | 2   |   |             | 22  | 20          |   |             |
|                            | 3   |   |             | 24  | 22          |   |             |

## Operating Information

**Table 3.1 Operating conditions during the monitoring of emission point C carried out on 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Parameter  | Result  |
|--|---|
| Sample Date  | 5 <sup>th</sup> to 7 <sup>th</sup> October 2015 |
| Process Type   | Continuous                                      |
| Process Duration   | N/A   |
| If 'Batch', was monitoring carried out over the whole batch? | N/A   |
| Abatement/Operational?                                       | Wet Scrubber/Operational                        |

| Comparison of Operator CEM and Periodic Monitoring Results |                                   |  |
|--|-----------------------------------|--|
| Substance  | CEMs Results (mg/m <sup>3</sup> ) | Periodic Monitoring Results (mg/m <sup>3</sup> ) |
| No CEMS Installed/Data Available                           |                                   |  |

**Table 3.2 Operating conditions during the monitoring of emission point F carried out on 5<sup>th</sup> - 7<sup>th</sup> October & 2<sup>nd</sup> December 2015**

| Parameter  | Result   |
|--|--|
| Sample Date  | 5 <sup>th</sup> to 7 <sup>th</sup> October & 2 <sup>nd</sup> December 2015 |
| Process Type   | Continuous   |
| Process Duration   | N/A  |
| If 'Batch', was monitoring carried out over the whole batch? | N/A  |
| Abatement/Operational?                                       | Oxidiser / Operational   |

| Comparison of Operator CEM and Periodic Monitoring Results |                                   |  |
|--|-----------------------------------|--|
| Substance  | CEMs Results (mg/m <sup>3</sup> ) | Periodic Monitoring Results (mg/m <sup>3</sup> ) |
| No CEMS Installed/Data Available                           |                                   |  |

**Table 3.3 Operating conditions during the monitoring of emission point G carried out on the 5<sup>th</sup> – 7<sup>th</sup> October 2015**

| Parameter  | Result  |
|--|---|
| Sample Date  | 5 <sup>th</sup> to 7 <sup>th</sup> October 2015 |
| Process Type   | Continuous                                      |
| Process Duration   | N/A   |
| If 'Batch', was monitoring carried out over the whole batch? | N/A   |
| Abatement/Operational?                                       | Wet Scrubber / Operational                      |

| Comparison of Operator CEM and Periodic Monitoring Results |                                   |  |
|--|-----------------------------------|--|
| Substance  | CEMs Results (mg/m <sup>3</sup> ) | Periodic Monitoring Results (mg/m <sup>3</sup> ) |
| No CEMS Installed/Data Available                           |                                   |  |

## Monitoring Deviations

**Table 4.1 Monitoring Deviations for Emission Point C**

| Pollutant  | Substance Deviations | Monitoring Deviations | Other Relevant Issues |
|--|----------------------|-----------------------|-----------------------|
| Amines, Ammonia, Formaldehyde, Phenol, Total Particulate Matter & Volatile Organic Compounds | None                 | None                  | None                  |

**Table 4.2 Monitoring Deviations for Emission Point F**

| Pollutant  | Substance Deviations | Monitoring Deviations   | Other Relevant Issues |
|--|----------------------|---|-----------------------|
| Amines, Ammonia, Formaldehyde, Nitric Oxide, Nitrogen Dioxide, Nitrous Oxide, Phenols, Total Particulate Matter & Volatile Organic Compounds | None                 | Due to the duct being horizontal, for wet chemistry tests, sampling could only be conducted along the horizontal plane. | None                  |

**Table 4.3 Monitoring Deviations for Emission Point G**

| Pollutant   | Substance Deviations | Monitoring Deviations | Other Relevant Issues |
|---|----------------------|-----------------------|-----------------------|
| Amines, Ammonia, Formaldehyde, Phenols, Total Particulate Matter & Volatile Organic Compounds | None                 | None                  | None                  |

**Table 4.4 Monitoring Deviations for Boundary Sampling**

| Pollutant   | Substance Deviations | Monitoring Deviations | Other Relevant Issues |
|---|----------------------|-----------------------|-----------------------|
| Amines, Ammonia, Formaldehyde, Phenols, Total Particulate Matter & Volatile Organic Compounds | None                 | None                  | None                  |



## Report for Periodic Monitoring of Emissions to Atmosphere

Part 2: **Supporting Information**

Permit Number: **BR9383 & Variation NP3835SW**

Operator: **Knauf Insulation Limited**

Installation: **Queensferry**

Emission Points: **C, F, G, Downwind Boundary & Upwind Boundary**

Monitoring Dates: **5<sup>th</sup> – 7<sup>th</sup> October 2015 & 2<sup>nd</sup> December 2015**



Contract Reference: FTBS 35216

Operator: Knauf Insulation Limited

Address: Chemistry Lane  
Queensferry  
Flintshire  
CH5 2DB

Monitoring Organisation: RPS Consultants

Address: Noble House, Capital Drive, Linford  
Wood, Milton Keynes. MK14 6QP.

Report Date: 25<sup>th</sup> April 2016

Report Approved By: Carl Redgrove

Position: Senior Consultant

MCERTS Registration Number: MM 03 173

MCERTS Certification Level: 2

Technical Endorsements: TE1, TE2, TE3, TE4

Signature:

A handwritten signature in black ink, appearing to read 'Carl Redgrove', enclosed within a rectangular box.

RPS Consultants has produced this report within the term of the contract with the client and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

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### **Part 2: Supporting Information**

#### **Appendix 1 – Staff & Methodology Details**

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#### **Appendix 3 – F Sampling, Analysis & Uncertainty Data**

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#### **Appendix 5 – Upwind Boundary Analysis & Uncertainty Data**

#### **Appendix 6 – Downwind Boundary Analysis & Uncertainty Data**

#### **Appendix 7 – Certificates of Analysis**

## **APPENDIX 1: General Information**

## Monitoring Organisation Staff Details

**Table 5.1 Sampling Personnel**

| Sampling Personnel | Position             | MCERTS Level | Technical Endorsements | MCERTS Registration Number |
|--------------------|----------------------|--------------|------------------------|----------------------------|
| Chris Davies       | Consultant           | 2            | TE1, TE2, TE3, TE4     | MM 03 252                  |
| Richard Harvey     | Principal Consultant | 2            | TE1, TE2, TE3, TE4     | MM 02 020                  |
| Edwin Powell       | Consultant           | 2            | TE1, TE2, TE3, TE4     | MM 05 621                  |
| Daniel Lewis       | Technician           | 1            | -                      | MM 14 1291                 |
| Jake Gelder        | Trainee Technician   | -            | -                      | MM 15 1339                 |

**Table 5.2 Report Author**

| Report Author | Position   | MCERTS Level | Technical Endorsements | MCERTS Registration Number |
|---------------|------------|--------------|------------------------|----------------------------|
| Daniel Lewis  | Technician | 1            | -                      | MM 14 1291                 |

**Table 5.3 Report Reviewer**

| Report Reviewer | Position          | MCERTS Level | Technical Endorsements | MCERTS Registration Number |
|-----------------|-------------------|--------------|------------------------|----------------------------|
| Carl Redgrove   | Senior Consultant | 2            | TE1, TE2, TE3, TE4     | MM 03 173                  |

## Monitoring Organisation Method Details

**Table 6.1 Monitoring Methods**

| Emission Parameter                           | Standard Method    | Monitoring Procedure No. | Monitoring Accreditation | Analysis                  | Analysis Procedure No. | Analytical Laboratory | Analysis Accreditation |
|--|--------------------|--------------------------|--------------------------|---------------------------|------------------------|-----------------------|------------------------|
| Practical Considerations Prior to Monitoring | N/A                | RPSCE/1/1                | UKAS                     | N/A                       | N/A                    | N/A                   | N/A                    |
| Gas Flows                                    | BS-EN 13284-1:2001 | RPSCE/1/2                | MCERTS                   | N/A                       | N/A                    | N/A                   | N/A                    |
| Gas Temperatures                             | BS-EN 13284-1:2001 | RPSCE/1/2                | MCERTS                   | N/A                       | N/A                    | N/A                   | N/A                    |
| Amines                                       | BS EN 13649:2002   | RPSCE/1/19c              | MCERTS                   | IC                        | A1                     | RPS Laboratories      | None                   |
| Ammonia                                      | BS EN 14791        | RPSCE/1/8b               | MCERTS                   | IC                        | A6                     | RPS Laboratories      | UKAS                   |
| Formaldehyde                                 | USEPA M316         | RPSCE/1/22               | MCERTS                   | Wet Chemistry             | M103                   | RPS Laboratories      | UKAS                   |
| Low Concentration Total Particulate Matter   | BS EN 13284-1:2002 | RPSCE/1/7c               | MCERTS                   | Gravimetric               | D9                     | RPS Laboratories      | UKAS                   |
| Nitrogen Monoxide                            | BS EN 14792        | RPSCE/1/21f              | MCERTS                   | Chemiluminescence         | N/A                    | N/A                   | N/A                    |
| TOCs   | BS EN 12619        | RPSCE/1/4b               | MCERTS                   | Flame Ionisation Detector | N/A                    | N/A                   | N/A                    |
| Phenols                                      | BS EN 13649:2002   | RPSCE/1/19b              | MCERTS                   | FTIR                      | N/A                    | N/A                   | N/A                    |
| Nitrogen Dioxide & Nitrous Oxide             | TGN M22            | RPSCE/1/24               | None                     | FTIR                      | N/A                    | N/A                   | N/A                    |

**Table 6.1 (Cont...) Monitoring Methods**

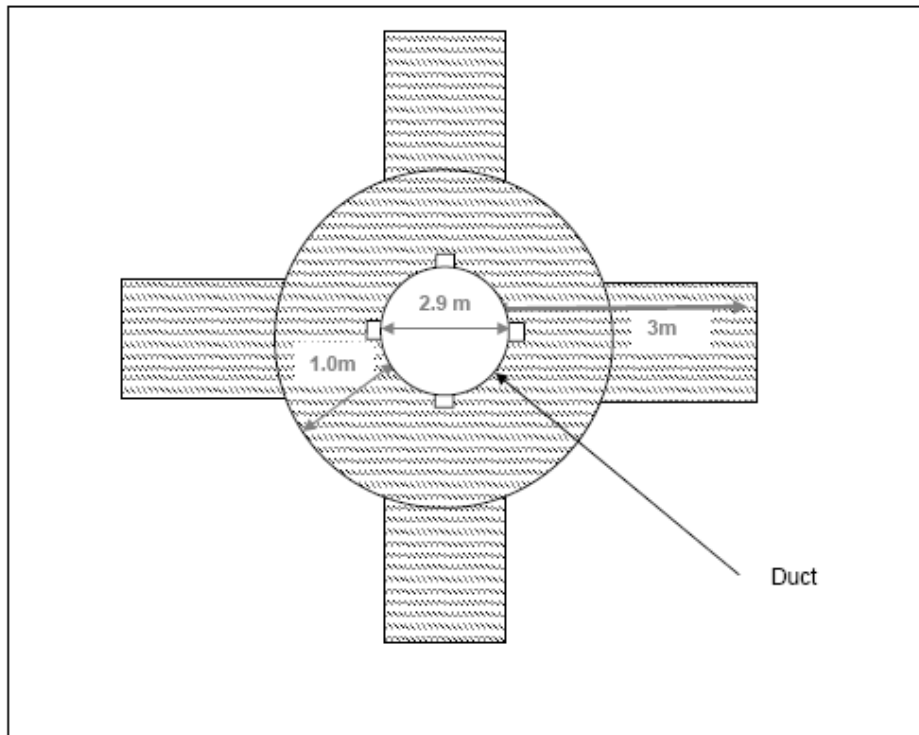
| Emission Parameter     | Standard Method       | Monitoring Procedure No. | Monitoring Accreditation | Analysis | Analysis Procedure No. | Analytical Laboratory | Analysis Accreditation |
|------------------------|-----------------------|--------------------------|--------------------------|----------|------------------------|-----------------------|------------------------|
| Phenol - Ambient       | Based on MDHS Methods | RPSCE/1/N/A              | None                     | GC       | P1                     | RPS Laboratories      | UKAS                   |
| Formaldehyde - Ambient | Based on MDHS Methods | RPSCE/1/N/A              | None                     | HPLC     | A40                    | RPS Laboratories      | UKAS                   |
| Ammonia - Ambient      | Based on MDHS Methods | RPSCE/1/N/A              | None                     | GC       | A6                     | RPS Laboratories      | UKAS                   |

**Table 7.1 – Checklist Used**

| Equipment Checklist Used | File Location Address            |
|--------------------------|----------------------------------|
| FTBS35216 Checklist      | FTBS35216 Electronic & Work File |

## **APPENDIX 2: C Sampling, Analysis & Uncertainty Data**

## Stack Diagram





Company Name: Knauf Insulations  
Site Ref: Queensferry  
Sampling Point Ref: Stack C  
Project Ref: FTBS 35216

Date: 05/10/2015  
Run 1 : Amines

Static Press, mm H<sub>2</sub>O: 8  
Barometric press, mm Hg: 775  
Stack Diamter (m): 2.92  
Pitot Tube Constant: 0.825

| Traverse            | Port A                  |                                  |           |               | Port B                  |                                  |           |               |
|---------------------|-------------------------|----------------------------------|-----------|---------------|-------------------------|----------------------------------|-----------|---------------|
| Point No.           | Δ p, mmH <sub>2</sub> O | Conversion for pitot coefficient | Root Δ p, | Stack Temp °C | Δ p, mmH <sub>2</sub> O | Conversion for coefficient and t | Root Δ p, | Stack Temp °C |
| 1                   | 3.5                     | 23.8                             | 4.881     | 36            | 3.5                     | 23.8                             | 4.881     | 36            |
| 2                   | 4.5                     | 30.6                             | 5.535     | 36            | 4                       | 27.2                             | 5.218     | 36            |
| 3                   | 4.5                     | 30.6                             | 5.535     | 36            | 4.5                     | 30.6                             | 5.535     | 36            |
| 4                   | 4                       | 27.2                             | 5.218     | 36            | 4                       | 27.2                             | 5.218     | 36            |
| Minimum             | 3.5                     | 23.8                             | 4.881     | 36.0          | 3.5                     | 23.8                             | 4.881     | 36.0          |
| Maximum             | 4.5                     | 30.6                             | 5.535     | 36.0          | 4.5                     | 30.6                             | 5.535     | 36.0          |
| Average             | 4.1                     | 28.1                             | 5.292     | 36.0          | 4.0                     | 27.2                             | 5.213     | 36.0          |
| Sum                 | 16.5                    | 112.3                            | 21.169    | 144.0         | 16.5                    | 112.3                            | 21.169    | 144.0         |
| Total Sum           |                         |                                  |           |               |                         |                                  |           |               |
| Max. pitot press. = |                         |                                  | 30.6      |               |                         |                                  |           | 36.0          |
| Min. pitot press. = |                         |                                  | 23.8      |               |                         |                                  |           | 36.0          |
| Ratio Max:Min =     |                         |                                  | 1.3 :1    |               |                         |                                  |           | 36.0          |
|                     |                         |                                  |           |               |                         |                                  |           |               |

Mean Root D p 5.253

Mean Stack Temperature, °C 36.00

Traverse Stack Velocity, m/s 6.925

Stack Area, m<sup>2</sup> 6.697

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (acms) 46.375

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms wet) 41.788

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms WET) O<sub>2</sub> Corrected 41.788

Moisture 3.0

Stack Pressure, mm Hg 775.59

#### Gas Data

|                   |     |
|-------------------|-----|
| Oxygen %          |     |
| CO <sub>2</sub> % | N/A |

#### Oxygen Correction

|                                       |       |
|---------------------------------------|-------|
| Required Correction Value (%)         | 0     |
| Oxygen Factor                         | 1.000 |
| Enter 0 if correction is not required |       |

|  |        |         |  |                   |             |
|--|--------|---------|--|-------------------|-------------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Stack C</b> |        |         | Personnel: CD - JG                           |                   |             |
|  |        |         | Date of Sampling: 05/10/2015                 |                   |             |
|  |        |         | Sampling Comments                            |                   |             |
|  |        |         | Run 1 : Amines                               |                   |             |
| Ref Moisture   | -      | Wet     |  |                   |             |
| Ref Temp   | K      | 273     |  |                   |             |
| Ref Pressure   | kPa    | 101.325 |  |                   |             |
| Ref Oxygen   | %      | 0       |  |                   |             |
|  | Start  | End     |  |                   |             |
| Sample Times   | 15:55  | 16:55   |  |                   |             |
| Barometric   | kPa    | 103.3   | Measured Volume                              | m <sup>3</sup>    | 0.021       |
| Static Pressure  | Pa     | 78.4    | Volume at STP                                | m <sup>3</sup>    | 0.020       |
| Duct Diameter  | m      | 2.92    | Area of Duct                                 | m <sup>2</sup>    | 6.70        |
| Average Stack Temperature  | °C     | 36      | Duct Pressure                                | kPa               | 103.401     |
| Meter Correction Yd  | -      | 1       | Mean Sum SQRT Delta P                        | Pa                | 20009190.00 |
| Meter Temp Average   | °C     | 15      | Velocity                                     | m/s               | 6.93        |
| Meter Volume (Start)   | litres | 0       | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 46.3748     |
| Meter Volume (End)   | litres | 21.012  | Vol Flow (corrected)                         | m <sup>3</sup> /s | 41.7878     |
| Pitot Coefficient  | -      | 0.823   | Mass Emission                                | kg/hr             | 0.03592     |
| Measured Oxygen  | %      |         | Moisture Content                             | %                 | 3.0         |
| Sample Laboratory Data tube 1  |        |         | Mass Concentration (at reference conditions) |                   |             |
| Amines   | mg     | 0.005   | LOD  | mg/m <sup>3</sup> | 0.239       |
| Blank Laboratory Data  |        |         | Mass Concentration (at reference conditions) |                   |             |
| 20009188   | mg     | 0.005   | LOD  | mg/m <sup>3</sup> | 0.239       |

### ISO 14956 Calculation Sheet - BS EN 13649

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.24 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.047759                  | 0.002281       | 0.047759               | 0.002281       |
| O2 Correction                    | U <sub>correction</sub>    | 0.004776                  | 0.000023       | 0.004776               | 0.000023       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.002757                  | 0.000008       | 0.002757               | 0.000008       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.001379                  | 0.000002       | 0.000276               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.000551                  | 0.000000       | 0.002757               | 0.000008       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.013787                  | 0.000190       | 0.013787               | 0.000190       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.001379                  | 0.000002       | 0.001379               | 0.000002       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.002757                  | 0.000008       | 0.002757               | 0.000008       |

|                            |            |       |
|----------------------------|------------|-------|
| Measurement Uncertainty at | 0.23879421 | mg/m3 |
| U <sub>tot</sub>           | 0.050      | mg/m3 |

|  |        |         |  |                   |             |
|--|--------|---------|--|-------------------|-------------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Stack C</b> |        |         | Personnel: CD - JG                           |                   |             |
|  |        |         | Date of Sampling: 06/10/2015                 |                   |             |
|  |        |         | Sampling Comments                            |                   |             |
|  |        |         | Run 2 : Amines                               |                   |             |
| Ref Moisture   | -      | Wet     |  |                   |             |
| Ref Temp   | K      | 273     |  |                   |             |
| Ref Pressure   | kPa    | 101.325 |  |                   |             |
| Ref Oxygen   | %      | 0       |  |                   |             |
|  | Start  | End     |  |                   |             |
| Sample Times   | 09:05  | 10:05   |  |                   |             |
| Barometric   | kPa    | 99.7    | Measured Volume                              | m <sup>3</sup>    | 0.019       |
| Static Pressure  | Pa     | 78.4    | Volume at STP                                | m <sup>3</sup>    | 0.018       |
| Duct Diameter  | m      | 2.92    | Area of Duct                                 | m <sup>2</sup>    | 6.70        |
| Average Stack Temperature  | °C     | 32      | Duct Pressure                                | kPa               | 99.802      |
| Meter Correction Yd  | -      | 1       | Mean Sum SQRT Delta P                        | Pa                | 20009193.00 |
| Meter Temp Average   | °C     | 15      | Velocity                                     | m/s               | 7.18        |
| Meter Volume (Start)   | litres | 0       | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 48.0890     |
| Meter Volume (End)   | litres | 19.02   | Vol Flow (corrected)                         | m <sup>3</sup> /s | 42.4420     |
| Pitot Coefficient  | -      | 0.823   | Mass Emission                                | kg/hr             | 0.04116     |
| Measured Oxygen  | %      |         | Moisture Content                             | %                 | 4.4         |
| Sample Laboratory Data tube 1  |        |         | Mass Concentration (at reference conditions) |                   |             |
| Amines   | mg     | 0.005   | LOD  | mg/m <sup>3</sup> | 0.269       |
| Blank Laboratory Data  |        |         | Mass Concentration (at reference conditions) |                   |             |
| 20009191   | mg     | 0.005   | LOD  | mg/m <sup>3</sup> | 0.269       |

### ISO 14956 Calculation Sheet - BS EN 13649

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.27 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/kPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.053876                  | 0.002903       | 0.053876               | 0.002903       |
| O2 Correction                    | U <sub>correction</sub>    | 0.005388                  | 0.000029       | 0.005388               | 0.000029       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.003111                  | 0.000010       | 0.003111               | 0.000010       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.001555                  | 0.000002       | 0.000311               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.000622                  | 0.000000       | 0.003111               | 0.000010       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.015553                  | 0.000242       | 0.015553               | 0.000242       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.001555                  | 0.000002       | 0.001555               | 0.000002       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.003111                  | 0.000010       | 0.003111               | 0.000010       |

|                            |             |                   |
|----------------------------|-------------|-------------------|
| Measurement Uncertainty at | 0.269380984 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 0.057       | mg/m <sup>3</sup> |

|  |              |              |  |                        |                |
|--|--------------|--------------|--|------------------------|----------------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Stack C</b> |              |              | Personnel: CD - JG                           |                        |                |
|  |              |              | Date of Sampling: 06/10/2015                 |                        |                |
|  |              |              | Sampling Comments                            |                        |                |
|  |              |              | Run 3 : Amines                               |                        |                |
| Ref Moisture   | -            | Wet          |  |                        |                |
| Ref Temp   | K            | 273          |  |                        |                |
| Ref Pressure   | kPa          | 101.325      |  |                        |                |
| Ref Oxygen   | %            | 0            |  |                        |                |
|  | Start        | End          |  |                        |                |
| <b>Sample Times</b>  | <b>10:07</b> | <b>11:47</b> |  |                        |                |
| <b>Barometric</b>  | <b>kPa</b>   | <b>99.7</b>  | Measured Volume                              | m <sup>3</sup>         | 0.027          |
| Static Pressure  | Pa           | 78.4         | Volume at STP                                | m <sup>3</sup>         | 0.025          |
| Duct Diameter  | m            | 2.92         | <b>Area of Duct</b>                          | <b>m<sup>2</sup></b>   | <b>6.70</b>    |
| Average Stack Temperature  | °C           | 32           | Duct Pressure                                | kPa                    | 99.802         |
| Meter Correction Yd  | -            | 1            | Mean Sum SQRT Delta P                        | Pa                     | 20009195.00    |
| Meter Temp Average   | °C           | 15           | <b>Velocity</b>                              | <b>m/s</b>             | <b>7.18</b>    |
| Meter Volume (Start)   | litres       | 0            | <b>Vol Flow (as Measured)</b>                | <b>m<sup>3</sup>/s</b> | <b>48.0890</b> |
| Meter Volume (End)   | litres       | 27.102       | <b>Vol Flow (corrected)</b>                  | <b>m<sup>3</sup>/s</b> | <b>42.4420</b> |
| Pitot Coefficient  | -            | 0.823        | Mass Emission                                | kg/hr                  | 0.02889        |
| Measured Oxygen  | %            |              | Moisture Content                             | %                      | 4.4            |
| Sample Laboratory Data tube 1  |              |              | Mass Concentration (at reference conditions) |                        |                |
| Amines   | mg           | 0.005        | LOD  | mg/m <sup>3</sup>      | 0.189          |
| Blank Laboratory Data  |              |              | Mass Concentration (at reference conditions) |                        |                |
| 20009191   | mg           | 0.005        | LOD  | mg/m <sup>3</sup>      | 0.189          |

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.19 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.037810                  | 0.001430       | 0.037810               | 0.001430       |
| O2 Correction                    | U <sub>correction</sub>    | 0.003781                  | 0.000014       | 0.003781               | 0.000014       |
| Gas Meter Volume, sampling rate  | U <sub>volum</sub>         | 0.002183                  | 0.000005       | 0.002183               | 0.000005       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.001091                  | 0.000001       | 0.000218               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.000437                  | 0.000000       | 0.002183               | 0.000005       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.010915                  | 0.000119       | 0.010915               | 0.000119       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.001091                  | 0.000001       | 0.001091               | 0.000001       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.002183                  | 0.000005       | 0.002183               | 0.000005       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 0.189049749 | mg/m3 |
| U <sub>tot</sub>           | 0.040       | mg/m3 |

|  |        |         |  |                   |         |
|--|--------|---------|--|-------------------|---------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Stack C</b> |        |         | Personnel: CD - JG                           |                   |         |
|  |        |         | Date of Sampling: 06/10/2015                 |                   |         |
|  |        |         | Sampling Comments                            |                   |         |
|  |        |         | RUN : Phenols 1                              |                   |         |
| Ref Moisture   | -      | Wet     |  |                   |         |
| Ref Temp   | K      | 273     |  |                   |         |
| Ref Pressure   | kPa    | 101.325 |  |                   |         |
| Ref Oxygen   | %      | 0       |  |                   |         |
|  | Start  | End     |  |                   |         |
| Sample Times   | 13:29  | 14:29   |  |                   |         |
| Barometric   | kPa    | 99.7    | Measured Volume                              | m <sup>3</sup>    | 0.026   |
| Static Pressure  | Pa     | 78.4    | Volume at STP                                | m <sup>3</sup>    | 0.023   |
| Duct Diameter  | m      | 2.92    | Area of Duct                                 | m <sup>2</sup>    | 6.70    |
| Average Stack Temperature  | °C     | 32      | Duct Pressure                                | kPa               | 99.802  |
| Meter Correction Yd  | -      | 0.978   | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C     | 15      | Velocity                                     | m/s               | 7.16    |
| Meter Volume (Start)   | litres | 640.3   | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 47.9724 |
| Meter Volume (End)   | litres | 665.8   | Vol Flow (corrected)                         | m <sup>3</sup> /s | 42.3391 |
| Pitot Coefficient  | -      | 0.823   | Mass Emission                                | kg/hr             | 0.78417 |
| Measured Oxygen  | %      |         | Moisture Content                             | %                 | 5.0     |
| Sample Laboratory Data   |        |         | Mass Concentration (at reference conditions) |                   |         |
| Phenols  | mg     | 0.126   |  | mg/m <sup>3</sup> | 5.14    |
| Blank Laboratory Data  |        |         | Mass Concentration (at reference conditions) |                   |         |
| Blank Phenols  | mg     | 0.025   | LOD  | mg/m <sup>3</sup> | 1.02    |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 5.14 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 1.028951                  | 1.058740       | 1.028951               | 1.058740       |
| O2 Correction                    | U <sub>correction</sub>    | 0.102895                  | 0.010587       | 0.102895               | 0.010587       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.059407                  | 0.003529       | 0.059407               | 0.003529       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.029703                  | 0.000882       | 0.005941               | 0.000035       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.011881                  | 0.000141       | 0.059407               | 0.003529       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.297033                  | 0.088228       | 0.297033               | 0.088228       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.029703                  | 0.000882       | 0.029703               | 0.000882       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.059407                  | 0.003529       | 0.059407               | 0.003529       |

|                            |             |                   |
|----------------------------|-------------|-------------------|
| Measurement Uncertainty at | 5.144754616 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 1.08        | mg/m <sup>3</sup> |

|  |        |         |  |                   |         |
|--|--------|---------|--|-------------------|---------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Stack C</b> |        |         | Personnel: CD - JG                           |                   |         |
|  |        |         | Date of Sampling: 07/10/2015                 |                   |         |
|  |        |         | Sampling Comments                            |                   |         |
|  |        |         | RUN : Phenols 2                              |                   |         |
| Ref Moisture   | -      | Wet     |  |                   |         |
| Ref Temp   | K      | 273     |  |                   |         |
| Ref Pressure   | kPa    | 101.325 |  |                   |         |
| Ref Oxygen   | %      | 0       |  |                   |         |
|  | Start  | End     |  |                   |         |
| Sample Times   | 09:50  | 10:50   |  |                   |         |
| Barometric   | kPa    | 99.3    |  |                   |         |
| Static Pressure  | Pa     | 78.4    |  |                   |         |
| Duct Diameter  | m      | 2.92    | Measured Volume                              | m <sup>3</sup>    | 0.026   |
| Average Stack Temperature  | °C     | 32      | Volume at STP                                | m <sup>3</sup>    | 0.024   |
| Meter Correction Yd  | -      | 1       | Area of Duct                                 | m <sup>2</sup>    | 6.70    |
| Meter Temp Average   | °C     | 15      | Duct Pressure                                | kPa               | 99.402  |
| Meter Volume (Start)   | litres | 0       | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Volume (End)   | litres | 26.019  | Velocity                                     | m/s               | 7.19    |
| Pitot Coefficient  | -      | 0.823   | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 48.1584 |
| Measured Oxygen  | %      |         | Vol Flow (corrected)                         | m <sup>3</sup> /s | 42.6428 |
| Sample Laboratory Data   |        |         | Mass Emission                                | kg/hr             | 0.34384 |
| Phenols  | mg     | 0.057   | Moisture Content                             | %                 | 5.0     |
| Blank Laboratory Data  |        |         | Mass Concentration (at reference conditions) |                   |         |
| 20009211   | mg     | 0.025   |  | mg/m <sup>3</sup> | 2.24    |
|  |        |         | Mass Concentration (at reference conditions) |                   |         |
|  |        |         | LOD  | mg/m <sup>3</sup> | 0.98    |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 2.24 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.447953                  | 0.200662       | 0.447953               | 0.200662       |
| O2 Correction                    | U <sub>correction</sub>    | 0.044795                  | 0.002007       | 0.044795               | 0.002007       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.025863                  | 0.000669       | 0.025863               | 0.000669       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.012931                  | 0.000167       | 0.025863               | 0.000669       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.005173                  | 0.000027       | 0.025863               | 0.000669       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.129313                  | 0.016722       | 0.129313               | 0.016722       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.012931                  | 0.000167       | 0.012931               | 0.000167       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.025863                  | 0.000669       | 0.025863               | 0.000669       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 2.239766451 | mg/m3 |
| U <sub>tot</sub>           | 0.47        | mg/m3 |

|  |        |         |  |                   |         |
|--|--------|---------|--|-------------------|---------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Stack C</b> |        |         | Personnel: CD - JG                           |                   |         |
|  |        |         | Date of Sampling: 07/10/2015                 |                   |         |
|  |        |         | Sampling Comments                            |                   |         |
|  |        |         | RUN : Phenols 3                              |                   |         |
| Ref Moisture   | -      | Wet     |  |                   |         |
| Ref Temp   | K      | 273     |  |                   |         |
| Ref Pressure   | kPa    | 101.325 |  |                   |         |
| Ref Oxygen   | %      | 0       |  |                   |         |
|  | Start  | End     |  |                   |         |
| Sample Times   | 11:00  | 12:00   |  |                   |         |
| Barometric   | kPa    | 99.3    |  |                   |         |
| Static Pressure  | Pa     | 78.4    |  |                   |         |
| Duct Diameter  | m      | 2.92    |  |                   |         |
| Average Stack Temperature  | °C     | 32      |  |                   |         |
| Meter Correction Yd  | -      | 1       | Measured Volume                              | m <sup>3</sup>    | 0.021   |
| Meter Temp Average   | °C     | 15      | Volume at STP                                | m <sup>3</sup>    | 0.019   |
| Meter Volume (Start)   | litres | 0       | Area of Duct                                 | m <sup>2</sup>    | 6.70    |
| Meter Volume (End)   | litres | 20.777  | Duct Pressure                                | kPa               | 99.402  |
| Pitot Coefficient  | -      | 0.823   | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Measured Oxygen  | %      |         | Velocity                                     | m/s               | 7.19    |
| Sample Laboratory Data   |        |         | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 48.1584 |
|  |        |         | Vol Flow (corrected)                         | m <sup>3</sup> /s | 42.6428 |
|  |        |         | Mass Emission                                | kg/hr             | 0.35504 |
|  |        |         | Moisture Content                             | %                 | 5.0     |
|  |        |         | Mass Concentration (at reference conditions) |                   |         |
| Phenols  | mg     | 0.047   |  | mg/m <sup>3</sup> | 2.31    |
| Blank Laboratory Data  |        |         | Mass Concentration (at reference conditions) |                   |         |
| 20009211   | mg     | 0.025   | LOD  | mg/m <sup>3</sup> | 1.23    |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 2.31 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.462555                  | 0.213957       | 0.462555               | 0.213957       |
| O2 Correction                    | U <sub>correction</sub>    | 0.046256                  | 0.002140       | 0.046256               | 0.002140       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.026706                  | 0.000713       | 0.026706               | 0.000713       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.013353                  | 0.000178       | 0.002671               | 0.000007       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.005341                  | 0.000029       | 0.026706               | 0.000713       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.133528                  | 0.017830       | 0.133528               | 0.017830       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.013353                  | 0.000178       | 0.013353               | 0.000178       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.026706                  | 0.000713       | 0.026706               | 0.000713       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 2.312775611 | mg/m3 |
| U <sub>tot</sub>           | 0.49        | mg/m3 |

Company Name: Knauf Insulation Ltd  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 05/10/15  
Run: Particulate / Ammonia R1  
Sampling Point Ref: C Stack

In-stack Filter?  Bar. Press.mm Hg  K Factor   
Outstack Filter?  Cp  Dn used   
Operators  Bws%  Nozzle No.   
Meter Correction Yd

Ambient Temp.  Leak Rate (fn / %)   
Start Time  Leak Rate (start / %)   
Stop Time  Box/Probe setting

#### TPM

##### Sample

|                | Sample ID | Laboratory | Increase. mg |
|----------------|-----------|------------|--------------|
| Filter         | 122028    | RPS        | 73.98        |
| Probe Washings | 20009179  | RPS        | 6.51         |

#### Ammonia (H2SO4)

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009181 | 0.248        | 188  | 46.624      |
| 20009182 | 0.122        | 0.49 | 0.05978     |

##### Blank

|            | Sample ID | Laboratory | Increase. mg |
|------------|-----------|------------|--------------|
| Filter     | 122027    | RPS        | 1.32         |
| Probe Wash | 20009178  | RPS        | 0.5          |

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009180 | 0.135        | 0.1  | 0.0135      |

##### Impinger Weights

| Weights    | Initial | Final | Increase. g |
|------------|---------|-------|-------------|
| Impinger 1 | 665.9   | 683.3 | 17.4        |
| Impinger 2 | 769.1   | 773.3 | 4.2         |
| Impinger 3 | 780.2   | 780.2 | 0.0         |
| Impinger 4 | 603     | 605.3 | 2.3         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel | 966.7   | 975.5 | 8.8         |
| Total      |         |       | 32.7        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
| A            | 0                 | 5                                 | 36                | 24.05                            | 24     | 3396                                | 14                                |                          | 120                      | 120                 | 1                           | 10                           | 2.236     |
|              | 5                 | 5                                 | 36                | 24.05                            | 19     |                                     | 14                                |                          | 120                      | 120                 | 1                           | 10                           | 2.236     |
|              | 10                | 5.5                               | 36                | 26.455                           | 26     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 11                           | 2.345     |
|              | 15                | 5.5                               | 35                | 26.455                           | 19     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 12                           | 2.345     |
|              | 20                | 5                                 | 35                | 24.05                            | 24     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 13                           | 2.236     |
|              | 25                | 5                                 | 35                | 24.05                            | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 14                           | 2.236     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
| B            | 0                 | 5                                 | 35                | 24.05                            | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 12                           | 2.236     |
|              | 5                 | 4.5                               | 35                | 21.645                           | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 13                           | 2.121     |
|              | 10                | 4.5                               | 35                | 21.645                           | 20     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 14                           | 2.121     |
|              | 15                | 5                                 | 35                | 24.05                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 15                           | 2.236     |
|              | 20                | 5.5                               | 35                | 26.455                           | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 16                           | 2.345     |
|              | 25                | 5                                 | 35                | 24.05                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 17                           | 2.236     |
| Endpoint     | 30                |                                   |                   |                                  |        | 4439                                | 19                                |                          |                          |                     |                             |                              |           |
|              | 60                | 5.0                               | 35.3              | 24.3                             | 20.5   | 1.043                               | 16.4                              | n/a                      | 120.0                    | 120.0               | 1.0                         | 13.1                         | 2.2       |



**Company Name: Knauf Insulation Ltd**

**Site Name: Queensferry**

**Project Reference: FTBS 35216**

**Date:**

**05/10/15**

**Run : 1**

| <b>Sampling Point Ref: C Stack</b>                  | <b>Total Particulate</b> |
|---|--------------------------|
| Meter Volume Sampled, acm                           | 1.043                    |
| <b>Sample Run Start Time</b>                        | <b>14:37</b>             |
| <b>Sample Run End Time</b>                          | <b>15:55</b>             |
| Total Actual Sampling Time, min                     | 60.0                     |
| Barometric Pressure, mm Hg                          | 775.00                   |
| Stack Pressure, mm Hg                               | 775.59                   |
| Average Stack Temp, °C                              | 35.3                     |
| Meter Volume at Wet STP, scm                        | 1.024                    |
| Stack Moisture Content, %                           | 4.0                      |
| Average Stack Velocity, m/sec                       | 7.627                    |
| Stack Flow Rate, scms wet, STP                      | 46.136                   |
| Nozzle Diameter, mm                                 | 7.00                     |
| <b>% Isokinetic Variation</b>                       | <b>107.0</b>             |
| Total Mass of Particulate, mg                       | 80.5                     |
| Percentage of Total Particulate Collected on Filter | 91.9                     |
| <b>Particulate Concentration, mg/m<sup>3</sup></b>  | <b>78.63</b>             |
| <b>Particulate Mass emission rate, kg/hour</b>      | <b>13.0589</b>           |
| Emission Limit Value                                | 50                       |

| <b>Total Particulate Sample Train Blank Results</b>       |             |
|---|-------------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 1.78        |
| Total Weight Gain, mg (Sample Train Blank)                | 1.82        |
| Blank Result Less than 10% of Limit Value                 | <b>PASS</b> |
| Isokinetic variation within 95 - 115% criteria ?          | <b>Pass</b> |

| <b>Sampling Point Ref: C Stack</b>         | <b>Ammonia</b> |
|--|----------------|
| Impinger 1 20009181                        | 45.5438        |
| Impinger 2 20009182                        | 0.0584         |
| <b>NH3 Concentration, mg/m<sup>3</sup></b> | <b>45.60</b>   |
| <b>Ammonia Mass Emission Rate, kg/hour</b> | <b>7.5741</b>  |
| Emission Limit Value                       | 50             |

| <b>Ammonia Sample Train Impinger Efficiency / Blank Results</b> |             |
|---|-------------|
| Sample Blank Concentration, mg/m <sup>3</sup>                   | 0.0132      |
| Impinger Efficiency (%)   | 99.9        |
| Impinger Efficiency Less than 10% ?                             | <b>PASS</b> |

### Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |        |                                       |
|--------------------------|--------|---------------------------------------|
| Determined Concentration | 78.625 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|--------|---------------------------------------|

#### Measured Values

|                         |             |                |
|-------------------------|-------------|----------------|
| Sampled Volume          | 1.043       | m <sup>3</sup> |
| Sampled gas Temperature | 289.3846154 | K              |
| Sampled gas Pressure    | 103.41      | kPa            |
| Sampled gas Humidity    | 3.980021759 | % by volume    |
| Oxygen content          | n/a         | % by volume    |
| Mass                    | 80.49       | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.04 | %  |
| Uncollected Mass | 0    | mg |

#### Standard Uncertainties for Measured Values

|                         |            |                |
|-------------------------|------------|----------------|
| Sampled Volume          | 0.001      | m <sup>3</sup> |
| Sampled gas Temperature | 2          | K              |
| Sampled gas Pressure    | 1          | kPa            |
| Sampled gas Humidity    | 1          | % by volume    |
| Oxygen content          | 0.1        | % by volume    |
| Mass                    | 0.14152385 | mg             |

| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.925                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0032                              |  | 0.0064                      | Oxygen Measurement                            | N/A                     |                      | N/A                         |
| Sampled gas Pressure                          | 0.0089                              |  | 0.0089                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0096                              |  | 0.0096                      |   |                         |                      |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0146                      |   |                         |                      |                             |
|   | Total U <sub>v</sub>                |  | 0.015                       |   |                         | Total U <sub>o</sub> | N/A                         |

| Uncertainty Contributions (Itemised) |       |                    |                         |                          |                    |        |
|--------------------------------------|-------|--------------------|-------------------------|--------------------------|--------------------|--------|
|                                      | Value |                    | Sensitivity coefficient | Uncertainty Contribution |                    |        |
|                                      |       |                    |                         | Concentration            |                    | %      |
| Volume Correction                    | 0.983 | m <sup>3</sup>     | 79.99                   | 1.22                     | mg.m <sup>-3</sup> | 1.55 % |
| Mass (weighing)                      | 80.49 | mg                 | 0.98                    | 0.14                     | mg.m <sup>-3</sup> | 0.18 % |
| Oxygen Correction                    | N/A   |                    | 0.00                    | 0.00                     | mg.m <sup>-3</sup> | 0.00 % |
| System Leak                          | 0.02  | mg.m <sup>-3</sup> | 1.00                    | 0.02                     | mg.m <sup>-3</sup> | 0.02 % |
| Uncollected Mass                     | 0.00  | mg                 | 0.98                    | 0.00                     | mg.m <sup>-3</sup> | 0.00 % |
|                                      |       |                    | Total Uncertainty       | 1.23                     | mg.m <sup>-3</sup> |        |

|                           |  |  |                    |
|---------------------------|--|--|--------------------|
| <b>Uncertainty Result</b> |  | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |
| Expanded Uncertainty =    |  | 2.46   | mg.m <sup>-3</sup> |
| =>                        |  | 3.13   | % of Result        |
| =>                        |  | 4.92   | % of ELV           |

### Uncertainty Calculation for Ammonia Run 1

|                          |      |                                       |
|--------------------------|------|---------------------------------------|
| Determined Concentration | 45.6 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|------|---------------------------------------|

| Measured Values             |             |                |
|-----------------------------|-------------|----------------|
| Sampled Volume              | 1.043       | m <sup>3</sup> |
| Sampled gas Temperature     | 289.3846154 | k              |
| Sampled gas Pressure        | 103.41      | kPa            |
| Sampled gas Humidity        | 3.980021759 | % by volume    |
| Oxygen content              | n/a         | % by volume    |
| Concentration in Impinger 1 | 46.624      | mg/l           |
| Concentration in Impinger 2 | 0.05978     | mg/l           |
| Volume in Impingers         | 0.37        | litre          |
| Total Mass                  | 74.817      | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.04 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |                |
|--|-------|----------------|
| Sampled Volume                             | 0.001 | m <sup>3</sup> |
| Sampled gas Temperature                    | 2     | k              |
| Sampled gas Pressure                       | 1     | kPa            |
| Sampled gas Humidity                       | 1     | % by volume    |
| Oxygen content                             | 0.1   | % by volume    |
| Concentration in Impinger                  | 4     | %              |
| Volume in Impinger                         | 0.001 | litre          |
| Mass                                       | 3.018 | mg             |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |  |                 |
|---|-------------------------|--|-----------------|---|-------------------------|--|-----------------|
| Volume Correction Factor                      | 0.925                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |  |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |  | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0032                  |  | 0.0064          | Oxygen Measurement                            | 1                       |  | 0               |
| Sampled gas Pressure                          | 0.0089                  |  | 0.0089          |   |                         |  |                 |
| Sampled gas Humidity                          | 0.0096                  |  | 0.0096          |   |                         |  |                 |
|   | Sqrt (Uv)*2             |  | 0.0146          |   |                         |  |                 |
|   | Total Uv                |  | 0.015           |   | Total Uo                |  | 0               |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |       |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|-------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |       |
|                                      |        |                    |                         | Concentration            | %     |
| Volume Correction                    | 0.983  | m <sup>3</sup>     | 46.39                   | 0.71 mg.m <sup>-3</sup>  | 1.55% |
| Mass Analyte                         | 74.82  | mg                 | 0.61                    | 1.84 mg.m <sup>-3</sup>  | 4.03% |
| Oxygen Correction                    | 1.0000 |                    | 45.60                   | 0.00 mg.m <sup>-3</sup>  | 0.00% |
| System Leak                          | 0.01   | mg.m <sup>-3</sup> | 1.00                    | 0.01 mg.m <sup>-3</sup>  | 0.02% |
| Total Uncertainty                    |        |                    |                         | 1.97 mg.m <sup>-3</sup>  |       |

| Uncertainty Result     |  | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |
|------------------------|--|--|
| Expanded Uncertainty = |  | 3.9424 mg.m <sup>-3</sup>  |
| =>                     |  | 8.65 % of Result   |
| =>                     |  | 7.88 % of ELV  |

Company Name: Knauf Insulation Ltd  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 06/10/15  
Run: Particulate / Ammonia R2  
Sampling Point Ref: C Stack

In-stack Filter?  Bar. Press.mm Hg  K Factor   
Outstack Filter?  Cp  Dn used   
Operators  Bws%  Nozzle No.   
Meter Correction Yd

Ambient Temp.  Leak Rate (fin / %)   
Start Time  Leak Rate (start / %)   
Stop Time  Box/Probe setting

#### TPM

##### Sample

|                | Sample ID | Laboratory | Increase, mg |
|----------------|-----------|------------|--------------|
| Filter         | 122029    | RPS        | 109.74       |
| Probe Washings | 20009184  | RPS        | 23.18        |

#### Ammonia (H2SO4)

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009186 | 0.234        | 232  | 54.288      |
| 20009187 | 0.112        | 0.86 | 0.09632     |

##### Blank

|            | Sample ID | Laboratory | Increase, mg |
|------------|-----------|------------|--------------|
| Filter     | 110867    | RPS        | 1.5          |
| Probe Wash | 20009183  | RPS        | 0.5          |

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009185 | 0.13         | 0.1  | 0.013       |

##### Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 | 692     | 712.9 | 20.9        |
| Impinger 2 | 753.5   | 759.9 | 6.4         |
| Impinger 3 | 786     | 786   | 0.0         |
| Impinger 4 | 605.3   | 608.8 | 3.5         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel | 975.5   | 982.5 | 7.0         |
| Total      |         |       | 37.8        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
| A            | 0                 | 5                                 | 32                | 24.05                            | 24     | 5240                                | 15                                |                          | 120                      | 120                 | 1                           | 11                           | 2.236     |
|              | 5                 | 5                                 | 32                | 24.05                            | 19     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 12                           | 2.236     |
|              | 10                | 6                                 | 32                | 28.86                            | 29     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 13                           | 2.449     |
|              | 15                | 6                                 | 32                | 28.86                            | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 14                           | 2.449     |
|              | 20                | 5.5                               | 32                | 26.455                           | 26     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 15                           | 2.345     |
|              | 25                | 5                                 | 31                | 24.05                            | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 16                           | 2.236     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
| B            | 0                 | 5                                 | 31                | 24.05                            | 19     | 6390                                | 17                                |                          | 120                      | 120                 | 1                           | 13                           | 2.236     |
|              | 5                 | 5.5                               | 31                | 26.455                           | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 14                           | 2.345     |
|              | 10                | 5.5                               | 31                | 26.455                           | 20     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 15                           | 2.345     |
|              | 15                | 5                                 | 31                | 24.05                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 16                           | 2.236     |
|              | 20                | 6                                 | 31                | 28.86                            | 19     |                                     | 19                                |                          | 120                      | 120                 | 1                           | 17                           | 2.449     |
|              | 25                | 6                                 | 31                | 28.86                            | 19     |                                     | 19                                |                          | 120                      | 120                 | 1                           | 18                           | 2.449     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     | 19                                |                          |                          |                     |                             |                              |           |
|              | 60                | 5.5                               | 31.4              | 26.3                             | 20.9   | 1.150                               | 17.1                              | n/a                      | 120.0                    | 120.0               | 1.0                         | 14.5                         | 2.3       |

**Company Name: Knauf Insulation Ltd**

**Site Name: Queensferry**

**Project Reference: FTBS 35216**

**Date:**

**06/10/15**

**Run : 2**

| <b>Sampling Point Ref: C Stack</b>                  | <b>Total Particulate</b> |
|---|--------------------------|
| Meter Volume Sampled, acm                           | 1.150                    |
| <b>Sample Run Start Time</b>                        | <b>12:10</b>             |
| <b>Sample Run End Time</b>                          | <b>13:15</b>             |
| Total Actual Sampling Time, min                     | 60.0                     |
| Barometric Pressure, mm Hg                          | 748.00                   |
| Stack Pressure, mm Hg                               | 748.59                   |
| Average Stack Temp, °C                              | 31.4                     |
| Meter Volume at Wet STP, scm                        | 1.091                    |
| Stack Moisture Content, %                           | 4.3                      |
| Average Stack Velocity, m/sec                       | 8.031                    |
| Stack Flow Rate, scms wet, STP                      | 47.476                   |
| Nozzle Diameter, mm                                 | 7.00                     |
| <b>% Isokinetic Variation</b>                       | <b>110.8</b>             |
| Total Mass of Particulate, mg                       | 132.9                    |
| Percentage of Total Particulate Collected on Filter | 82.6                     |
| <b>Particulate Concentration, mg/m<sup>3</sup></b>  | <b>121.84</b>            |
| <b>Particulate Mass emission rate, kg/hour</b>      | <b>20.8237</b>           |
| Emission Limit Value                                | 50                       |

| <b>Total Particulate Sample Train Blank Results</b>       |             |
|---|-------------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 1.83        |
| Total Weight Gain, mg (Sample Train Blank)                | 2.00        |
| Blank Result Less than 10% of Limit Value                 | <b>PASS</b> |
| Isokinetic variation within 95 - 115% criteria ?          | <b>Pass</b> |

| <b>Sampling Point Ref: C Stack</b>         | <b>ammonia</b> |
|--|----------------|
| Impinger 1 20009186                        | 49.7621        |
| Impinger 2 20009187                        | 0.0883         |
| <b>NH3 Concentration, mg/m<sup>3</sup></b> | <b>49.85</b>   |
| <b>Ammonia Mass Emission Rate, kg/hour</b> | <b>8.1522</b>  |
| Emission Limit Value                       | 50             |

| <b>Ammonia Sample Train Impinger Efficiency / Blank Results</b> |             |
|---|-------------|
| Sample Blank Concentration, mg/m <sup>3</sup>                   | 0.0119      |
| Impinger Efficiency (%)   | 99.8        |
| Impinger Efficiency Less than 10% ?                             | <b>PASS</b> |

### Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |         |                                       |
|--------------------------|---------|---------------------------------------|
| Determined Concentration | 121.839 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|---------|---------------------------------------|

#### Measured Values

|                         |             |                |
|-------------------------|-------------|----------------|
| Sampled Volume          | 1.15        | m <sup>3</sup> |
| Sampled gas Temperature | 290.0769231 | k              |
| Sampled gas Pressure    | 99.81       | kPa            |
| Sampled gas Humidity    | 4.317224523 | % by volume    |
| Oxygen content          | n/a         | % by volume    |
| Mass                    | 132.92      | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.04 | %  |
| Uncollected Mass | 0    | mg |

#### Standard Uncertainties for Measured Values

|                         |            |                |
|-------------------------|------------|----------------|
| Sampled Volume          | 0.001      | m <sup>3</sup> |
| Sampled gas Temperature | 2          | k              |
| Sampled gas Pressure    | 1          | kPa            |
| Sampled gas Humidity    | 1          | % by volume    |
| Oxygen content          | 0.1        | % by volume    |
| Mass                    | 0.14152385 | mg             |

| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.887                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0031                              |  | 0.0061                      | Oxygen Measurement                            | N/A                     |                      | N/A                         |
| Sampled gas Pressure                          | 0.0089                              |  | 0.0089                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0093                              |  | 0.0093                      |   |                         |                      |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0142                      |   |                         |                      |                             |
|   | Total U <sub>v</sub>                |  | 0.016                       |   |                         | Total U <sub>o</sub> | N/A                         |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |      |   |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|------|---|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |      |   |
|                                      |        |                    |                         | Concentration            |      | % |
| Volume Correction                    | 1.044  | m <sup>3</sup>     | 116.72                  | 1.91 mg.m <sup>-3</sup>  | 1.57 | % |
| Mass (weighing)                      | 132.92 | mg                 | 0.92                    | 0.13 mg.m <sup>-3</sup>  | 0.11 | % |
| Oxygen Correction                    | N/A    |                    | 0.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 | % |
| System Leak                          | 0.02   | mg.m <sup>-3</sup> | 1.00                    | 0.02 mg.m <sup>-3</sup>  | 0.02 | % |
| Uncollected Mass                     | 0.00   | mg                 | 0.92                    | 0.00 mg.m <sup>-3</sup>  | 0.00 | % |
|                                      |        |                    | Total Uncertainty       | 1.92 mg.m <sup>-3</sup>  |      |   |

|                           |  |  |                    |  |  |  |
|---------------------------|--|--|--------------------|--|--|--|
| <b>Uncertainty Result</b> |  | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |  |  |  |
| Expanded Uncertainty =    |  | 3.84   | mg.m <sup>-3</sup> |  |  |  |
| =>                        |  | 3.15   | % of Result        |  |  |  |
| =>                        |  | 7.67   | % of ELV           |  |  |  |

## Uncertainty Calculation for Ammonia Run 2

|                          |      |                           |
|--------------------------|------|---------------------------|
| Determined Concentration | 49.9 | mg/m3 (at Reference Cond) |
|--------------------------|------|---------------------------|

| Measured Values             |             |                |
|-----------------------------|-------------|----------------|
| Sampled Volume              | 1.15        | m <sup>3</sup> |
| Sampled gas Temperature     | 290.0769231 | k              |
| Sampled gas Pressure        | 99.81       | kPa            |
| Sampled gas Humidity        | 4.317224523 | % by volume    |
| Oxygen content              | n/a         | % by volume    |
| Concentration in Impinger 1 | 54.288      | mg/l           |
| Concentration in Impinger 2 | 0.09632     | mg/l           |
| Volume in Impingers         | 0.346       | litre          |
| Total Mass                  | 74.817      | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.04 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |             |
|--|-------|-------------|
| Sampled Volume                             | 0.001 | m3          |
| Sampled gas Temperature                    | 2     | k           |
| Sampled gas Pressure                       | 1     | kPa         |
| Sampled gas Humidity                       | 1     | % by volume |
| Oxygen content                             | 0.1   | % by volume |
| Concentration in Impinger                  | 4     | %           |
| Volume in Impinger                         | 0.001 | litre       |
| Mass                                       | 3.020 | mg          |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |  |                 |
|---|-------------------------|--|-----------------|---|-------------------------|--|-----------------|
| Volume Correction Factor                      | 0.887                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |  |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |  | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0031                  |  | 0.0061          | Oxygen Measurement                            | 1                       |  | 0               |
| Sampled gas Pressure                          | 0.0089                  |  | 0.0089          |   |                         |  |                 |
| Sampled gas Humidity                          | 0.0093                  |  | 0.0093          |   |                         |  |                 |
|   | Sqrt (Uv)^2             |  | 0.0142          |   |                         |  |                 |
|   | Total Uv                |  | 0.016           |   | Total Uo                |  | 0               |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |                    |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |                    |        |
|                                      |        |                    |                         | Concentration            |                    | %      |
| Volume Correction                    | 1.044  | m3                 | 47.76                   | 0.78                     | mg.m <sup>-3</sup> | 1.57 % |
| Mass Analyte                         | 74.82  | mg                 | 0.67                    | 2.01                     | mg.m <sup>-3</sup> | 4.04 % |
| Oxygen Correction                    | 1.0000 |                    | 49.85                   | 0.00                     | mg.m <sup>-3</sup> | 0.00 % |
| System Leak                          | 0.01   | mg.m <sup>-3</sup> | 1.00                    | 0.01                     | mg.m <sup>-3</sup> | 0.02 % |
|                                      |        |                    | Total Uncertainty       | 2.16                     | mg.m <sup>-3</sup> |        |

| Uncertainty Result |                        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |
|--------------------|------------------------|--|--------------------|
|                    | Expanded Uncertainty = | 4.3178   | mg.m <sup>-3</sup> |
|                    | =>                     | 8.66   | % of Result        |
|                    | =>                     | 8.64   | % of ELV           |



Company Name: Knauf Insulation Ltd  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 06/10/15  
Run: Particulate / Ammonia R3  
Sampling Point Ref: C Stack

In-stack Filter?  Bar. Press.mm Hg  K Factor   
Outstack Filter?  Cp  Dn used   
Operators  Bws%  Nozzle No.   
Meter Correction Yd

Ambient Temp.  Leak Rate (fin / %)   
Start Time  Leak Rate (start / %)   
Stop Time  Box/Probe setting

#### TPM

##### Sample

|                | Sample ID | Laboratory | Increase, mg |
|----------------|-----------|------------|--------------|
| Filter         | 122404    | RPS        | 15.9         |
| Probe Washings | 20009216  | RPS        | 0.5          |

#### Ammonia (H2SO4)

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009199 | 0.206        | 148  | 30.488      |
| 20009200 | 0.107        | 0.61 | 0.06527     |

##### Blank

|            | Sample ID | Laboratory | Increase, mg |
|------------|-----------|------------|--------------|
| Filter     | 110867    | RPS        | 1.5          |
| Probe Wash | 20009183  | RPS        | 0.5          |

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009185 | 0.13         | 0.1  | 0.013       |

##### Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 | 674.8   | 690.2 | 15.4        |
| Impinger 2 | 745.9   | 748.2 | 2.3         |
| Impinger 3 | 772.5   | 772.7 | 0.2         |
| Impinger 4 | 608.8   | 611.2 | 2.4         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel | 957.7   | 968.4 | 10.7        |
| Total      |         |       | 31.0        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
| A            | 0                 | 4                                 | 31                | 19.24                            | 19     | 6858.5                              | 15                                |                          | 120                      | 120                 | 1                           | 12                           | 2.000     |
|              | 5                 | 3.5                               | 31                | 16.835                           | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 13                           | 1.871     |
|              | 10                | 4                                 | 31                | 19.24                            | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 14                           | 2.000     |
|              | 15                | 3.5                               | 31                | 16.835                           | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 15                           | 1.871     |
|              | 20                | 4                                 | 31                | 19.24                            | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 16                           | 2.000     |
|              | 25                | 4                                 | 31                | 19.24                            | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 17                           | 2.000     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
| B            | 0                 | 4                                 | 31                | 19.24                            | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 14                           | 2.000     |
|              | 5                 | 4.5                               | 31                | 21.645                           | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 15                           | 2.121     |
|              | 10                | 4                                 | 31                | 19.24                            | 20     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 16                           | 2.000     |
|              | 15                | 3.5                               | 31                | 16.835                           | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 17                           | 1.871     |
|              | 20                | 4                                 | 31                | 19.24                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 18                           | 2.000     |
|              | 25                | 4                                 | 31                | 19.24                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 19                           | 2.000     |
| Endpoint     | 30                |                                   |                   |                                  |        | 7754                                | 19                                |                          |                          |                     |                             |                              |           |
|              | 60                | 3.9                               | 31.0              | 18.8                             | 19.1   | 0.896                               | 17.2                              | n/a                      | 120.0                    | 120.0               | 1.0                         | 15.5                         | 2.0       |



**Company Name: Knauf Insulation Ltd**

**Site Name: Queensferry**

**Project Reference: FTBS 35216**

**Date:**

**06/10/15**

**Run : 3**

| <b>Sampling Point Ref: C Stack</b>                  | <b>Total Particulate</b> |
|---|--------------------------|
| Meter Volume Sampled, acm                           | 0.896                    |
| <b>Sample Run Start Time</b>                        | <b>15:24</b>             |
| <b>Sample Run End Time</b>                          | <b>16:29</b>             |
| Total Actual Sampling Time, min                     | 60.0                     |
| Barometric Pressure, mm Hg                          | 748.00                   |
| Stack Pressure, mm Hg                               | 748.59                   |
| Average Stack Temp, °C                              | 31.0                     |
| Meter Volume at Wet STP, scm                        | 0.850                    |
| Stack Moisture Content, %                           | 4.5                      |
| Average Stack Velocity, m/sec                       | 6.802                    |
| Stack Flow Rate, scms wet, STP                      | 40.267                   |
| Nozzle Diameter, mm                                 | 7.00                     |
| <b>% Isokinetic Variation</b>                       | <b>101.9</b>             |
| Total Mass of Particulate, mg                       | 16.4                     |
| Percentage of Total Particulate Collected on Filter | 97.0                     |
| <b>Particulate Concentration, mg/m<sup>3</sup></b>  | <b>19.28</b>             |
| <b>Particulate Mass emission rate, kg/hour</b>      | <b>2.7954</b>            |
| Emission Limit Value                                | <b>50</b>                |

| <b>Total Particulate Sample Train Blank Results</b>       |             |
|---|-------------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 2.35        |
| Total Weight Gain, mg (Sample Train Blank)                | 2.00        |
| Blank Result Less than 10% of Limit Value                 | <b>PASS</b> |
| Isokinetic variation within 95 - 115% criteria ?          | <b>Pass</b> |

| <b>Sampling Point Ref: C Stack</b>         | <b>Ammonia</b> |
|--|----------------|
| Impinger 1 20009199                        | 35.8494        |
| Impinger 2 20009200                        | 0.0767         |
| <b>NH3 Concentration, mg/m<sup>3</sup></b> | <b>35.93</b>   |
| <b>Ammonia Mass Emission Rate, kg/hour</b> | <b>5.2079</b>  |
| Emission Limit Value                       | <b>50</b>      |

| <b>Ammonia Sample Train Impinger Efficiency / Blank Results</b> |             |
|---|-------------|
| Sample Blank Concentration, mg/m <sup>3</sup>                   | 0.0153      |
| Impinger Efficiency (%)   | 99.8        |
| Impinger Efficiency Less than 10% ?                             | <b>PASS</b> |

### Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |        |                                       |
|--------------------------|--------|---------------------------------------|
| Determined Concentration | 19.284 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|--------|---------------------------------------|

#### Measured Values

|                         |             |                |
|-------------------------|-------------|----------------|
| Sampled Volume          | 0.8955      | m <sup>3</sup> |
| Sampled gas Temperature | 290.2307692 | k              |
| Sampled gas Pressure    | 99.81       | kPa            |
| Sampled gas Humidity    | 4.541843921 | % by volume    |
| Oxygen content          | n/a         | % by volume    |
| Mass                    | 16.4        | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.04 | %  |
| Uncollected Mass | 0    | mg |

#### Standard Uncertainties for Measured Values

|                         |            |                |
|-------------------------|------------|----------------|
| Sampled Volume          | 0.001      | m <sup>3</sup> |
| Sampled gas Temperature | 2          | k              |
| Sampled gas Pressure    | 1          | kPa            |
| Sampled gas Humidity    | 1          | % by volume    |
| Oxygen content          | 0.1        | % by volume    |
| Mass                    | 0.14152385 | mg             |

| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.885                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0030                              |  | 0.0061                      | Oxygen Measurement                            | N/A                     |                      | N/A                         |
| Sampled gas Pressure                          | 0.0089                              |  | 0.0089                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0093                              |  | 0.0093                      |   |                         |                      |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0142                      |   |                         |                      |                             |
|   | Total U <sub>v</sub>                |  | 0.013                       |   |                         | Total U <sub>o</sub> | N/A                         |

| Uncertainty Contributions (Itemised) |       |                    |                         |                          |      |   |
|--------------------------------------|-------|--------------------|-------------------------|--------------------------|------|---|
|                                      | Value |                    | Sensitivity coefficient | Uncertainty Contribution |      |   |
|                                      |       |                    |                         | Concentration            |      | % |
| Volume Correction                    | 0.812 | m <sup>3</sup>     | 23.75                   | 0.30 mg.m <sup>-3</sup>  | 1.57 | % |
| Mass (weighing)                      | 16.40 | mg                 | 1.18                    | 0.17 mg.m <sup>-3</sup>  | 0.86 | % |
| Oxygen Correction                    | N/A   |                    | 0.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 | % |
| System Leak                          | 0.00  | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.02 | % |
| Uncollected Mass                     | 0.00  | mg                 | 1.18                    | 0.00 mg.m <sup>-3</sup>  | 0.00 | % |
|                                      |       |                    | Total Uncertainty       | 0.35 mg.m <sup>-3</sup>  |      |   |

|                           |  |  |                    |  |  |  |
|---------------------------|--|--|--------------------|--|--|--|
| <b>Uncertainty Result</b> |  | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |  |  |  |
| Expanded Uncertainty =    |  | 0.69   | mg.m <sup>-3</sup> |  |  |  |
| =>                        |  | 3.59   | % of Result        |  |  |  |
| =>                        |  | 1.38   | % of ELV           |  |  |  |

### Uncertainty Calculation for Ammonia Run 3

|                          |      |                           |
|--------------------------|------|---------------------------|
| Determined Concentration | 35.9 | mg/m3 (at Reference Cond) |
|--------------------------|------|---------------------------|

| Measured Values             |             |                |
|-----------------------------|-------------|----------------|
| Sampled Volume              | 0.8955      | m <sup>3</sup> |
| Sampled gas Temperature     | 290.2307692 | k              |
| Sampled gas Pressure        | 99.81       | kPa            |
| Sampled gas Humidity        | 4.541843921 | % by volume    |
| Oxygen content              | n/a         | % by volume    |
| Concentration in Impinger 1 | 30.488      | mg/l           |
| Concentration in Impinger 2 | 0.06527     | mg/l           |
| Volume in Impingers         | 0.313       | litre          |
| Total Mass                  | 74.817      | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.04 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |             |
|--|-------|-------------|
| Sampled Volume                             | 0.001 | m3          |
| Sampled gas Temperature                    | 2     | k           |
| Sampled gas Pressure                       | 1     | kPa         |
| Sampled gas Humidity                       | 1     | % by volume |
| Oxygen content                             | 0.1   | % by volume |
| Concentration in Impinger                  | 4     | %           |
| Volume in Impinger                         | 0.001 | litre       |
| Mass                                       | 3.022 | mg          |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |  |                 |
|---|-------------------------|--|-----------------|---|-------------------------|--|-----------------|
| Volume Correction Factor                      | 0.885                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |  |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |  | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0030                  |  | 0.0061          | Oxygen Measurement                            | 1                       |  | 0               |
| Sampled gas Pressure                          | 0.0089                  |  | 0.0089          |   |                         |  |                 |
| Sampled gas Humidity                          | 0.0093                  |  | 0.0093          |   |                         |  |                 |
|   | Sqrt (Uv)*2             |  | 0.0142          |   |                         |  |                 |
|   | Total Uv                |  | 0.013           |   | Total Uo                |  | 0               |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.812  | m3                 | 44.25                   | 0.56 mg.m <sup>-3</sup>  | 1.57 % |
| Mass Analyte                         | 74.82  | mg                 | 0.48                    | 1.45 mg.m <sup>-3</sup>  | 4.04 % |
| Oxygen Correction                    | 1.0000 |                    | 35.93                   | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.01   | mg.m <sup>-3</sup> | 1.00                    | 0.01 mg.m <sup>-3</sup>  | 0.02 % |
| Total Uncertainty                    |        |                    |                         | 1.56 mg.m <sup>-3</sup>  |        |

| Uncertainty Result     |        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |
|------------------------|--------|--|
| Expanded Uncertainty = | 3.1145 | mg.m <sup>-3</sup>   |
| =>                     | 8.67   | % of Result  |
| =>                     | 6.23   | % of ELV   |

Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: C

Date: 06/10/15  
Run: Total VOC : Run 1

|                | VOC (as Carbon)<br>ppm | VOC (as Carbon)<br>mg/m <sup>3</sup> | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m <sup>3</sup> | VOC (as Toluene)<br>kg/h | Oxygen<br>% |
|----------------|------------------------|--------------------------------------|-------------------------|---------------------------------------|--------------------------|-------------|
| Average        | 17.17                  | 27.59                                | 4.55                    | 32.82                                 | 4.98                     | n/a         |
| Max            | 98.80                  | 158.79                               | 24.11                   | 173.91                                | 26.40                    | 0.00        |
| Min            | 11.10                  | 17.84                                | 2.71                    | 19.54                                 | 2.97                     | 0.00        |
| Emission Limit |                        | 50.00                                |                         |                                       |                          |             |
| Moisture, %    | n/a                    |                                      |                         |                                       |                          |             |

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms WET) O<sub>2</sub> Corrected 42.16947377

| Calibrations            | ppm     |
|-------------------------|---------|
| Analyser - Start Zero   | 0.00    |
| Analyser - Start Span   | 76.00   |
| Analyser - Zero Check   | 0.10    |
| System - Zero Check     | 0.20    |
| System - Span Check     | 75.50   |
| System - End Zero Check | 0.20    |
| System - End Span Check | 75.00   |
| Cylinder Number         | 0161060 |
| Span Value              | 76.00   |
| Analyser Range (0 - X)  | 0 - 100 |

Stack Ref: C  
Cont....

### ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |        |
|--|--------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 27.59  |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.71 |

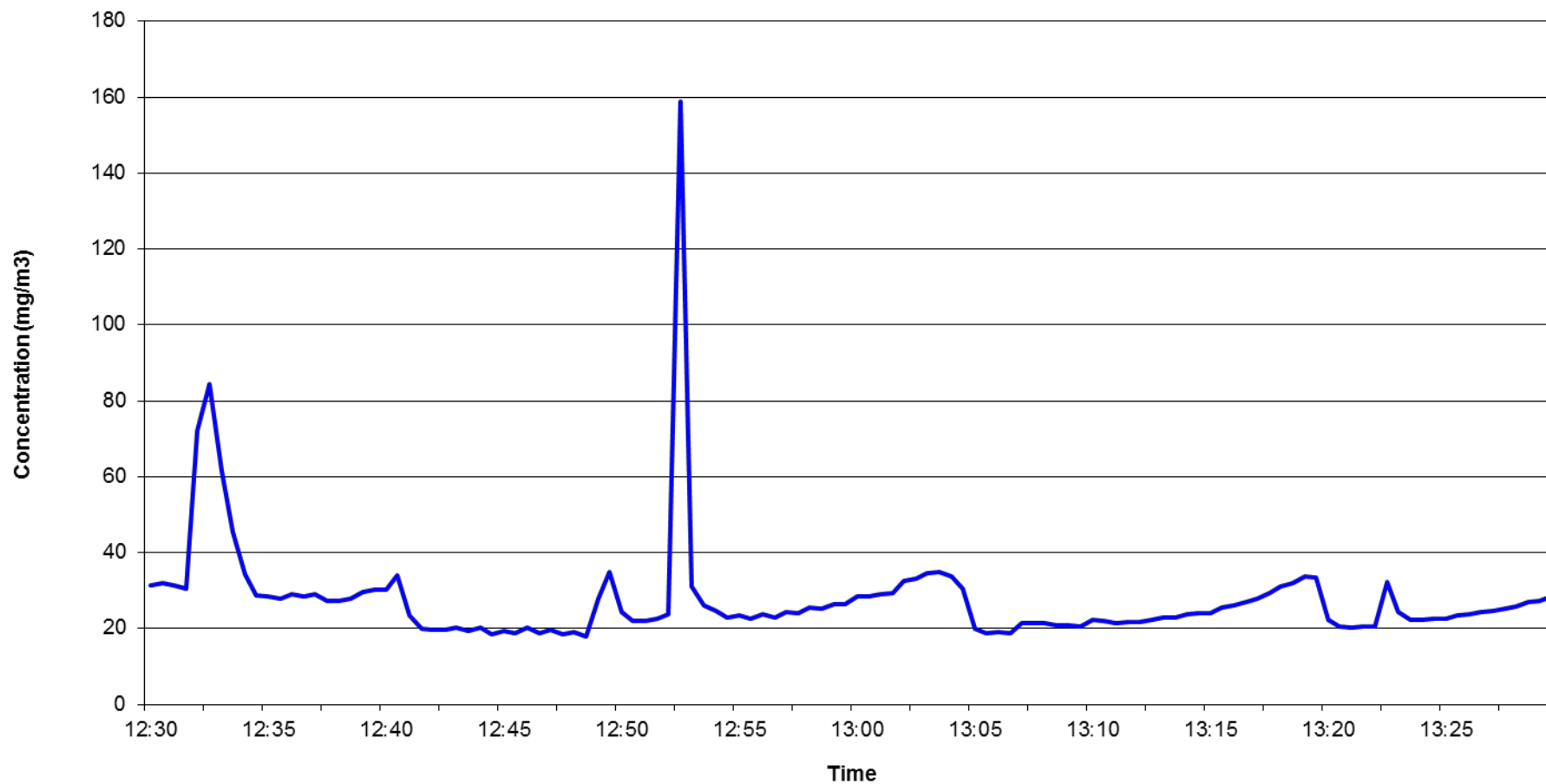
| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

| Selected Performance Characteristic | Value of Performance Characteristic |           |                             | Operating Conditions compared to calibration condition |                                     |                             |
|-------------------------------------|-------------------------------------|-----------|-----------------------------|--|-------------------------------------|-----------------------------|
|                                     | %                                   | Numerical | Units                       | Required   | Variable due to sampling conditions | Units                       |
| Response Time                       | 2                                   | 0.02      | minutes                     | 0.02   | 1                                   | minutes                     |
| Deviation from Linearity            | 1                                   | 0.01      | % FS                        | 0.01   | 1                                   | % FS                        |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS                        | 0.01   | 1                                   | % FS                        |
| 8 Hour Drift                        | 2                                   | 0.02      | %                           | 0.02   | 1                                   | %                           |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa                       | 0.001  | 1                                   | % kPa                       |
| Temperature Dependence              | 0.2                                 | 0.002     | %K                          | 0.002  | 1                                   | %K                          |
| Sum Interference                    | 2                                   | 0.02      | %                           | 0.02   | 2                                   | %                           |
| Voltage Supply                      | 0.1                                 | 0.001     | %V                          | 0.001  | 1                                   | %V                          |
| Losses in sample line               | 2                                   | 0.02      | %                           | 0.02   | 2                                   | %                           |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %                           | 0.02   | 1                                   | %                           |
| Calibration Error (Gas Divider)     | 0.5                                 | 0.005     | %                           | 0.005  | 1                                   | %                           |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H <sub>2</sub> O Error | 0.01   | 2                                   | %Vol H <sub>2</sub> O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %                           | 0.02   | 2                                   | %                           |

| Measurement Performance related to stationary conditions |                              |                      |                               |            |                |                        |          |                |
|--|------------------------------|----------------------|-------------------------------|------------|----------------|------------------------|----------|----------------|
| Performance Characteristic                               |                              | Uncertainty Quantity | Value of Uncertainty Quantity |            |                |                        |          |                |
|  |                              |                      | At Calibration Conditions     |            |                | At Sampling Conditions |          |                |
|  |                              |                      | Units                         | U          | U <sup>2</sup> | Units                  | U        | U <sup>2</sup> |
| Response Time  | U <sub>response</sub>        |                      | minutes                       | 1.856      | 3.444          | minutes                | 0.319    | 0.102          |
| Deviation from Linearity                                 | U <sub>Fit</sub>             |                      | % FS                          | 1.60714286 | 2.583          | % FS                   | 0.275933 | 0.076          |
| Repeatability Standard Deviation                         | U <sub>R</sub>               |                      | % FS                          | 0.159      | 0.025          | % FS                   | 0.159    | 0.025          |
| 8 Hour Drift   | U <sub>drift</sub>           |                      | %                             | 0.3186     | 0.102          | %                      | 0.319    | 0.102          |
| Atmospheric Pressure Dependence                          | U <sub>Atmos</sub>           |                      | % / kPa                       | 0.016      | 0.000          | % / kPa                | 0.016    | 0.000          |
| Temperature Dependence                                   | U <sub>Temp</sub>            |                      | % / K                         | 0.032      | 0.001          | % / K                  | 0.032    | 0.001          |
| Sum Interference   | U <sub>Interference</sub>    |                      | %                             | 0.319      | 0.102          | %                      | 0.016    | 0.000          |
| Voltage Supply   | U <sub>Voltage</sub>         |                      | % / V                         | 0.016      | 0.000          | % / V                  | 0.016    | 0.000          |
| Losses in sample line                                    | U <sub>Losses, TOC</sub>     |                      | %                             | 0.319      | 0.102          | %                      | 0.637    | 0.406          |
| Uncertainty of Calibration Gas                           | U <sub>Calibration gas</sub> |                      | %                             | 0.319      | 0.102          | %                      | 0.319    | 0.102          |
| Calibration Error (Gas Divider)                          | U <sub>gas divider</sub>     |                      | %                             | 0.080      | 0.006          | %                      | 0.080    | 0.006          |
| Loss in sample line (Leaks)                              | U <sub>Losses, leak</sub>    |                      | %                             | 0.319      | 0.102          | %                      | 0.637    | 0.406          |
| Sum  |                              |                      |                               | 5.359      | 6.568          | Sum                    | 2.825    | 1.226          |

|                            |             |                     |
|----------------------------|-------------|---------------------|
| Measurement Uncertainty at | 27.59330357 | mg/m <sup>3</sup> C |
| U <sub>tot</sub>           | 1.107       | mg/m <sup>3</sup> C |
| U <sub>rel</sub> /C        | 4.013       | %                   |
| U <sub>limit</sub>         | 30          | %                   |

**TOC Run 1 Emissions Profile from Stack C on 6th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, **without correction for oxygen or moisture content.***



Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: C

Date: 06/10/15  
Run: Total VOC : Run 2

|                | VOC (as Carbon)<br>ppm | VOC (as Carbon)<br>mg/m <sup>3</sup> | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m <sup>3</sup> | VOC (as Toluene)<br>kg/h | Oxygen<br>% |
|----------------|------------------------|--------------------------------------|-------------------------|---------------------------------------|--------------------------|-------------|
| Average        | 13.55                  | 21.78                                | 3.34                    | 24.07                                 | 3.65                     | n/a         |
| Max            | 28.30                  | 45.48                                | 5.47                    | 39.43                                 | 5.99                     | 0.00        |
| Min            | 9.50                   | 15.27                                | 2.85                    | 20.59                                 | 3.13                     | 0.00        |
| Emission Limit |                        | 50.00                                |                         |                                       |                          |             |
| Moisture, %    | 3.0                    |                                      |                         |                                       |                          |             |

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms WET) O2 Corrected 42.16947377

| Calibrations            | ppm     |
|-------------------------|---------|
| Analyser - Start Zero   | 0.00    |
| Analyser - Start Span   | 76.00   |
| Analyser - Zero Check   | 0.10    |
| System - Zero Check     | 0.20    |
| System - Span Check     | 75.50   |
| System - End Zero Check | 0.20    |
| System - End Span Check | 75.00   |
| Cylinder Number         | 0161060 |
| Span Value              | 76.00   |
| Analyser Range (0 - X)  | 0 - 100 |

Stack Ref: C  
Cont....

### ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |        |
|--|--------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 21.78  |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.71 |

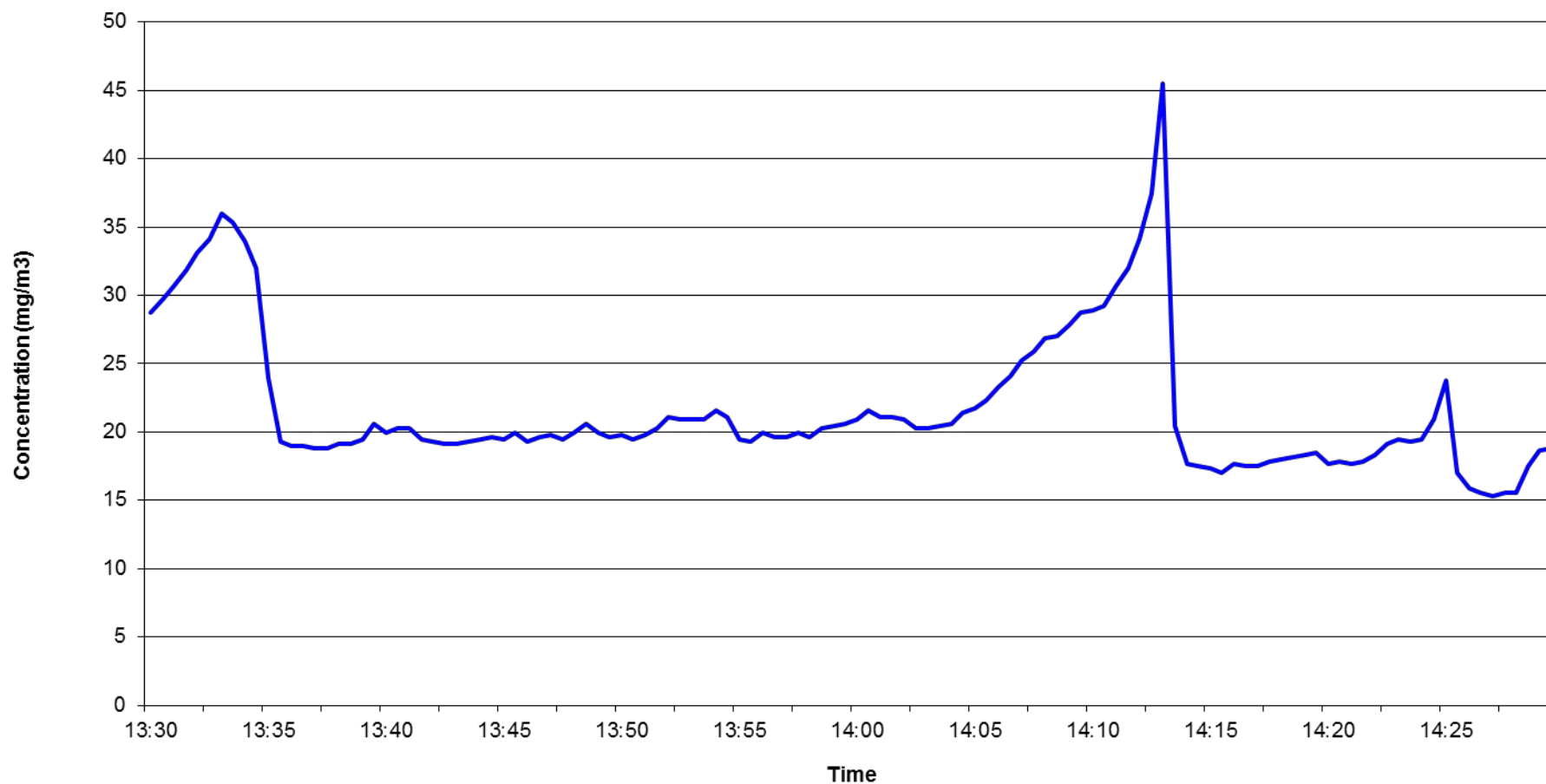
| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

| Selected Performance Characteristic | Value of Performance Characteristic |           |                | Operating Conditions compared to calibration condition |                                     |                |
|-------------------------------------|-------------------------------------|-----------|----------------|--|-------------------------------------|----------------|
|                                     | %                                   | Numerical | Units          | Required   | Variable due to sampling conditions | Units          |
| Response Time                       | 2                                   | 0.02      | minutes        | 0.02   | 1                                   | minutes        |
| Deviation from Linearity            | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| 8 Hour Drift                        | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa          | 0.001  | 1                                   | % kPa          |
| Temperature Dependence              | 0.2                                 | 0.002     | %K             | 0.002  | 1                                   | %K             |
| Sum Interference                    | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Voltage Supply                      | 0.1                                 | 0.001     | %V             | 0.001  | 1                                   | %V             |
| Losses in sample line               | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Calibration Error (Gas Divider)     | 0.5                                 | 0.005     | %              | 0.005  | 1                                   | %              |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H2O Error | 0.01   | 2                                   | %Vol H2O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |

| Measurement Performance related to stationary conditions |  |                              |                               |            |                |                        |           |                |
|--|--|------------------------------|-------------------------------|------------|----------------|------------------------|-----------|----------------|
| Performance Characteristic                               |  | Uncertainty Quantity         | Value of Uncertainty Quantity |            |                |                        |           |                |
|  |  |                              | At Calibration Conditions     |            |                | At Sampling Conditions |           |                |
|  |  |                              | Units                         | U          | U <sup>2</sup> | Units                  | U         | U <sup>2</sup> |
| Response Time  |  | U <sub>response</sub>        | minutes                       | 1.856      | 3.444          | minutes                | 0.252     | 0.063          |
| Deviation from Linearity                                 |  | U <sub>Fit</sub>             | % FS                          | 1.60714286 | 2.583          | % FS                   | 0.2178214 | 0.047          |
| Repeatability Standard Deviation                         |  | U <sub>R</sub>               | % FS                          | 0.126      | 0.016          | % FS                   | 0.126     | 0.016          |
| 8 Hour Drift   |  | U <sub>drift</sub>           | %                             | 0.2515     | 0.063          | %                      | 0.252     | 0.063          |
| Atmospheric Pressure Dependence                          |  | U <sub>Atmos</sub>           | % / kPa                       | 0.013      | 0.000          | % / kPa                | 0.013     | 0.000          |
| Temperature Dependence                                   |  | U <sub>temp</sub>            | % / K                         | 0.025      | 0.001          | % / K                  | 0.025     | 0.001          |
| Sum Interference   |  | U <sub>interference</sub>    | %                             | 0.252      | 0.063          | %                      | 0.013     | 0.000          |
| Voltage Supply   |  | U <sub>voltage</sub>         | % / V                         | 0.013      | 0.000          | % / V                  | 0.013     | 0.000          |
| Losses in sample line                                    |  | U <sub>Losses, TOC</sub>     | %                             | 0.252      | 0.063          | %                      | 0.503     | 0.253          |
| Uncertainty of Calibration Gas                           |  | U <sub>calibration gas</sub> | %                             | 0.252      | 0.063          | %                      | 0.252     | 0.063          |
| Calibration Error (Gas Divider)                          |  | U <sub>gas divider</sub>     | %                             | 0.063      | 0.004          | %                      | 0.063     | 0.004          |
| Loss in sample line (Leaks)                              |  | U <sub>Losses, leak</sub>    | %                             | 0.252      | 0.063          | %                      | 0.503     | 0.253          |
| Sum  |  |                              |                               | 4.959      | 6.364          | Sum                    | 2.230     | 0.764          |

|                                |             |                     |
|--------------------------------|-------------|---------------------|
| Measurement Uncertainty at     | 21.78214286 | mg/m <sup>3</sup> C |
| U <sub>tot</sub>               | 0.874       | mg/m <sup>3</sup> C |
| U <sub>tot</sub> <sup>7c</sup> | 4.013       | %                   |
| U <sub>limit</sub>             | 30          | %                   |

**TOC Run 2 Emissions Profile from Stack C on 6th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*



Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: CDate: 06/10/15  
Run: Total VOC : Run 3

|                | VOC (as Carbon)<br>ppm | VOC (as Carbon)<br>mg/m <sup>3</sup> | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m <sup>3</sup> | VOC (as Toluene)<br>kg/h | Oxygen<br>% |
|----------------|------------------------|--------------------------------------|-------------------------|---------------------------------------|--------------------------|-------------|
| Average        | 10.54                  | 16.93                                | 2.57                    | 18.56                                 | 2.82                     | n/a         |
| Max            | 11.60                  | 18.64                                | 2.83                    | 20.42                                 | 3.10                     | 0.00        |
| Min            | 9.70                   | 15.59                                | 2.37                    | 17.07                                 | 2.59                     | 0.00        |
| Emission Limit |                        | 50.00                                |                         |                                       |                          |             |
| Moisture, %    | n/a                    |                                      |                         |                                       |                          |             |

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms WET) O<sub>2</sub> Corrected 42.16947377

| Calibrations            | ppm     |
|-------------------------|---------|
| Analyser - Start Zero   | 0.00    |
| Analyser - Start Span   | 76.00   |
| Analyser - Zero Check   | 0.10    |
| System - Zero Check     | 0.20    |
| System - Span Check     | 75.50   |
| System - End Zero Check | 0.20    |
| System - End Span Check | 75.00   |
| Cylinder Number         | 0161060 |
| Span Value              | 76.00   |
| Analyser Range (0 - X)  | 0 - 100 |

Stack Ref: C  
Cont....

## ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |        |
|--|--------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 16.93  |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.71 |

| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

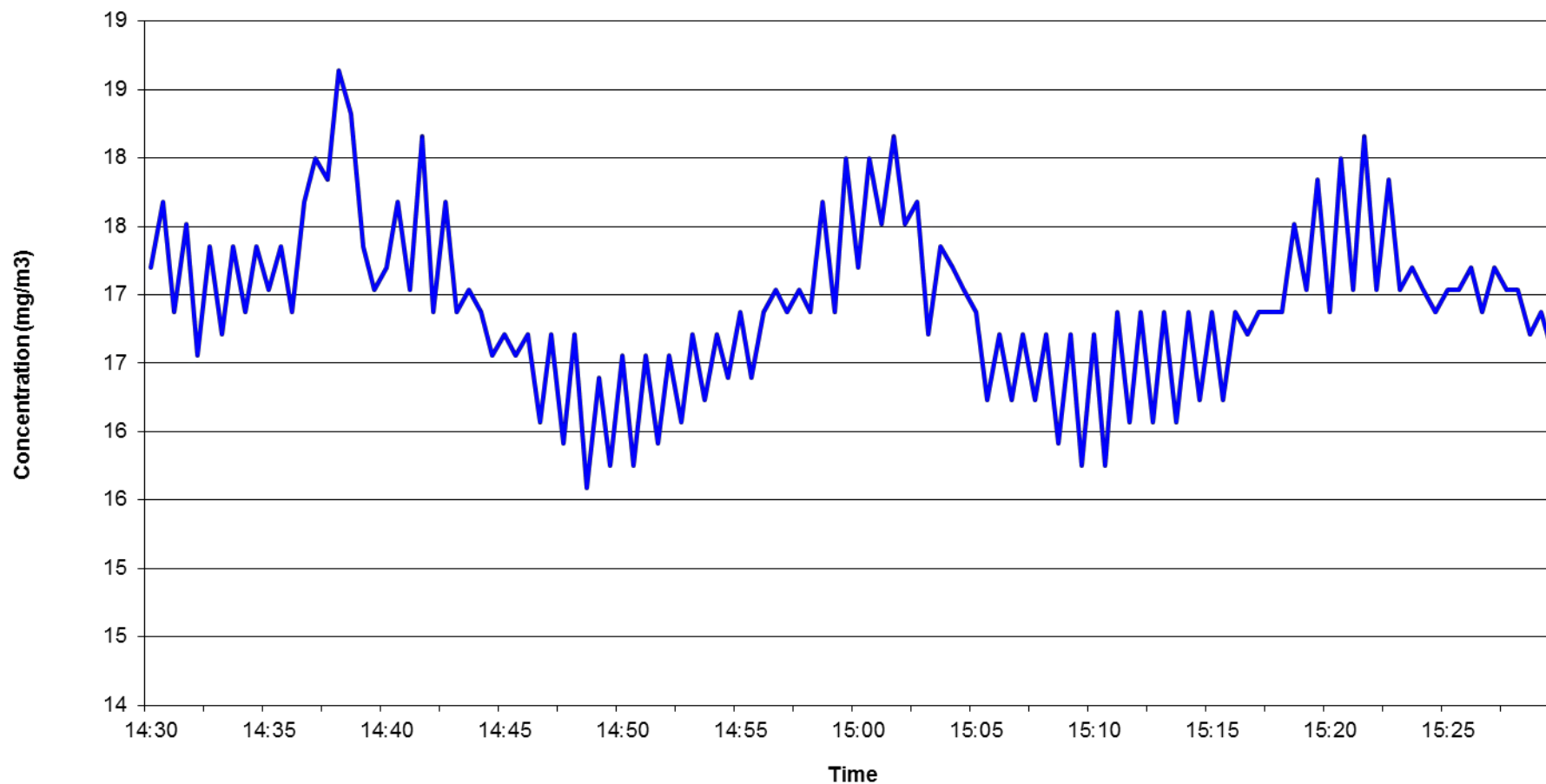
| Selected Performance Characteristic | Value of Performance Characteristic |           |                             | Operating Conditions compared to calibration condition |                                     |                             |
|-------------------------------------|-------------------------------------|-----------|-----------------------------|--|-------------------------------------|-----------------------------|
|                                     | %                                   | Numerical | Units                       | Required   | Variable due to sampling conditions | Units                       |
| Response Time                       | 2                                   | 0.02      | minutes                     | 0.02   | 1                                   | minutes                     |
| Deviation from Linearity            | 1                                   | 0.01      | % FS                        | 0.01   | 1                                   | % FS                        |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS                        | 0.01   | 1                                   | % FS                        |
| 8 Hour Drift                        | 2                                   | 0.02      | %                           | 0.02   | 1                                   | %                           |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa                       | 0.001  | 1                                   | % kPa                       |
| Temperature Dependence              | 0.2                                 | 0.002     | %K                          | 0.002  | 1                                   | %K                          |
| Sum Interference                    | 2                                   | 0.02      | %                           | 0.02   | 2                                   | %                           |
| Voltage Supply                      | 0.1                                 | 0.001     | %V                          | 0.001  | 1                                   | %V                          |
| Losses in sample line               | 2                                   | 0.02      | %                           | 0.02   | 2                                   | %                           |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %                           | 0.02   | 1                                   | %                           |
| Calibration Error (Gas Divider)     | 0.5                                 | 0.005     | %                           | 0.005  | 1                                   | %                           |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H <sub>2</sub> O Error | 0.01   | 2                                   | %Vol H <sub>2</sub> O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %                           | 0.02   | 2                                   | %                           |

| Measurement Performance related to stationary conditions |  |                              |                               |            |                |                        |           |                |
|--|--|------------------------------|-------------------------------|------------|----------------|------------------------|-----------|----------------|
| Performance Characteristic                               |  | Uncertainty Quantity         | Value of Uncertainty Quantity |            |                |                        |           |                |
|  |  |                              | At Calibration Conditions     |            |                | At Sampling Conditions |           |                |
|  |  |                              | Units                         | U          | U <sup>2</sup> | Units                  | U         | U <sup>2</sup> |
| Response Time  |  | U <sub>response</sub>        | minutes                       | 1.856      | 3.444          | minutes                | 0.196     | 0.038          |
| Deviation from Linearity                                 |  | U <sub>Fit</sub>             | % FS                          | 1.60714286 | 2.583          | % FS                   | 0.1693259 | 0.029          |
| Repeatability Standard Deviation                         |  | U <sub>R</sub>               | % FS                          | 0.098      | 0.010          | % FS                   | 0.098     | 0.010          |
| 8 Hour Drift   |  | U <sub>drift</sub>           | %                             | 0.1955     | 0.038          | %                      | 0.196     | 0.038          |
| Atmospheric Pressure Dependence                          |  | U <sub>Atmos</sub>           | % / kPa                       | 0.010      | 0.000          | % / kPa                | 0.010     | 0.000          |
| Temperature Dependence                                   |  | U <sub>Temp</sub>            | % / K                         | 0.020      | 0.000          | % / K                  | 0.020     | 0.000          |
| Sum Interference   |  | U <sub>Interference</sub>    | %                             | 0.196      | 0.038          | %                      | 0.010     | 0.000          |
| Voltage Supply   |  | U <sub>Voltage</sub>         | % / V                         | 0.010      | 0.000          | % / V                  | 0.010     | 0.000          |
| Losses in sample line                                    |  | U <sub>Losses, TOC</sub>     | %                             | 0.196      | 0.038          | %                      | 0.391     | 0.153          |
| Uncertainty of Calibration Gas                           |  | U <sub>Calibration gas</sub> | %                             | 0.196      | 0.038          | %                      | 0.196     | 0.038          |
| Calibration Error (Gas Divider)                          |  | U <sub>gas divider</sub>     | %                             | 0.049      | 0.002          | %                      | 0.049     | 0.002          |
| Loss in sample line (Leaks)                              |  | U <sub>Losses, leak</sub>    | %                             | 0.196      | 0.038          | %                      | 0.391     | 0.153          |
| Sum  |  |                              |                               | 4.626      | 6.230          | Sum                    | 1.733     | 0.462          |

|                            |             |                     |
|----------------------------|-------------|---------------------|
| Measurement Uncertainty at | 16.93258929 | mg/m <sup>3</sup> C |
| U <sub>tot</sub>           | 0.680       | mg/m <sup>3</sup> C |
| U <sub>tot</sub> / C       | 4.013       | %                   |
| U <sub>limit</sub>         | 30          | %                   |



**TOC Run 3 Emissions Profile from Stack C on 6th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*



Company Name: Knauf Insulation Ltd  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 07/10/15  
Run: Formaldehyde R1  
Sampling Point Ref: C Stack

In-stack Filter?  Bar. Press.mm Hg   
Outstack Filter?  Cp   
Operators  Bws%   
K Factor   
Dn used   
Nozzle No.   
Meter Correction Yd   
Ambient Temp.   
Start Time   
Stop Time   
Leak Rate (fin / %)   
Leak Rate (start / %)   
Box/Probe setting

### Formaldehyde

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009202 | 0.219        | 3.2  | 0.7008      |
| 20009203 | 0.116        | 0.1  | 0.0116      |

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009201 | 0.124        | 0.1  | 0.0124      |

### Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 | 669.1   | 684.8 | 15.7        |
| Impinger 2 | 776.4   | 779.4 | 3.0         |
| Impinger 3 | 775.2   | 775   | -0.2        |
| Impinger 4 | 602.5   | 603.9 | 1.4         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel | 968.4   | 977.8 | 9.4         |
|            |         | Total | 29.3        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p. |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
| A            | 0                 | 4.5                               | 36                | 21.645                           | 22     | 7793                                | 12                                |                          | 120                      | 120                 | 1                           | 9                            | 2.121     |
|              | 5                 | 5                                 | 36                | 24.05                            | 19     |                                     | 13                                |                          | 120                      | 120                 | 1                           | 9                            | 2.236     |
|              | 10                | 4.5                               | 36                | 21.645                           | 22     |                                     | 14                                |                          | 120                      | 120                 | 1                           | 10                           | 2.121     |
|              | 15                | 4.5                               | 35                | 21.645                           | 19     |                                     | 14                                |                          | 120                      | 120                 | 1                           | 11                           | 2.121     |
|              | 20                | 5                                 | 35                | 24.05                            | 24     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 12                           | 2.236     |
|              | 25                | 5                                 | 35                | 24.05                            | 19     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 13                           | 2.236     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
| B            | 0                 | 5                                 | 35                | 24.05                            | 19     | 8740                                | 15                                |                          | 120                      | 120                 | 1                           | 11                           | 2.236     |
|              | 5                 | 4.5                               | 35                | 21.645                           | 19     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 12                           | 2.121     |
|              | 10                | 4.5                               | 35                | 21.645                           | 20     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 13                           | 2.121     |
|              | 15                | 4                                 | 35                | 19.24                            | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 14                           | 2.000     |
|              | 20                | 4.5                               | 35                | 21.645                           | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 16                           | 2.121     |
|              | 25                | 4.5                               | 35                | 21.645                           | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 17                           | 2.121     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
|              | 60                | 4.6                               | 35.3              | 22.2                             | 19.9   | 0.947                               | 14.8                              | n/a                      | 120.0                    | 120.0               | 1.0                         | 12.3                         | 2.1       |

**Company Name: Knauf Insulation Ltd**

**Site Name: Queensferry**

**Project Reference: FTBS 35216**

**Date:**

**07/10/15**

**Run : 1**

| <b>Sampling Point Ref: C Stack</b> | <b>Total Particulate</b> |
|------------------------------------|--------------------------|
| Meter Volume Sampled, acm          | 0.947                    |
| <b>Sample Run Start Time</b>       | <b>9:45</b>              |
| <b>Sample Run End Time</b>         | <b>10:50</b>             |
| Total Actual Sampling Time, min    | 60.0                     |
| Barometric Pressure, mm Hg         | 775.00                   |
| Stack Pressure, mm Hg              | 775.59                   |
| Average Stack Temp, °C             | 35.3                     |
| Meter Volume at Wet STP, scm       | 0.934                    |
| Stack Moisture Content, %          | 3.9                      |
| Average Stack Velocity, m/sec      | 7.304                    |
| Stack Flow Rate, scms wet, STP     | 44.182                   |
| Nozzle Diameter, mm                | 7.00                     |
| <b>% Isokinetic Variation</b>      | <b>101.9</b>             |

| <b>Sampling Point Ref: C Stack</b>                  | <b>Formaldehyde</b> |
|---|---------------------|
| Impinger 1 20009202                                 | 0.7506              |
| Impinger 2 20009203                                 | 0.0124              |
| <b>Formaldehyde Concentration, mg/m<sup>3</sup></b> | <b>0.76</b>         |
| <b>Formaldehyde Mass Emission Rate, kg/hour</b>     | <b>0.1214</b>       |
| Emission Limit Value                                | <b>10</b>           |

| <b>Formaldehyde Sample Train Impinger Efficiency / Blank Results</b> |             |
|--|-------------|
| Sample Blank Concentration, mg/m <sup>3</sup>                        | 0.0133      |
| Impinger Efficiency (%)  | 98.4        |
| Impinger Efficiency Less than 10% ?                                  | <b>PASS</b> |

### Uncertainty Calculation for Formaldehyde Run 1

|                          |     |                           |
|--------------------------|-----|---------------------------|
| Determined Concentration | 0.8 | mg/m3 (at Reference Cond) |
|--------------------------|-----|---------------------------|

| Measured Values             |             |                |
|-----------------------------|-------------|----------------|
| Sampled Volume              | 0.947       | m <sup>3</sup> |
| Sampled gas Temperature     | 287.8461538 | k              |
| Sampled gas Pressure        | 103.41      | kPa            |
| Sampled gas Humidity        | 3.910405471 | % by volume    |
| Oxygen content              | n/a         | % by volume    |
| Concentration in Impinger 1 | 0.7008      | mg/l           |
| Concentration in Impinger 2 | 0.0116      | mg/l           |
| Volume in Impingers         | 0.335       | litre          |
| Total Mass                  | 74.817      | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.05 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |             |
|--|-------|-------------|
| Sampled Volume                             | 0.001 | m3          |
| Sampled gas Temperature                    | 2     | k           |
| Sampled gas Pressure                       | 1     | kPa         |
| Sampled gas Humidity                       | 1     | % by volume |
| Oxygen content                             | 0.1   | % by volume |
| Concentration in Impinger                  | 3.5   | %           |
| Volume in Impinger                         | 0.001 | litre       |
| Mass                                       | 2.650 | mg          |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |          |                 |
|---|-------------------------|--|-----------------|---|-------------------------|----------|-----------------|
| Volume Correction Factor                      | 0.930                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |          |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |          | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0032                  |  | 0.0065          | Oxygen Measurement                            | 1                       |          | 0               |
| Sampled gas Pressure                          | 0.0090                  |  | 0.0090          |   |                         |          |                 |
| Sampled gas Humidity                          | 0.0097                  |  | 0.0097          |   |                         |          |                 |
|   | Sqrt (Uv)^2             |  | 0.0147          |   |                         |          |                 |
|   | Total Uv                |  | 0.014           |   |                         | Total Uo | 0               |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |                    |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |                    |        |
|                                      |        |                    |                         | Concentration            |                    | %      |
| Volume Correction                    | 0.897  | m3                 | 0.85                    | 0.01                     | mg.m <sup>-3</sup> | 1.56 % |
| Mass Analyte                         | 74.82  | mg                 | 0.01                    | 0.03                     | mg.m <sup>-3</sup> | 3.54 % |
| Oxygen Correction                    | 1.0000 |                    | 0.76                    | 0.00                     | mg.m <sup>-3</sup> | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00                     | mg.m <sup>-3</sup> | 0.03 % |
|                                      |        |                    | Total Uncertainty       | 0.03                     | mg.m <sup>-3</sup> |        |

| Uncertainty Result |                        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |
|--------------------|------------------------|--|--------------------|
|                    | Expanded Uncertainty = | 0.0591   | mg.m <sup>-3</sup> |
|                    | =>                     | 7.74   | % of Result        |
|                    | =>                     | 0.59   | % of ELV           |

Company Name: Knauf Insulation Ltd  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 07/10/15  
Run: Formaldehyde R2  
Sampling Point Ref: C Stack

In-stack Filter?  Bar. Press.mm Hg   
Outstack Filter?  Cp   
Operators  Bws%   
Meter Correction Yd

K Factor   
Dn used   
Nozzle No.   
Ambient Temp.   
Start Time   
Stop Time   
Leak Rate (fin / %)   
Leak Rate (start / %)   
Box/Probe setting

## Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 | 726.7   | 740   | 13.3        |
| Impinger 2 | 803.6   | 810.4 | 6.8         |
| Impinger 3 | 777.5   | 777.6 | 0.1         |
| Impinger 4 | 591.2   | 602.9 | 11.7        |
| Impinger 5 |         |       | 0.0         |
| Silica Gel | 968.2   | 975.1 | 6.9         |
| Total      |         |       | 38.8        |

## Formaldehyde

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009205 | 0.224        | 0.1  | 0.0224      |
| 20009206 | 0.148        | 0.1  | 0.0148      |

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009204 | 0.109        | 0.1  | 0.0109      |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
| A            | 0                 | 4.5                               | 35                | 21.645                           | 22     | 8747                                | 14                                |                          | 120                      | 120                 | 1                           | 10                           | 2.121     |
|              | 5                 | 4.5                               | 35                | 21.645                           | 19     |                                     | 14                                |                          | 120                      | 120                 | 1                           | 11                           | 2.121     |
|              | 10                | 4.5                               | 35                | 21.645                           | 22     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 11                           | 2.121     |
|              | 15                | 5                                 | 35                | 24.05                            | 19     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 12                           | 2.236     |
|              | 20                | 4.5                               | 35                | 21.645                           | 22     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 13                           | 2.121     |
|              | 25                | 5                                 | 35                | 24.05                            | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 13                           | 2.236     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
| B            | 0                 | 5                                 | 35                | 24.05                            | 19     | 9744.5                              | 16                                |                          | 120                      | 120                 | 1                           | 14                           | 2.236     |
|              | 5                 | 4.5                               | 35                | 21.645                           | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 14                           | 2.121     |
|              | 10                | 4                                 | 35                | 19.24                            | 20     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 15                           | 2.000     |
|              | 15                | 4                                 | 35                | 19.24                            | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 16                           | 2.000     |
|              | 20                | 4.5                               | 35                | 21.645                           | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 17                           | 2.121     |
|              | 25                | 4                                 | 35                | 19.24                            | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 18                           | 2.000     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
|              | 60                | 4.5                               | 35.0              | 21.6                             | 19.7   | 0.998                               | 16.0                              | n/a                      | 120.0                    | 120.0               | 1.0                         | 13.7                         | 2.1       |

**Company Name: Knauf Insulation Ltd**

**Site Name: Queensferry**

**Project Reference: FTBS 35216**

**Date:**

**07/10/15**

**Run : 2**

|                                    |              |
|------------------------------------|--------------|
| <b>Sampling Point Ref: C Stack</b> |              |
| Meter Volume Sampled, acm          | 0.998        |
| <b>Sample Run Start Time</b>       | <b>10:55</b> |
| <b>Sample Run End Time</b>         | <b>12:00</b> |
| Total Actual Sampling Time, min    | 60.0         |
| Barometric Pressure, mm Hg         | 745.00       |
| Stack Pressure, mm Hg              | 745.59       |
| Average Stack Temp, °C             | 35.0         |
| Meter Volume at Wet STP, scm       | 0.953        |
| Stack Moisture Content, %          | 5.1          |
| Average Stack Velocity, m/sec      | 7.360        |
| Stack Flow Rate, scms wet, STP     | 42.832       |
| Nozzle Diameter, mm                | 7.00         |
| <b>% Isokinetic Variation</b>      | <b>107.3</b> |

|   |                     |
|---|---------------------|
| <b>Sampling Point Ref: C Stack</b>                  | <b>Formaldehyde</b> |
| Impinger 1 20009205                                 | 0.0235              |
| Impinger 2 20009206                                 | 0.0155              |
| <b>Formaldehyde Concentration, mg/m<sup>3</sup></b> | <b>0.039</b>        |
| <b>Formaldehyde Mass Emission Rate, kg/hour</b>     | <b>0.0060</b>       |
| Emission Limit Value                                | 10                  |

|  |             |
|--|-------------|
| <b>Formaldehyde Sample Train Impinger Efficiency / Blank Results</b> |             |
| Sample Blank Concentration, mg/m <sup>3</sup>                        | 0.0114      |
| Impinger Efficiency (%)  | 60.2        |
| Impinger Efficiency Less than 10% ?                                  | <b>FAIL</b> |

## Uncertainty Calculation for Formaldehyde Run 2

|                          |        |                           |
|--------------------------|--------|---------------------------|
| Determined Concentration | 0.0390 | mg/m3 (at Reference Cond) |
|--------------------------|--------|---------------------------|

| Measured Values             |             |                |
|-----------------------------|-------------|----------------|
| Sampled Volume              | 0.9975      | m <sup>3</sup> |
| Sampled gas Temperature     | 289         | k              |
| Sampled gas Pressure        | 99.41       | kPa            |
| Sampled gas Humidity        | 5.072370544 | % by volume    |
| Oxygen content              | n/a         | % by volume    |
| Concentration in Impinger 1 | 0.0224      | mg/l           |
| Concentration in Impinger 2 | 0.0148      | mg/l           |
| Volume in Impingers         | 0.372       | litre          |
| Total Mass                  | 74.817      | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.05 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |             |
|--|-------|-------------|
| Sampled Volume                             | 0.001 | m3          |
| Sampled gas Temperature                    | 2     | k           |
| Sampled gas Pressure                       | 1     | kPa         |
| Sampled gas Humidity                       | 1     | % by volume |
| Oxygen content                             | 0.1   | % by volume |
| Concentration in Impinger                  | 3.5   | %           |
| Volume in Impinger                         | 0.001 | litre       |
| Mass                                       | 2.647 | mg          |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |          |                 |
|---|-------------------------|--|-----------------|---|-------------------------|----------|-----------------|
| Volume Correction Factor                      | 0.880                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |          |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |          | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0030                  |  | 0.0061          | Oxygen Measurement                            | 1                       |          | 0               |
| Sampled gas Pressure                          | 0.0089                  |  | 0.0089          |   |                         |          |                 |
| Sampled gas Humidity                          | 0.0093                  |  | 0.0093          |   |                         |          |                 |
|   | Sqrt (Uv)^2             |  | 0.0142          |   |                         |          |                 |
|   | Total Uv                |  | 0.014           |   |                         | Total Uo | 0               |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |                    |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |                    |        |
|                                      |        |                    |                         | Concentration            |                    | %      |
| Volume Correction                    | 0.905  | m3                 | 0.04                    | 0.00                     | mg.m <sup>-3</sup> | 1.57 % |
| Mass Analyte                         | 74.82  | mg                 | 0.00                    | 0.00                     | mg.m <sup>-3</sup> | 3.54 % |
| Oxygen Correction                    | 1.0000 |                    | 0.04                    | 0.00                     | mg.m <sup>-3</sup> | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00                     | mg.m <sup>-3</sup> | 0.03 % |
|                                      |        |                    | Total Uncertainty       | 0.00                     | mg.m <sup>-3</sup> |        |

| Uncertainty Result |                        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |  |  |
|--------------------|------------------------|--|--------------------|--|--|
|                    | Expanded Uncertainty = | 0.0030   | mg.m <sup>-3</sup> |  |  |
|                    | =>                     | 7.74   | % of Result        |  |  |
|                    | =>                     | 0.03   | % of ELV           |  |  |



|                                    |   |   |  |   |   |
|------------------------------------|---|---|--|---|---|
| Company Name: Knauf Insulation Ltd | In-stack Filter? <input type="text" value="N"/> | Bar. Press.mm Hg <input type="text" value="745"/> | K Factor <input type="text" value="4.81"/>             | Ambient Temp. <input type="text" value="15"/> | Leak Rate (fin / %) <input type="text" value="0.04"/>       |
| Site Name: Queensferry             | Outstack Filter? <input type="text" value="N"/> | Cp <input type="text" value="0.823"/>             | Dn used <input type="text" value="7"/>                 | Start Time <input type="text" value="12:00"/> | Leak Rate (start / %) <input type="text" value="0.05"/>     |
| Project Reference: FTBS 35216      | Operators <input type="text" value="CD - JG"/>  | Bws% <input type="text" value="4"/>               | Nozzle No. <input type="text" value="367-7"/>          | Stop Time <input type="text" value="13:04"/>  | Box/Probe setting <input type="text" value="120 +/- 5 °C"/> |
| Date: 07/10/15                     |   |   | Meter Correction Yd <input type="text" value="0.978"/> |   |   |
| Run: Formaldehyde R3               |   |   |  |   |   |
| Sampling Point Ref: C Stack        |   |   |  |   |   |

Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 | 658     | 676.7 | 18.7        |
| Impinger 2 | 757.5   | 760.5 | 3.0         |
| Impinger 3 | 780.2   | 780.3 | 0.1         |
| Impinger 4 | 603.9   | 606.2 | 2.3         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel | 977.8   | 987.7 | 9.9         |
| Total      |         |       | 34.0        |

Formaldehyde

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009406 | 0.192        | 10.8 | 2.0736      |
| 20009407 | 0.141        | 0.2  | 0.0282      |

|          | Vol (litres) | mg/L | result (mg) |
|----------|--------------|------|-------------|
| 20009204 | 0.109        | 0.1  | 0.0109      |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
| A            | 0                 | 5.5                               | 35                | 26.455                           | 26     | 9747                                | 14                                |                          | 120                      | 120                 | 1                           | 12                           | 2.345     |
|              | 5                 | 5                                 | 35                | 24.05                            | 19     |                                     | 15                                |                          | 120                      | 120                 | 1                           | 13                           | 2.236     |
|              | 10                | 5.5                               | 35                | 26.455                           | 26     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 14                           | 2.345     |
|              | 15                | 5                                 | 35                | 24.05                            | 19     |                                     | 16                                |                          | 120                      | 120                 | 1                           | 15                           | 2.236     |
|              | 20                | 4.5                               | 35                | 21.645                           | 22     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 16                           | 2.121     |
|              | 25                | 5                                 | 35                | 24.05                            | 19     |                                     | 17                                |                          | 120                      | 120                 | 1                           | 17                           | 2.236     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
| B            | 0                 | 4.5                               | 35                | 21.645                           | 19     | 10846                               | 17                                |                          | 120                      | 120                 | 1                           | 14                           | 2.121     |
|              | 5                 | 5                                 | 35                | 24.05                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 15                           | 2.236     |
|              | 10                | 4.5                               | 35                | 21.645                           | 20     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 16                           | 2.121     |
|              | 15                | 5                                 | 35                | 24.05                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 17                           | 2.236     |
|              | 20                | 5.5                               | 35                | 26.455                           | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 18                           | 2.345     |
|              | 25                | 5                                 | 35                | 24.05                            | 19     |                                     | 18                                |                          | 120                      | 120                 | 1                           | 19                           | 2.236     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
|              | 60                | 5.0                               | 35.0              | 24.1                             | 20.5   | 1.099                               | 16.9                              | n/a                      | 120.0                    | 120.0               | 1.0                         | 15.5                         | 2.2       |



**Company Name: Knauf Insulation Ltd**

**Site Name: Queensferry**

**Project Reference: FTBS 35216**

**Date:**

**07/10/15**

**Run : 3**

|   |                     |
|---|---------------------|
| <b>Sampling Point Ref: C Stack</b>                  |                     |
| Meter Volume Sampled, acm                           | 1.099               |
| <b>Sample Run Start Time</b>                        | <b>12:00</b>        |
| <b>Sample Run End Time</b>                          | <b>13:04</b>        |
| Total Actual Sampling Time, min                     | 60.0                |
| Barometric Pressure, mm Hg                          | 745.00              |
| Stack Pressure, mm Hg                               | 745.59              |
| Average Stack Temp, °C                              | 35.0                |
| Meter Volume at Wet STP, scm                        | 1.036               |
| Stack Moisture Content, %                           | 4.1                 |
| Average Stack Velocity, m/sec                       | 7.744               |
| Stack Flow Rate, scms wet, STP                      | 45.070              |
| Nozzle Diameter, mm                                 | 7.00                |
| <b>% Isokinetic Variation</b>                       | <b>110.9</b>        |
| <b>Sampling Point Ref: C Stack</b>                  | <b>Formaldehyde</b> |
| Impinger 1 20009406                                 | 2.0011              |
| Impinger 2 20009407                                 | 0.0272              |
| <b>Formaldehyde Concentration, mg/m<sup>3</sup></b> | <b>2.03</b>         |
| <b>Formaldehyde Mass Emission Rate, kg/hour</b>     | <b>0.3291</b>       |
| Emission Limit Value                                | <b>N/A</b>          |

| <b>Formaldehyde Sample Train Impinger Efficiency / Blank Results</b> |             |
|--|-------------|
| Sample Blank Concentration, mg/m <sup>3</sup>                        | 0.0105      |
| Impinger Efficiency (%)  | 98.7        |
| Impinger Efficiency Less than 10% ?                                  | <b>PASS</b> |

### Uncertainty Calculation for Formaldehyde Run 3

|                          |     |                                       |
|--------------------------|-----|---------------------------------------|
| Determined Concentration | 2.0 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|-----|---------------------------------------|

| Measured Values             |             |                |
|-----------------------------|-------------|----------------|
| Sampled Volume              | 1.099       | m <sup>3</sup> |
| Sampled gas Temperature     | 289.9230769 | k              |
| Sampled gas Pressure        | 99.41       | kPa            |
| Sampled gas Humidity        | 4.088224688 | % by volume    |
| Oxygen content              | n/a         | % by volume    |
| Concentration in Impinger 1 | 2.0736      | mg/l           |
| Concentration in Impinger 2 | 0.0282      | mg/l           |
| Volume in Impingers         | 0.333       | litre          |
| Total Mass                  | 74.817      | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.05 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |                |
|--|-------|----------------|
| Sampled Volume                             | 0.001 | m <sup>3</sup> |
| Sampled gas Temperature                    | 2     | k              |
| Sampled gas Pressure                       | 1     | kPa            |
| Sampled gas Humidity                       | 1     | % by volume    |
| Oxygen content                             | 0.1   | % by volume    |
| Concentration in Impinger                  | 3.5   | %              |
| Volume in Impinger                         | 0.001 | litre          |
| Mass                                       | 2.650 | mg             |

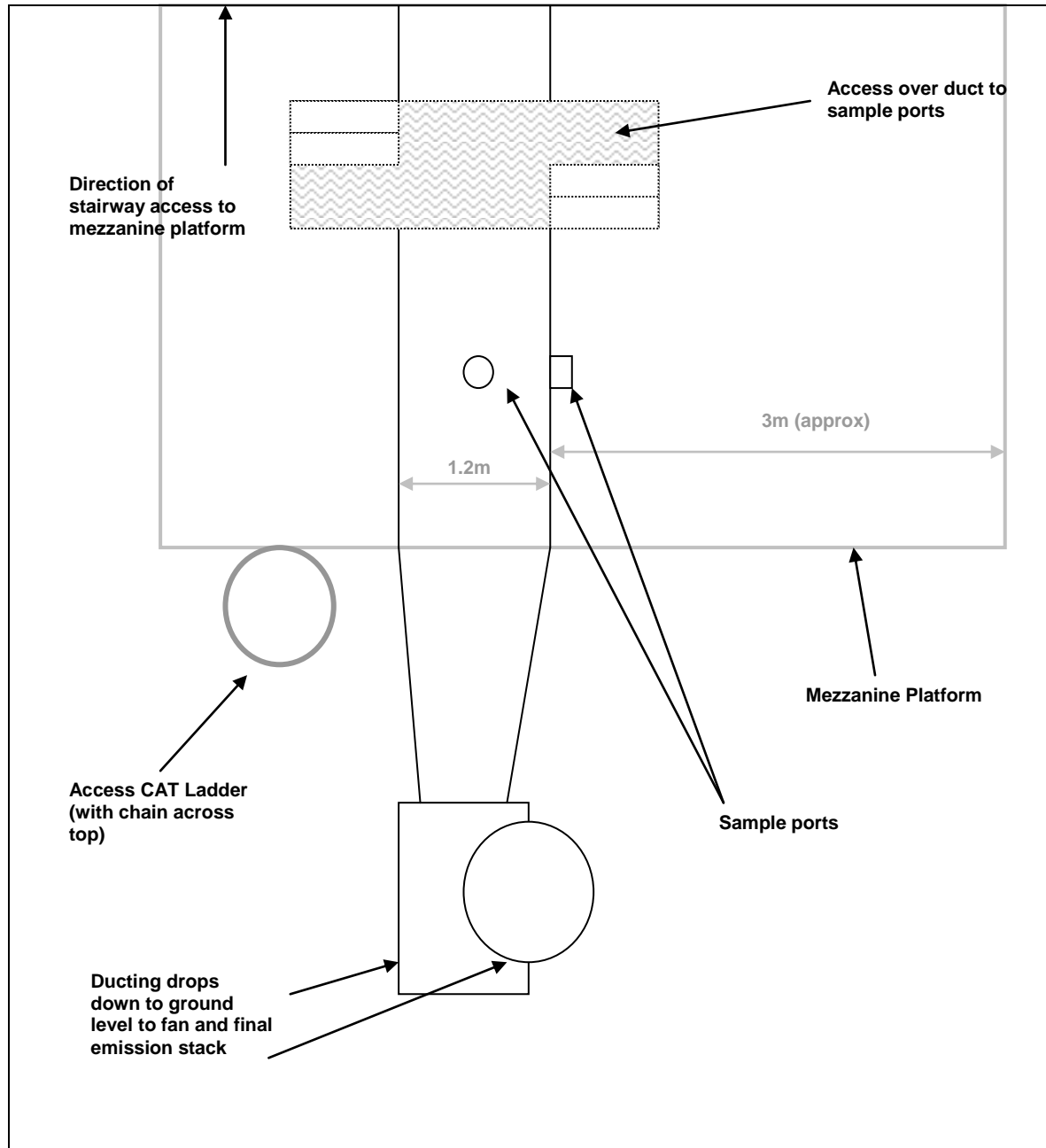
| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |  |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|--|-----------------------------|
| Volume Correction Factor                      | 0.886                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |  |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |  | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0031                              |  | 0.0061                      | Oxygen Measurement                            | 1                       |  | 0                           |
| Sampled gas Pressure                          | 0.0089                              |  | 0.0089                      |   |                         |  |                             |
| Sampled gas Humidity                          | 0.0092                              |  | 0.0092                      |   |                         |  |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0142                      |   |                         |  |                             |
|   | Total U <sub>v</sub>                |  | 0.016                       |   | Total U <sub>o</sub>    |  | 0                           |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.994  | m <sup>3</sup>     | 2.04                    | 0.03 mg.m <sup>-3</sup>  | 1.58 % |
| Mass Analyte                         | 74.82  | mg                 | 0.03                    | 0.07 mg.m <sup>-3</sup>  | 3.54 % |
| Oxygen Correction                    | 1.0000 |                    | 2.03                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.03 % |
|                                      |        |                    | Total Uncertainty       | 0.08 mg.m <sup>-3</sup>  |        |

| Uncertainty Result |                        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |
|--------------------|------------------------|--|
|                    | Expanded Uncertainty = | 0.1573 mg.m <sup>-3</sup>  |
|                    | =>                     | 7.75 % of Result   |
|                    | =>                     | N/A % of ELV   |

### **APPENDIX 3: F Sampling, Analysis & Uncertainty Data**

## Sample Point Diagram



Company Name: Knauf  
Site Name: Queensferry  
Sampling Point Ref: F

Date: 06/10/2015  
Run:

|                                    |                     |            |                                  |           |               |                      |                                  |           |               |
|------------------------------------|---------------------|------------|----------------------------------|-----------|---------------|----------------------|----------------------------------|-----------|---------------|
| Static Press, mm H <sub>2</sub> O: |                     | -230       |                                  |           |               | Stack Diamter (m)    |                                  | 1.2       |               |
| Barometric press, mm Hg:           |                     | 744        |                                  |           |               | Pitot Tube Constant: |                                  | 0.841     |               |
| Traverse                           | Traverse            | Port A     |                                  |           |               | Port B               |                                  |           |               |
| Point No.                          | Point (m)           | Δ p, mmH2O | Conversion for pitot coefficient | Root Δ p, | Stack Temp °C | Δ p, mmH2O           | Conversion for coefficient and t | Root Δ p, | Stack Temp °C |
| 1                                  | 0.08                | 2.6        | 18.4                             | 4.289     | 352           |                      |                                  |           |               |
| 2                                  | 0.30                | 3.8        | 26.9                             | 5.185     | 361           |                      |                                  |           |               |
| 3                                  | 0.90                | 2.2        | 15.6                             | 3.945     | 352           |                      |                                  |           |               |
| 4                                  | 1.12                | 1.8        | 12.7                             | 3.568     | 358           |                      |                                  |           |               |
| 5                                  | N/A                 |            |                                  |           |               |                      |                                  |           |               |
| 6                                  | N/A                 |            |                                  |           |               |                      |                                  |           |               |
| 7                                  | N/A                 |            |                                  |           |               |                      |                                  |           |               |
| 8                                  | N/A                 |            |                                  |           |               |                      |                                  |           |               |
| 9                                  | N/A                 |            |                                  |           |               |                      |                                  |           |               |
| 10                                 | N/A                 |            |                                  |           |               |                      |                                  |           |               |
|                                    | Minimum             | 1.8        | 12.7                             | 3.568     | 352.0         |                      |                                  |           |               |
|                                    | Maximum             | 3.8        | 26.9                             | 5.185     | 361.0         |                      |                                  |           |               |
|                                    | Mean                | 2.6        | 18.4                             | 4.247     | 355.8         |                      |                                  |           |               |
|                                    | Sum                 | 10.4       | 73.6                             | 16.987    | 1423.0        |                      |                                  |           |               |
|                                    | Total Sum           |            |                                  |           |               |                      |                                  |           |               |
|                                    | Max. pitot press. = | 26.9       |                                  |           |               | Max. Temp. =         |                                  | 361.0     |               |
|                                    | Min. pitot press. = | 12.7       |                                  |           |               | Min. Temp. =         |                                  | 352.0     |               |
|                                    | Ratio Max:Min =     | 2.1 :1     |                                  |           |               | Mean Temp. =         |                                  | 355.8     |               |

Mean Root D p 4.247

Mean Stack Temperature, °C 355.75

Traverse Stack Velocity, m/s 7.986

Stack Area, m<sup>2</sup> 1.131

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (acms) 9.033

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms wet) 3.750

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms WET) O<sub>2</sub> Corrected 3.750

Moisture 7.13

Stack Pressure, mm Hg 727.08

#### Gas Data

|                   |     |
|-------------------|-----|
| Oxygen %          | 0   |
| CO <sub>2</sub> % | N/A |

#### Oxygen Correction

|                                       |       |
|---------------------------------------|-------|
| Required Correction Value (%)         | 0     |
| Oxygen Factor                         | 1.000 |
| Enter 0 if correction is not required |       |

Company Name: Knauf In-stack Filter? ☐ n Bar. Press. mm Hg 764 K Factor ☐ N/A Ambient Temp.  11.25 Leak Rate (fin / %)  0  
 Site Name: Queensferry Outstack Filter? ☐ y Cp  0.841 Dn used ☐ N/A Start Time  13:55 Leak Rate (start / %  0  
 Sampling Point Ref: F Date: 02/12/15 Operators  EP DL Bws%  3.5 Nozzle No.  N/A Stop Time  14:55 Box/Probe setting  160 +/- 5 °C  
 Run: Ammonia Project Reference: FTBS 35216 Meter Correction Yd  0.997

Sample Impinger & Wash Solution Analysis

| Sample ID | Sample Conc (mg/l) | Sample Vol (litre) | Blank Conc (mg/l) | Blank Vol (litre) | Blank ID |
|-----------|--------------------|--------------------|-------------------|-------------------|----------|
| 30008868  | 2.1                | 0.065              | 0.1000            | 0.0640            | 30008872 |
| 30008869  | 0.42               | 0.032              |                   |                   |          |

Sample Impinger & Wash Solution Mass Determination

| Analysis Result (mg) | Analysis Blank Results (mg) | Result (mg) |
|----------------------|-----------------------------|-------------|
| 0.1365               | 0.0064                      | 0.1365      |
| 0.01344              | 0                           | 0.0134      |

Impinger Weighings

| Weights    | Initial | Final | Increase, mg |
|------------|---------|-------|--------------|
| Impinger 1 | 736.3   | 742.9 | 6.6          |
| Impinger 2 |         |       | 0            |
| Impinger 3 |         |       | 0            |
| Impinger 4 |         |       | 0            |
| Impinger 5 |         |       | 0            |
| Silica Gel |         |       | 0            |
|            |         | Total | 6.6          |

| Sample Point | Clock Time min | Pitot Δ p, mm H <sub>2</sub> O | Stack Temp, °C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading m <sup>3</sup> | Temp at Gas Meter Outlet °C |  | Filter Box Temp °C | Probe Temp °C | Pump Vacuum Inches Hg | Impinger Stem Temp, °C | Root Δ p. |
|--------------|----------------|--------------------------------|----------------|----------------------------------|--------|----------------------------------|-----------------------------|--|--------------------|---------------|-----------------------|------------------------|-----------|
|              |                |                                |                | Desired                          | Actual |                                  |                             |  |                    |               |                       |                        |           |
|              | 0              |                                |                | 2                                | 2      | 0                                | 13                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 15             |                                |                | 2                                | 2      |                                  | 13                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 30             |                                |                | 2                                | 2      |                                  | 13                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 45             |                                |                | 2                                | 2      |                                  | 14                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
| Endpoint     | 60             |                                | 356            |                                  |        | 115.163                          |                             |  |                    |               |                       |                        |           |
|              | 60.00          | #DIV/0!                        | 356.0          | 2.0                              | 2.0    | 0.115                            | 13.3                        |  | 150.0              | 150.0         | 0.0                   | 12.0                   | 0.0       |

Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: F

Date: 02/12/15

|                                 |         |
|---------------------------------|---------|
| Project Reference: FTBS 35216   | Ammonia |
| Meter Volume Sampled, acm       | 0.115   |
| Sample Run Start Time           | 13:55   |
| Sample Run End Time             | 14:55   |
| Total Actual Sampling Time, min | 60.0    |
| Barometric Pressure, mm Hg      | 764.00  |
| Stack Pressure, mm Hg           | 747.08  |
| Average Stack Temp, °C          | 356.0   |
| Meter Volume at STP, scm        | 0.110   |
| Stack Moisture Content, %       | 7.0     |
| Average Stack Velocity, m/sec   | 8.098   |
| Stack Flow Rate, acms           | 9.159   |
| Stack Flow Rate, scms dry,STP   | 3.634   |
| Emission Limit value            | 10.000  |

#### SAMPLE RUN CONCENTRATIONS & MASS EMISSION RATES

| Sample ID                     |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|-------------------------------|--|--------------------------------------|-----------------------|
| 30008868                      |  | 1.1542                               | 0.0162                |
| 30008869                      |  | 0.1136                               | 0.0016                |
| % of Analyte in<br>Impinger 2 |  | 8.9636                               |                       |
| <b>SUM</b>                    |  | <b>1.2679</b>                        | <b>0.0178</b>         |

#### SAMPLE BLANK CONCENTRATIONS & MASS EMISSIONS RATES

| Sample ID  |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|------------|--|--------------------------------------|-----------------------|
| 30008872   |  | 0.0582                               | 0.0008                |
| 0          |  | 0.0000                               | 0.0000                |
| <b>SUM</b> |  | <b>0.0582</b>                        | <b>0.0008</b>         |

## Uncertainty Calculation for Ammonia

|                          |     |                           |
|--------------------------|-----|---------------------------|
| Determined Concentration | 1.3 | mg/m3 (at Reference Cond) |
|--------------------------|-----|---------------------------|

| Measured Values             |          |                |
|-----------------------------|----------|----------------|
| Sampled Volume              | 0.115163 | m <sup>3</sup> |
| Sampled gas Temperature     | 286.25   | K              |
| Sampled gas Pressure        | 99.61    | kPa            |
| Sampled gas Humidity        | 0        | % by volume    |
| Oxygen content              | 16.5     | % by volume    |
| Concentration in Impinger 1 | 2.1      | mg/l           |
| Concentration in Impinger 2 | 0.42     | mg/l           |
| Volume in Impingers         | 0.097    | litre          |
| Total Mass                  | 0.150    | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.00 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |                |
|--|-------|----------------|
| Sampled Volume                             | 0.001 | m <sup>3</sup> |
| Sampled gas Temperature                    | 2     | K              |
| Sampled gas Pressure                       | 1     | kPa            |
| Sampled gas Humidity                       | 1     | % by volume    |
| Oxygen content                             | 0.1   | % by volume    |
| Concentration in Impinger                  | 4     | %              |
| Volume in Impinger                         | 0.001 | litre          |
| Mass                                       | 0.006 | mg             |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |  |                 |
|---|-------------------------|--|-----------------|---|-------------------------|--|-----------------|
| Volume Correction Factor                      | 0.938                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |  |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |  | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0033                  |  | 0.0066          | Oxygen Measurement                            | 1                       |  | 0               |
| Sampled gas Pressure                          | 0.0094                  |  | 0.0094          |   |                         |  |                 |
| Sampled gas Humidity                          | 0.0094                  |  | 0.0094          |   |                         |  |                 |
|   | Sqrt (Uv)*2             |  | 0.0148          |   |                         |  |                 |
|   | Total Uv                |  | 0.002           |   | Total Uo                |  | 0               |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.110  | m <sup>3</sup>     | 11.52                   | 0.02 mg.m <sup>-3</sup>  | 1.80 % |
| Mass Analyte                         | 0.15   | mg                 | 8.46                    | 0.05 mg.m <sup>-3</sup>  | 4.13 % |
| Oxygen Correction                    | 1.0000 |                    | 1.27                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                                      |        |                    | Total Uncertainty       | 0.06 mg.m <sup>-3</sup>  |        |

| Uncertainty Result     |  | (Uncertainty has been expanded with a coverage factor of 2 (K=2)) |
|------------------------|--|---|
| Expanded Uncertainty = |  | 0.1141 mg.m <sup>-3</sup>   |
| =>                     |  | 9.00 % of Result  |
| =>                     |  | 1.14 % of ELV   |



Company Name: Knauf  
Site Name: Queensferry  
Sampling Point Ref: F  
Date: 02/12/15  
Run: Ammonia  
Project Reference: FTBS 35216

In-stack Filter?  Bar. Press.mm H<sub>2</sub>O   
Outstack Filter?  Cp   
Operators  Bws%

K Factor   
Dn used   
Nozzle No.   
Meter Correction Yd

Ambient Temp.  Leak Rate (fin / %)   
Start Time  Leak Rate (start / min)   
Stop Time  Box/Probe setting

#### Sample Impinger & Wash Solution Analysis

| Sample ID | Sample Conc (mg/l) | Sample Vol (litre) | Blank Conc (mg/l) | Blank Vol (litre) | Blank ID |
|-----------|--------------------|--------------------|-------------------|-------------------|----------|
| 30008870  | 1.4                | 0.102              | 0.1000            | 0.0640            | 30008872 |
|           |                    |                    |                   |                   |          |

#### Sample Impinger & Wash Solution Mass Determination

| Analysis Result (mg) | Analysis Blank Results (mg) | Result (mg) |
|----------------------|-----------------------------|-------------|
| 0.1428               | 0.0064                      | 0.1428      |
| 0                    | 0                           | 0.0000      |

#### Impinger Weighings

| Weights    | Initial | Final | Increase, mg |
|------------|---------|-------|--------------|
| Impinger 1 | 742.3   | 746.7 | 4.4          |
| Impinger 2 |         |       | 0            |
| Impinger 3 |         |       | 0            |
| Impinger 4 |         |       | 0            |
| Impinger 5 |         |       | 0            |
| Silica Gel |         |       | 0            |
|            |         | Total | 4.4          |

| Sample Point | Clock Time min | Pitot Δ p, mm H <sub>2</sub> O | Stack Temp, °C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading m <sup>3</sup> | Temp at Gas Meter Outlet °C |  | Filter Box Temp °C | Probe Temp °C | Pump Vacuum Inches Hg | Impinger Stem Temp. °C | Root Δ p, |
|--------------|----------------|--------------------------------|----------------|----------------------------------|--------|----------------------------------|-----------------------------|--|--------------------|---------------|-----------------------|------------------------|-----------|
|              |                |                                |                | Desired                          | Actual |                                  |                             |  |                    |               |                       |                        |           |
|              | 0              |                                |                | 2                                | 2      | 0                                | 13                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 15             |                                |                | 2                                | 2      |                                  | 13                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 30             |                                |                | 2                                | 2      |                                  | 13                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 45             |                                |                | 2                                | 2      |                                  | 13                          |  | 150                | 150           | 0                     | 12                     | 0.000     |
| Endpoint     | 60             |                                | 356            |                                  |        | 122.972                          |                             |  |                    |               |                       |                        |           |
|              | 60.00          | #DIV/0!                        | 356.0          | 2.0                              | 2.0    | 0.123                            | 13.0                        |  | 150.0              | 150.0         | 0.0                   | 12.0                   | 0.0       |

Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: F

Date: 02/12/15

|                                 |               |
|---------------------------------|---------------|
| Project Reference: FTBS 35216   | Ammonia       |
| Meter Volume Sampled, acm       | 0.123         |
| Sample Run Start Time           | 15:02         |
| Sample Run End Time             | 16:02         |
| Total Actual Sampling Time, min | 60.0          |
| Barometric Pressure, mm Hg      | 764.00        |
| Stack Pressure, mm Hg           | 747.08        |
| Average Stack Temp, °C          | 356.0         |
| Meter Volume at STP, scm        | 0.118         |
| Stack Moisture Content, %       | 4.5           |
| Average Stack Velocity, m/sec   | 8.059         |
| Stack Flow Rate, acms           | 9.115         |
| Stack Flow Rate, scms dry,STP   | 3.713         |
| Emission Limit value            | <b>10.000</b> |

#### SAMPLE RUN CONCENTRATIONS & MASS EMISSION RATES

| Sample ID                     |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|-------------------------------|--|--------------------------------------|-----------------------|
| 30008870                      |  | 1.1602                               | <b>0.0162</b>         |
| 0                             |  | 0.0000                               | <b>0.0000</b>         |
| % of Analyte in<br>Impinger 2 |  | 0.0000                               |                       |
| <b>SUM</b>                    |  | <b>1.1602</b>                        | <b>0.0162</b>         |

#### SAMPLE BLANK CONCENTRATIONS & MASS EMISSIONS RATES

| Sample ID  |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|------------|--|--------------------------------------|-----------------------|
| 30008872   |  | 0.0544                               | <b>0.0007</b>         |
| 0          |  | 0.0000                               | <b>0.0000</b>         |
| <b>SUM</b> |  | <b>0.0544</b>                        | <b>0.0007</b>         |

## Uncertainty Calculation for Ammonia

|                          |     |                           |
|--------------------------|-----|---------------------------|
| Determined Concentration | 1.2 | mg/m3 (at Reference Cond) |
|--------------------------|-----|---------------------------|

| Measured Values             |          |                |
|-----------------------------|----------|----------------|
| Sampled Volume              | 0.122972 | m <sup>3</sup> |
| Sampled gas Temperature     | 286      | K              |
| Sampled gas Pressure        | 99.61    | kPa            |
| Sampled gas Humidity        | 0        | % by volume    |
| Oxygen content              | 16.5     | % by volume    |
| Concentration in Impinger 1 | 1.4      | mg/l           |
| Concentration in Impinger 2 | 0        | mg/l           |
| Volume in Impingers         | 0.102    | litre          |
| Total Mass                  | 0.143    | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.00 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |                |
|--|-------|----------------|
| Sampled Volume                             | 0.001 | m <sup>3</sup> |
| Sampled gas Temperature                    | 2     | K              |
| Sampled gas Pressure                       | 1     | kPa            |
| Sampled gas Humidity                       | 1     | % by volume    |
| Oxygen content                             | 0.1   | % by volume    |
| Concentration in Impinger                  | 4     | %              |
| Volume in Impinger                         | 0.001 | litre          |
| Mass                                       | 0.006 | mg             |

| Uncertainty Calculation for Volume Correction |                         |                                     |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------|-------------------------------------|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.939                   |                                     |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient |                                     | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0033                  |                                     | 0.0066                      | Oxygen Measurement                            | 1                       |                      | 0                           |
| Sampled gas Pressure                          | 0.0094                  |                                     | 0.0094                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0094                  |                                     | 0.0094                      |   |                         |                      |                             |
|   |                         | Sqrt (U <sub>v</sub> ) <sup>2</sup> | 0.0148                      |   |                         |                      |                             |
|   |                         | Total U <sub>v</sub>                | 0.002                       |   |                         | Total U <sub>o</sub> | 0                           |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.118  | m <sup>3</sup>     | 9.87                    | 0.02 mg.m <sup>-3</sup>  | 1.77 % |
| Mass Analyte                         | 0.14   | mg                 | 8.12                    | 0.05 mg.m <sup>-3</sup>  | 4.12 % |
| Oxygen Correction                    | 1.0000 |                    | 1.16                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                                      |        |                    | Total Uncertainty       | 0.05 mg.m <sup>-3</sup>  |        |

|                    |  |        |                    |
|--------------------|--|--------|--------------------|
| Uncertainty Result | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |        |                    |
|                    | Expanded Uncertainty =   | 0.1041 | mg.m <sup>-3</sup> |
|                    | =>   | 8.97   | % of Result        |
|                    | =>   | 1.04   | % of ELV           |

Company Name: Knauf  
Site Name: Queensferry  
Sampling Point Ref: F  
Date: 02/12/15  
Run: Ammonia  
Project Reference: FTBS 35216

In-stack Filter? n Bar. Press. mm Hg 764  
Outstack Filter? y Cp 0.841  
Operators EP DL Bws% 3.5

K Factor N/A  
Dn used N/A  
Nozzle No. N/A  
Meter Correction Yd 0.997

Ambient Temp. 11 Leak Rate (fin / %) 0  
Start Time 16:04 Leak Rate (start / % 0  
Stop Time 17:04 Box/Probe setting 160 +/- 5 °C

#### Sample Impinger & Wash Solution Analysis

| Sample ID | Sample Conc (mg/l) | Sample Vol (litre) | Blank Conc (mg/l) | Blank Vol (litre) | Blank ID |
|-----------|--------------------|--------------------|-------------------|-------------------|----------|
| 30008871  | 1.7                | 0.096              | 0.1000            | 0.0640            | 30008872 |

#### Sample Impinger & Wash Solution Mass Determination

| Analysis Result (mg) | Analysis Blank Results (mg) | Result (mg) |
|----------------------|-----------------------------|-------------|
| 0.1632               | 0.0064                      | 0.1632      |
| 0                    | 0                           | 0.0000      |

#### Impinger Weighings

| Weights    | Initial | Final | Increase, mg |
|------------|---------|-------|--------------|
| Impinger 1 | 734.8   | 741   | 6.2          |
| Impinger 2 |         |       | 0            |
| Impinger 3 |         |       | 0            |
| Impinger 4 |         |       | 0            |
| Impinger 5 |         |       | 0            |
| Silica Gel |         |       | 0            |
| Total      |         |       | 6.2          |

| Sample Point | Clock Time min | Pitot Δ p, mm H <sub>2</sub> O | Stack Temp, °C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading m <sup>3</sup> | Temp at Gas Meter Outlet °C | Filter Box Temp °C | Probe Temp °C | Pump Vacuum Inches Hg | Impinger Stem Temp, °C | Root Δ p. |
|--------------|----------------|--------------------------------|----------------|----------------------------------|--------|----------------------------------|-----------------------------|--------------------|---------------|-----------------------|------------------------|-----------|
|              |                |                                |                | Desired                          | Actual |                                  |                             |                    |               |                       |                        |           |
|              | 0              |                                |                | 2                                | 2      | 0                                | 13                          | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 15             |                                |                | 2                                | 2      |                                  | 13                          | 150                | 150           | 0                     | 12                     | 0.000     |
|              | 30             |                                |                | 2                                | 2      |                                  | 13                          | 150                | 150           | 0                     | 13                     | 0.000     |
|              | 45             |                                |                | 2                                | 2      |                                  | 13                          | 150                | 150           | 0                     | 13                     | 0.000     |
| Endpoint     | 60             |                                | 360            |                                  |        | 122.797                          |                             |                    |               |                       |                        |           |
|              | 60.00          | #DIV/0!                        | 360.0          | 2.0                              | 2.0    | 0.123                            | 13.0                        | 150.0              | 150.0         | 0.0                   | 12.5                   | 0.0       |

Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: F

Date: 02/12/15

|                                 |         |
|---------------------------------|---------|
| Project Reference: FTBS 35216   | Ammonia |
| Meter Volume Sampled, acm       | 0.123   |
| Sample Run Start Time           | 16:04   |
| Sample Run End Time             | 17:04   |
| Total Actual Sampling Time, min | 60.0    |
| Barometric Pressure, mm Hg      | 764.00  |
| Stack Pressure, mm Hg           | 747.08  |
| Average Stack Temp, °C          | 360.0   |
| Meter Volume at STP, scm        | 0.117   |
| Stack Moisture Content, %       | 6.2     |
| Average Stack Velocity, m/sec   | 8.112   |
| Stack Flow Rate, acms           | 9.174   |
| Stack Flow Rate, scms dry,STP   | 3.647   |
| Emission Limit value            | 10.000  |

#### SAMPLE RUN CONCENTRATIONS & MASS EMISSION RATES

| Sample ID                     |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|-------------------------------|--|--------------------------------------|-----------------------|
| 30008871                      |  | 1.3040                               | 0.0182                |
| 0                             |  | 0.0000                               | 0.0000                |
| % of Analyte in<br>Impinger 2 |  | 0.0000                               |                       |
| <b>SUM</b>                    |  | <b>1.3040</b>                        | <b>0.0182</b>         |

#### SAMPLE BLANK CONCENTRATIONS & MASS EMISSIONS RATES

| Sample ID  |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|------------|--|--------------------------------------|-----------------------|
| 30008872   |  | 0.0545                               | 0.0007                |
| 0          |  | 0.0000                               | 0.0000                |
| <b>SUM</b> |  | <b>0.0545</b>                        | <b>0.0007</b>         |

## Uncertainty Calculation for Ammonia

|                          |     |                           |
|--------------------------|-----|---------------------------|
| Determined Concentration | 1.3 | mg/m3 (at Reference Cond) |
|--------------------------|-----|---------------------------|

| Measured Values             |          |                |
|-----------------------------|----------|----------------|
| Sampled Volume              | 0.122797 | m <sup>3</sup> |
| Sampled gas Temperature     | 286      | K              |
| Sampled gas Pressure        | 99.61    | kPa            |
| Sampled gas Humidity        | 0        | % by volume    |
| Oxygen content              | 16.5     | % by volume    |
| Concentration in Impinger 1 | 1.7      | mg/l           |
| Concentration in Impinger 2 | 0        | mg/l           |
| Volume in Impingers         | 0.096    | litre          |
| Total Mass                  | 0.163    | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.00 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |             |
|--|-------|-------------|
| Sampled Volume                             | 0.001 | m3          |
| Sampled gas Temperature                    | 2     | K           |
| Sampled gas Pressure                       | 1     | kPa         |
| Sampled gas Humidity                       | 1     | % by volume |
| Oxygen content                             | 0.1   | % by volume |
| Concentration in Impinger                  | 4     | %           |
| Volume in Impinger                         | 0.001 | litre       |
| Mass                                       | 0.007 | mg          |

| Uncertainty Calculation for Volume Correction |                         |             |                 | Uncertainty Calculation for Oxygen Correction |                         |          |                 |
|---|-------------------------|-------------|-----------------|---|-------------------------|----------|-----------------|
| Volume Correction Factor                      | 0.939                   |             |                 | Oxygen Correction Factor                      | 1.0000                  |          |                 |
|   | Sensitivity Coefficient |             | Uncertainty, Uv |   | Sensitivity Coefficient |          | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0033                  |             | 0.0066          | Oxygen Measurement                            | 1                       |          | 0               |
| Sampled gas Pressure                          | 0.0094                  |             | 0.0094          |   |                         |          |                 |
| Sampled gas Humidity                          | 0.0094                  |             | 0.0094          |   |                         |          |                 |
|   |                         | Sqrt (Uv)^2 | 0.0148          |   |                         |          |                 |
|   |                         | Total Uv    | 0.002           |   |                         | Total Uo | 0               |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.117  | m3                 | 11.10                   | 0.02 mg.m <sup>-3</sup>  | 1.77 % |
| Mass Analyte                         | 0.16   | mg                 | 7.99                    | 0.05 mg.m <sup>-3</sup>  | 4.13 % |
| Oxygen Correction                    | 1.0000 |                    | 1.30                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                                      |        |                    | Total Uncertainty       | 0.06 mg.m <sup>-3</sup>  |        |

|                    |  |        |                    |
|--------------------|--|--------|--------------------|
| Uncertainty Result | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |        |                    |
|                    | Expanded Uncertainty =   | 0.1171 | mg.m <sup>-3</sup> |
|                    | =>   | 8.98   | % of Result        |
|                    | =>   | 1.17   | % of ELV           |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: F<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: RH DL                             |                   |         |
|  |                |          | Date of Sampling: 6/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Amines - 226 - 10                            |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 0        |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 11:58          | 12:58    |  |                   |         |
| Barometric   | kPa            | 99.2     | Measured Volume                              | m <sup>3</sup>    | 0.004   |
| Static Pressure  | Pa             | -2254.7  | Volume at STP                                | m <sup>3</sup>    | 0.004   |
| Duct Diameter  | m              | 1.2      | Area of Duct                                 | m <sup>2</sup>    | 1.131   |
| Average Stack Temperature  | °C             | 355.75   | Duct Pressure                                | kPa               | 96.935  |
| Meter Correction Yd  | -              | 0.976    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 25       | Velocity                                     | m/s               | 7.98650 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 9.03252 |
| Meter Volume (End)   | m <sup>3</sup> | 0.004496 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.74978 |
| Pitot Coefficient  | -              | 0.84     | Mass Emission                                | kg/hr             | 0.01593 |
| Measured Oxygen  | %              | 0        | Moisture Content                             | %                 | 7.13000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Amines   | mg             | 0.005    | Amines                                       | mg/m <sup>3</sup> | 1.18    |
| Blank Amines   | mg             | 0.005    | Amines (As Toluene)                          | mg/m <sup>3</sup> | 1.18    |

## ISO 14956 Calculation Sheet - BS EN 13649

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 1.18 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.235994                  | 0.055693       | 0.235994               | 0.055693       |
| O2 Correction                    | U <sub>correction</sub>    | 0.023599                  | 0.000557       | 0.023599               | 0.000557       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.013625                  | 0.000186       | 0.013625               | 0.000186       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.006813                  | 0.000046       | 0.001363               | 0.000002       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.002725                  | 0.000007       | 0.013625               | 0.000186       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.068126                  | 0.004641       | 0.068126               | 0.004641       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.006813                  | 0.000046       | 0.006813               | 0.000046       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.013625                  | 0.000186       | 0.013625               | 0.000186       |

|                            |             |                   |
|----------------------------|-------------|-------------------|
| Measurement Uncertainty at | 1.179970959 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 0.25        | mg/m <sup>3</sup> |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: F<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: RH DL                             |                   |         |
|  |                |          | Date of Sampling: 6/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Amines - 226 - 10                            |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 0        |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 13:45          | 14:45    |  |                   |         |
| Barometric   | kPa            | 99.2     | Measured Volume                              | m <sup>3</sup>    | 0.013   |
| Static Pressure  | Pa             | -2254.7  | Volume at STP                                | m <sup>3</sup>    | 0.011   |
| Duct Diameter  | m              | 1.2      | Area of Duct                                 | m <sup>2</sup>    | 1.131   |
| Average Stack Temperature  | °C             | 355.75   | Duct Pressure                                | kPa               | 96.935  |
| Meter Correction Yd  | -              | 0.976    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 27       | Velocity                                     | m/s               | 7.98650 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 9.03252 |
| Meter Volume (End)   | m <sup>3</sup> | 0.013136 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.74978 |
| Pitot Coefficient  | -              | 0.84     | Mass Emission                                | kg/hr             | 0.00545 |
| Measured Oxygen  | %              | 0        | Moisture Content                             | %                 | 7.85000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Amines   | mg             | 0.005    | Amines                                       | mg/m <sup>3</sup> | 0.403   |
|  |                |          | Amines (As Toluene)                          | mg/m <sup>3</sup> | 0.43    |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.40 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/kPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.080684                  | 0.006510       | 0.080684               | 0.006510       |
| O2 Correction                    | U <sub>correction</sub>    | 0.008068                  | 0.000065       | 0.008068               | 0.000065       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.004658                  | 0.000022       | 0.004658               | 0.000022       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.002329                  | 0.000005       | 0.004658               | 0.000022       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.000932                  | 0.000001       | 0.004658               | 0.000022       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.023292                  | 0.000542       | 0.023292               | 0.000542       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.002329                  | 0.000005       | 0.002329               | 0.000005       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.004658                  | 0.000022       | 0.004658               | 0.000022       |

|                            |             |                   |
|----------------------------|-------------|-------------------|
| Measurement Uncertainty at | 0.403421803 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 0.085       | mg/m <sup>3</sup> |



|  |                |         |  |                   |         |  |
|--|----------------|---------|--|-------------------|---------|--|
| Sampling Point Ref: F<br>Company Name:Knauf<br>Site Name:Queensferry |                |         | Personnel:                                   |                   | RH DL   |  |
|  |                |         | Date of Sampling:                            |                   | 6/10/15 |  |
|  |                |         | Sampling Comments                            |                   |         |  |
|  |                |         | Amines - 226 - 10                            |                   |         |  |
| Ref Moisture   | -              | Wet     |  |                   |         |  |
| Ref Temp   | K              | 273     |  |                   |         |  |
| Ref Pressure   | kPa            | 101.325 |  |                   |         |  |
| Ref Oxygen   | %              | 0       |  |                   |         |  |
|  | Start          | End     |  |                   |         |  |
| Sample Times   | 15:18          | 16:50   |  |                   |         |  |
| Barometric   | kPa            | 99.2    | Measured Volume                              | m <sup>3</sup>    | 0.004   |  |
| Static Pressure  | Pa             | -2254.7 | Volume at STP                                | m <sup>3</sup>    | 0.004   |  |
| Duct Diameter  | m              | 1.2     | Area of Duct                                 | m <sup>2</sup>    | 1.131   |  |
| Average Stack Temperature  | °C             | 355.75  | Duct Pressure                                | kPa               | 96.935  |  |
| Meter Correction Yd  | -              | 0.976   | Mean Sum SQRT Delta P                        | Pa                | 0.00    |  |
| Meter Temp Average   | °C             | 26      | Velocity                                     | m/s               | 7.98650 |  |
| Meter Volume (Start)   | m <sup>3</sup> | 0       | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 9.03252 |  |
| Meter Volume (End)   | m <sup>3</sup> | 0.00418 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.74978 |  |
| Pitot Coefficient  | -              | 0.84    | Mass Emission                                | kg/hr             | 0.01692 |  |
| Measured Oxygen  | %              | 0       | Moisture Content                             | %                 | 8.60000 |  |
| Laboratory Data  |                |         | Mass Concentration (at reference conditions) |                   |         |  |
| Amines   | mg             | 0.0050  | Amines                                       | mg/m <sup>3</sup> | 1.253   |  |
|  |                |         | Amines (As Toluene)                          | mg/m <sup>3</sup> | 1.34    |  |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 1.25 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.250655                  | 0.062828       | 0.250655               | 0.062828       |
| O2 Correction                    | U <sub>correction</sub>    | 0.025066                  | 0.000628       | 0.025066               | 0.000628       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.014472                  | 0.000209       | 0.014472               | 0.000209       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.007236                  | 0.000052       | 0.001447               | 0.000002       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.002894                  | 0.000008       | 0.014472               | 0.000209       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.072358                  | 0.005236       | 0.072358               | 0.005236       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.007236                  | 0.000052       | 0.007236               | 0.000052       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.014472                  | 0.000209       | 0.014472               | 0.000209       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 1.253276839 | mg/m3 |
| U <sub>tot</sub>           | 0.26        | mg/m3 |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: F<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: RH DL                             |                   |         |
|  |                |          | Date of Sampling: 6/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Phenols - 226 - 95                           |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 0        |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 15:09          | 16:09    |  |                   |         |
| Barometric   | kPa            | 99.2     | Measured Volume                              | m <sup>3</sup>    | 0.010   |
| Static Pressure  | Pa             | -2254.7  | Volume at STP                                | m <sup>3</sup>    | 0.009   |
| Duct Diameter  | m              | 1.2      | Area of Duct                                 | m <sup>2</sup>    | 1.131   |
| Average Stack Temperature  | °C             | 355.75   | Duct Pressure                                | kPa               | 96.935  |
| Meter Correction Yd  | -              | 0.976    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 23       | Velocity                                     | m/s               | 7.98650 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 9.03252 |
| Meter Volume (End)   | m <sup>3</sup> | 0.009798 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.74978 |
| Pitot Coefficient  | -              | 0.84     | Mass Emission                                | kg/hr             | 0.00718 |
| Measured Oxygen  | %              | 0        | Moisture Content                             | %                 | 8.20000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Phenols  | mg             | 0.005    | Phenols                                      | mg/m <sup>3</sup> | 0.532   |
| Blank Phenols  | mg             | 0.005    | Phenols (As Toluene)                         | mg/m <sup>3</sup> | 0.532   |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.53 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.106324                  | 0.011305       | 0.106324               | 0.011305       |
| O2 Correction                    | U <sub>correction</sub>    | 0.010632                  | 0.000113       | 0.010632               | 0.000113       |
| Gas Meter Volume, sampling rate  | U <sub>volum</sub>         | 0.006139                  | 0.000038       | 0.006139               | 0.000038       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.003069                  | 0.000009       | 0.000614               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.001228                  | 0.000002       | 0.006139               | 0.000038       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.030693                  | 0.000942       | 0.030693               | 0.000942       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.003069                  | 0.000009       | 0.003069               | 0.000009       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.006139                  | 0.000038       | 0.006139               | 0.000038       |

|                            |             |                   |
|----------------------------|-------------|-------------------|
| Measurement Uncertainty at | 0.531621907 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 0.11        | mg/m <sup>3</sup> |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: F<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: RH DL                             |                   |         |
|  |                |          | Date of Sampling: 6/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Phenols - 226 - 95                           |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 0        |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 16:15          | 17:15    |  |                   |         |
| Barometric   | kPa            | 99.2     | Measured Volume                              | m <sup>3</sup>    | 0.009   |
| Static Pressure  | Pa             | -2254.7  | Volume at STP                                | m <sup>3</sup>    | 0.008   |
| Duct Diameter  | m              | 1.2      | Area of Duct                                 | m <sup>2</sup>    | 1.131   |
| Average Stack Temperature  | °C             | 355.75   | Duct Pressure                                | kPa               | 96.935  |
| Meter Correction Yd  | -              | 0.976    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 28       | Velocity                                     | m/s               | 7.98650 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 9.03252 |
| Meter Volume (End)   | m <sup>3</sup> | 0.009438 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.74978 |
| Pitot Coefficient  | -              | 0.84     | Mass Emission                                | kg/hr             | 0.00747 |
| Measured Oxygen  | %              | 0        | Moisture Content                             | %                 | 9.50000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Phenol   | mg             | 0.005    | Phenol                                       | mg/m <sup>3</sup> | 0.553   |
|  |                |          | Phenol (As Toluene)                          | mg/m <sup>3</sup> | 0.59    |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.55 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.110655                  | 0.012245       | 0.110655               | 0.012245       |
| O2 Correction                    | U <sub>correction</sub>    | 0.011065                  | 0.000122       | 0.011065               | 0.000122       |
| Gas Meter Volume, sampling rate  | U <sub>v volume</sub>      | 0.006389                  | 0.000041       | 0.006389               | 0.000041       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.003194                  | 0.000010       | 0.006389               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.001278                  | 0.000002       | 0.006389               | 0.000041       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.031943                  | 0.001020       | 0.031943               | 0.001020       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.003194                  | 0.000010       | 0.003194               | 0.000010       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.006389                  | 0.000041       | 0.006389               | 0.000041       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 0.553274957 | mg/m3 |
| U <sub>tot</sub>           | 0.12        | mg/m3 |

|  |                |          |  |                   |         |                 |                |       |
|--|----------------|----------|--|-------------------|---------|-----------------|----------------|-------|
| Sampling Point Ref: F<br>Company Name:Knauf<br>Site Name:Queensferry |                |          | Personnel: RH DL                             |                   |         |                 |                |       |
|  |                |          | Date of Sampling: 7/10/15                    |                   |         |                 |                |       |
|  |                |          | Sampling Comments                            |                   |         |                 |                |       |
|  |                |          | Phenols - 226 - 95                           |                   |         |                 |                |       |
| Ref Moisture   | -              | Wet      |  |                   |         |                 |                |       |
| Ref Temp   | K              | 273      |  |                   |         |                 |                |       |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |                 |                |       |
| Ref Oxygen   | %              | 0        |  |                   |         |                 |                |       |
|  | Start          | End      |  |                   |         |                 |                |       |
| Sample Times   | 09:22          | 10:22    |  |                   |         |                 |                |       |
| Barometric   | kPa            | 99.2     |  |                   |         | Measured Volume | m <sup>3</sup> | 0.007 |
| Static Pressure  | Pa             | -2254.7  |  |                   |         | Volume at STP   | m <sup>3</sup> | 0.006 |
| Duct Diameter  | m              | 1.2      |  |                   |         | Area of Duct    | m <sup>2</sup> | 1.131 |
| Average Stack Temperature  | °C             | 355.75   | Duct Pressure                                | kPa               | 96.935  |                 |                |       |
| Meter Correction Yd  | -              | 0.976    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |                 |                |       |
| Meter Temp Average   | °C             | 21.5     | Velocity                                     | m/s               | 7.98650 |                 |                |       |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 9.03252 |                 |                |       |
| Meter Volume (End)   | m <sup>3</sup> | 0.007173 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.74978 |                 |                |       |
| Pitot Coefficient  | -              | 0.84     | Mass Emission                                | kg/hr             | 0.00983 |                 |                |       |
| Measured Oxygen  | %              | 0        | Moisture Content                             | %                 | 7.50000 |                 |                |       |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |                 |                |       |
| Phenol   | mg             | 0.005    | Phenol                                       | mg/m <sup>3</sup> | 0.728   |                 |                |       |
|  |                |          | Phenol (As Toluene)                          | mg/m <sup>3</sup> | 0.78    |                 |                |       |

## ISO 14956 Calculation Sheet - BS EN 13649

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.73 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O <sub>2</sub> Correction           | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/kPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.145600                  | 0.021199       | 0.145600               | 0.021199       |
| O <sub>2</sub> Correction        | U <sub>correction</sub>    | 0.014560                  | 0.000212       | 0.014560               | 0.000212       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.008406                  | 0.000071       | 0.008406               | 0.000071       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.004203                  | 0.000018       | 0.000841               | 0.000001       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.001681                  | 0.000003       | 0.008406               | 0.000071       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.042031                  | 0.001767       | 0.042031               | 0.001767       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.004203                  | 0.000018       | 0.004203               | 0.000018       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.008406                  | 0.000071       | 0.008406               | 0.000071       |

|                            |             |                   |
|----------------------------|-------------|-------------------|
| Measurement Uncertainty at | 0.728001229 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 0.15        | mg/m <sup>3</sup> |

Company Name: Knauf  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 06/10/15  
Run: TPM Run 1  
Sampling Point Ref: F

In-stack Filter?  Bar. Press.mm Hg  K Factor   
Outstack Filter?  Cp  Dn used   
Operators  Bws%  Nozzle No.   
Meter Correction Yd

Ambient Temp.  Leak Rate (fin / %)   
Start Time  Leak Rate (start / %)   
Stop Time  Box/Probe setting

Sample Filter Weights

|                | Sample ID | Laboratory | Increase, mg |
|----------------|-----------|------------|--------------|
| Filter         | 125247    | RPS        | 0.04         |
| Probe Washings | 30008566  | RPS        | 0.5          |

Sample Filter Blank Weighings

|            | Sample ID | Laboratory | Increase, mg |
|------------|-----------|------------|--------------|
| Filter     | 125236    | RPS        | 0.27         |
| Probe Wash | 30008565  | RPS        | 0.5          |

Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 |         |       | 0.0         |
| Impinger 2 |         |       | 0.0         |
| Impinger 3 |         |       | 0.0         |
| Impinger 4 |         |       | 0.0         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel |         |       | 0.0         |
| Total      |         |       | 57.0        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
| A1           | 0                 | 1.4                               | 336               | 22.4511974                       | 22.5   | 422391                              | 20                                | N/A                      | N/A                      | N/A                 | -2                          | 12                           | 1.183     |
|              | 7.5               | 1.4                               | 343               | 22.4511974                       | 22.5   |                                     | 21                                | N/A                      | N/A                      | N/A                 | -2                          | 13                           | 1.183     |
| A2           | 15                | 1.6                               | 337               | 25.65851131                      | 25.6   |                                     | 22                                | N/A                      | N/A                      | N/A                 | -2                          | 14                           | 1.265     |
|              | 22.5              | 1.6                               | 332               | 25.65851131                      | 25.6   |                                     | 23                                | N/A                      | N/A                      | N/A                 | -2                          | 14                           | 1.265     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
| A3           | 0                 | 2                                 | 343               | 32.07313914                      | 32     |                                     | 23                                | N/A                      | N/A                      | N/A                 | -3                          | 15                           | 1.414     |
|              | 7.5               | 2                                 | 352               | 32.07313914                      | 32     |                                     | 24                                | N/A                      | N/A                      | N/A                 | -3                          | 15                           | 1.414     |
| A4           | 15                | 2                                 | 351               | 32.07313914                      | 32     |                                     | 25                                | N/A                      | N/A                      | N/A                 | -3                          | 15                           | 1.414     |
|              | 22.5              | 1.8                               | 338               | 28.86582523                      | 29     |                                     | 25                                | N/A                      | N/A                      | N/A                 | -2                          | 16                           | 1.342     |
| Endpoint     | 30                |                                   |                   |                                  |        | 423383                              |                                   |                          |                          |                     |                             |                              |           |
|              | 60.00             | 1.725                             | 341.5             | 27.7                             | 27.7   | 0.992                               | 22.9                              | #DIV/0!                  | #DIV/0!                  | #DIV/0!             | -2.4                        | 14.3                         | 1.3       |

Company Name:Knauf  
Site Name:Queensferry  
Project Reference: FTBS 35216

Date: 06/10/15

|  |                |
|--|----------------|
| Sampling Point Ref: F                                    | Run: TPM Run 1 |
| Meter Volume Sampled, acm                                | 0.992          |
| Sample Run Start Time                                    | 14:35          |
| Sample Run End Time                                      | 16:10          |
| Total Actual Sampling Time, min                          | 60.0           |
| Barometric Pressure, mm Hg                               | 744.00         |
| Stack Pressure, mm Hg                                    | 727.08         |
| Average Stack Temp, °C                                   | 341.5          |
| Meter Volume at STP, scm                                 | 0.882          |
| Stack Moisture Content, %                                | 7.5            |
| %O <sub>2</sub>  | 16.50          |
| Average Stack Velocity, m/sec                            | 6.662          |
| Stack Flow Rate, scms wet, STP                           | 3.201          |
| Stack Flow Rate, scms dry,STP                            | 2.962          |
| Nozzle Diameter, mm                                      | 11.05          |
| <b>% Isokinetic Variation</b>                            | <b>97.4</b>    |
| Total Mass of Particulate, mg                            | 0.5            |
| Percentage of Total Particulate Collected on Filter      | 7.4            |
| <b>Stack Particulate Concentration, mg/m<sup>3</sup></b> | <b>0.567</b>   |
| Particulate Mass rate, kg/hour                           | 0.0065         |
| Emission Limit value                                     | <b>10</b>      |

| Sample Train Blank Results                                |      |
|---|------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 0.81 |
| Total Weight Gain, mg (Sample Train Blank)                | 0.77 |
| Blank Result Less than 10% of Limit Value                 | Y    |

### Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |       |                                       |
|--------------------------|-------|---------------------------------------|
| Determined Concentration | 0.567 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|-------|---------------------------------------|

#### Measured Values

|                         |         |                |
|-------------------------|---------|----------------|
| Sampled Volume          | 0.992   | m <sup>3</sup> |
| Sampled gas Temperature | 295.875 | K              |
| Sampled gas Pressure    | 96.94   | kPa            |
| Sampled gas Humidity    | 0       | % by volume    |
| Oxygen content          | 16.5    | % by volume    |
| Mass                    | 0.54    | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.00 | %  |
| Uncollected Mass | 0    | mg |

#### Standard Uncertainties for Measured Values

|                         |            |                |
|-------------------------|------------|----------------|
| Sampled Volume          | 0.001      | m <sup>3</sup> |
| Sampled gas Temperature | 2          | K              |
| Sampled gas Pressure    | 1          | kPa            |
| Sampled gas Humidity    | 1          | % by volume    |
| Oxygen content          | 0.1        | % by volume    |
| Mass                    | 0.14152385 | mg             |

| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.883                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0030                              |  | 0.0060                      | Oxygen Measurement                            | N/A                     |                      | N/A                         |
| Sampled gas Pressure                          | 0.0091                              |  | 0.0091                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0088                              |  | 0.0088                      |   |                         |                      |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0140                      |   |                         |                      |                             |
|   | Total U <sub>v</sub>                |  | 0.014                       |   |                         | Total U <sub>o</sub> | N/A                         |

| Uncertainty Contributions (Itemised) |       |                    |                         |                          |                    |         |
|--------------------------------------|-------|--------------------|-------------------------|--------------------------|--------------------|---------|
|                                      | Value |                    | Sensitivity coefficient | Uncertainty Contribution |                    |         |
|                                      |       |                    |                         | Concentration            |                    | %       |
| Volume Correction                    | 0.882 | m <sup>3</sup>     | 0.64                    | 0.01                     | mg.m <sup>-3</sup> | 1.58 %  |
| Mass (weighing)                      | 0.54  | mg                 | 1.05                    | 0.15                     | mg.m <sup>-3</sup> | 26.21 % |
| Oxygen Correction                    | N/A   |                    | 0.00                    | 0.00                     | mg.m <sup>-3</sup> | 0.00 %  |
| System Leak                          | 0.00  | mg.m <sup>-3</sup> | 1.00                    | 0.00                     | mg.m <sup>-3</sup> | 0.00 %  |
| Uncollected Mass                     | 0.00  | mg                 | 1.05                    | 0.00                     | mg.m <sup>-3</sup> | 0.00 %  |
|                                      |       |                    | Total Uncertainty       | 0.15                     | mg.m <sup>-3</sup> |         |

|                           |  |   |                    |
|---------------------------|--|---|--------------------|
| <b>Uncertainty Result</b> |  | (Uncertainty has been expanded with a coverage factor of 2 (K=2)) |                    |
| Expanded Uncertainty =    |  | 0.2976  | mg.m <sup>-3</sup> |
| =>                        |  | 52.51   | % of Result        |
| =>                        |  | 2.98  | % of ELV           |

Company Name: Knauf  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 06/10/15  
Run: TPM Run 2  
Sampling Point Ref: F

In-stack Filter?  Bar. Press. mm Hg   
Outstack Filter?  Cp   
Operators  Bws%   
Meter Correction Yd

K Factor   
Dn used   
Nozzle No.

Ambient Temp.   
Start Time   
Stop Time

Leak Rate (fin / %)   
Leak Rate (start / %)   
Box/Probe setting

Sample Filter Weights

|                | Sample ID | Laboratory | Increase, mg |
|----------------|-----------|------------|--------------|
| Filter         | 120588    | RPS        | 0.04         |
| Probe Washings | 30008567  | RPS        | 0.5          |

Sample Filter Blank Weighings

|            | Sample ID | Laboratory | Increase, mg |
|------------|-----------|------------|--------------|
| Filter     | 125236    | RPS        | 0.27         |
| Probe Wash | 30008565  | RPS        | 0.5          |

Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 |         |       | 0.0         |
| Impinger 2 |         |       | 0.0         |
| Impinger 3 |         |       | 0.0         |
| Impinger 4 |         |       | 0.0         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel |         |       | 0.0         |
| Total      |         |       | 55.0        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |      | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          |      |                                     |                                   |                          |                          |                     |                             |                              |           |
| A1           | 0                 | 1.8                               | 322               | 28.86582523                      | 29   | 423384                              | 24                                | N/A                      | N/A                      | N/A                 | -2                          | 12                           | 1.342     |
|              | 7.5               | 1.6                               | 319               | 25.65851131                      | 25.6 |                                     | 25                                | N/A                      | N/A                      | N/A                 | -2                          | 13                           | 1.265     |
| A2           | 15                | 1.4                               | 320               | 22.4511974                       | 22.5 |                                     | 25                                | N/A                      | N/A                      | N/A                 | -2                          | 14                           | 1.183     |
|              | 22.5              | 1.4                               | 324               | 22.4511974                       | 22.5 |                                     | 25                                | N/A                      | N/A                      | N/A                 | -2                          | 14                           | 1.183     |
| Endpoint     | 30                |                                   |                   |                                  |      |                                     |                                   |                          |                          |                     |                             |                              |           |
| A3           | 0                 | 1.4                               | 317               | 22.4511974                       | 22.4 |                                     | 25                                | N/A                      | N/A                      | N/A                 | -3                          | 15                           | 1.183     |
|              | 7.5               | 1.4                               | 322               | 22.4511974                       |      |                                     | 25                                | N/A                      | N/A                      | N/A                 | -3                          | 15                           | 1.183     |
| A4           | 15                | 1.5                               | 319               | 24.05485435                      |      |                                     | 25                                | N/A                      | N/A                      | N/A                 | -3                          | 15                           | 1.225     |
|              | 22.5              | 1.5                               | 319               | 24.05485435                      |      |                                     | 25                                | N/A                      | N/A                      | N/A                 | -2                          | 16                           | 1.225     |
| Endpoint     | 30                |                                   |                   |                                  |      | 424346                              |                                   |                          |                          |                     |                             |                              |           |
|              | 60.00             | 1.500                             | 320.3             | 24.1                             | 24.4 | 0.962                               | 24.9                              | #DIV/0!                  | #DIV/0!                  | #DIV/0!             | -2.4                        | 14.3                         | 1.2       |



Company Name:Knauf  
Site Name:Queensferry  
Project Reference: FTBS 35216

Date: 06/10/15

|  |                |
|--|----------------|
| Sampling Point Ref: F                                    | Run: TPM Run 2 |
| Meter Volume Sampled, acm                                | 0.962          |
| Sample Run Start Time                                    | 16:21          |
| Sample Run End Time                                      | 17:21          |
| Total Actual Sampling Time, min                          | 60.0           |
| Barometric Pressure, mm Hg                               | 744.00         |
| Stack Pressure, mm Hg                                    | 727.08         |
| Average Stack Temp, °C                                   | 320.3          |
| Meter Volume at STP, scm                                 | 0.849          |
| Stack Moisture Content, %                                | 7.5            |
| %O <sub>2</sub>  | 16.50          |
| Average Stack Velocity, m/sec                            | 6.114          |
| Stack Flow Rate, scms wet, STP                           | 3.042          |
| Stack Flow Rate, scms dry,STP                            | 2.815          |
| Nozzle Diameter, mm                                      | 11.05          |
| <b>% Isokinetic Variation</b>                            | <b>98.6</b>    |
| Total Mass of Particulate, mg                            | 0.5            |
| Percentage of Total Particulate Collected on Filter      | 7.4            |
| <b>Stack Particulate Concentration, mg/m<sup>3</sup></b> | <b>0.588</b>   |
| Particulate Mass rate, kg/hour                           | 0.006          |
| Emission Limit value                                     | <b>10</b>      |

| Sample Train Blank Results                                |      |
|---|------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 0.84 |
| Total Weight Gain, mg (Sample Train Blank)                | 0.77 |
| Blank Result Less than 10% of Limit Value                 | Y    |

### Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |       |                                       |
|--------------------------|-------|---------------------------------------|
| Determined Concentration | 0.588 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|-------|---------------------------------------|

#### Measured Values

|                         |         |                |
|-------------------------|---------|----------------|
| Sampled Volume          | 0.962   | m <sup>3</sup> |
| Sampled gas Temperature | 297.875 | K              |
| Sampled gas Pressure    | 96.94   | kPa            |
| Sampled gas Humidity    | 0       | % by volume    |
| Oxygen content          | 16.5    | % by volume    |
| Mass                    | 0.54    | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.00 | %  |
| Uncollected Mass | 0    | mg |

#### Standard Uncertainties for Measured Values

|                         |            |                |
|-------------------------|------------|----------------|
| Sampled Volume          | 0.001      | m <sup>3</sup> |
| Sampled gas Temperature | 2          | K              |
| Sampled gas Pressure    | 1          | kPa            |
| Sampled gas Humidity    | 1          | % by volume    |
| Oxygen content          | 0.1        | % by volume    |
| Mass                    | 0.14152385 | mg             |

| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.877                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0029                              |  | 0.0059                      | Oxygen Measurement                            | N/A                     |                      | N/A                         |
| Sampled gas Pressure                          | 0.0090                              |  | 0.0090                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0088                              |  | 0.0088                      |   |                         |                      |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0139                      |   |                         |                      |                             |
|   | Total U <sub>v</sub>                |  | 0.013                       |   |                         | Total U <sub>o</sub> | N/A                         |

| Uncertainty Contributions (Itemised) |       |                    |                         |                          |       |   |
|--------------------------------------|-------|--------------------|-------------------------|--------------------------|-------|---|
|                                      | Value |                    | Sensitivity coefficient | Uncertainty Contribution |       |   |
|                                      |       |                    |                         | Concentration            |       | % |
| Volume Correction                    | 0.849 | m <sup>3</sup>     | 0.69                    | 0.01 mg.m <sup>-3</sup>  | 1.58  | % |
| Mass (weighing)                      | 0.54  | mg                 | 1.09                    | 0.15 mg.m <sup>-3</sup>  | 26.21 | % |
| Oxygen Correction                    | N/A   |                    | 0.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00  | % |
| System Leak                          | 0.00  | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00  | % |
| Uncollected Mass                     | 0.00  | mg                 | 1.09                    | 0.00 mg.m <sup>-3</sup>  | 0.00  | % |
|                                      |       |                    | Total Uncertainty       | 0.15 mg.m <sup>-3</sup>  |       |   |

|                           |  |  |                    |
|---------------------------|--|--|--------------------|
| <b>Uncertainty Result</b> |  | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |
| Expanded Uncertainty =    |  | 0.3090   | mg.m <sup>-3</sup> |
| =>                        |  | 52.51  | % of Result        |
| =>                        |  | 3.09   | % of ELV           |

Company Name: Knauf  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 07/10/15  
Run: TPM Run 3  
Sampling Point Ref: G

In-stack Filter?  Bar. Press. mm Hg  K Factor   
Outstack Filter?  Cp  Dn used   
Operators  Bws%  Nozzle No.   
Meter Correction Yd

Ambient Temp.  Leak Rate (fin / %)   
Start Time  Leak Rate (start / %)   
Stop Time  Box/Probe setting

Sample Filter Weights

|                | Sample ID | Laboratory | Increase, mg |
|----------------|-----------|------------|--------------|
| Filter         | 121770    | RPS        | 0.04         |
| Probe Washings | 30008569  | RPS        | 0.5          |

Sample Filter Blank Weighings

|            | Sample ID | Laboratory | Increase, mg |
|------------|-----------|------------|--------------|
| Filter     | 121768    | RPS        | 0.04         |
| Probe Wash | 30008568  | RPS        | 0.5          |

Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 |         |       | 0.0         |
| Impinger 2 |         |       | 0.0         |
| Impinger 3 |         |       | 0.0         |
| Impinger 4 |         |       | 0.0         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel |         |       | 0.0         |
| Total      |         |       | 73.0        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |      | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          |      |                                     |                                   |                          |                          |                     |                             |                              |           |
| A1           | 0                 | 2.8                               | 307               | 44.90239479                      | 44   | 424352                              | 16                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.673     |
|              | 7.5               | 2.8                               | 310               | 44.90239479                      | 44   |                                     | 17                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.673     |
| A2           | 15                | 2.8                               | 313               | 44.90239479                      | 44   |                                     | 18                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.673     |
|              | 22.5              | 2.8                               | 313               | 44.90239479                      | 44   |                                     | 19                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.673     |
| Endpoint     | 30                |                                   |                   |                                  |      |                                     |                                   |                          |                          |                     |                             |                              |           |
| A3           | 0                 | 2.6                               | 311               | 41.69508088                      | 42   |                                     | 19                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.612     |
|              | 7.5               | 2.6                               | 311               | 41.69508088                      | 42   |                                     | 20                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.612     |
| A4           | 15                | 2.1                               | 312               | 33.6767961                       | 34   |                                     | 20                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.449     |
|              | 22.5              | 2.4                               | 324               | 38.48776697                      | 38   |                                     | 20                                | N/A                      | N/A                      | N/A                 | -2                          |                              | 1.549     |
| Endpoint     | 30                |                                   |                   |                                  |      | 425593                              |                                   |                          |                          |                     |                             |                              |           |
|              | 60.00             | 2.613                             | 312.6             | 41.9                             | 41.5 | 1.241                               | 18.6                              | #DIV/0!                  | #DIV/0!                  | #DIV/0!             | -2.0                        | #DIV/0!                      | 1.6       |

Company Name:Knauf  
Site Name:Queensferry  
Project Reference: FTBS 35216

Date: 07/10/15

|  |                |
|--|----------------|
| Sampling Point Ref: G                                    | Run: TPM Run 3 |
| Meter Volume Sampled, acm                                | 1.241          |
| Sample Run Start Time                                    | 9:14           |
| Sample Run End Time                                      | 10:14          |
| Total Actual Sampling Time, min                          | 60.0           |
| Barometric Pressure, mm Hg                               | 744.00         |
| Stack Pressure, mm Hg                                    | 727.08         |
| Average Stack Temp, °C                                   | 312.6          |
| Meter Volume at STP, scm                                 | 1.121          |
| Stack Moisture Content, %                                | 7.5            |
| %O <sub>2</sub>  | 16.50          |
| Average Stack Velocity, m/sec                            | 8.016          |
| Stack Flow Rate, scms wet, STP                           | 4.041          |
| Stack Flow Rate, scms dry,STP                            | 3.738          |
| Nozzle Diameter, mm                                      | 11.05          |
| <b>% Isokinetic Variation</b>                            | <b>98.1</b>    |
| Total Mass of Particulate, mg                            | 0.5            |
| Percentage of Total Particulate Collected on Filter      | 7.4            |
| <b>Stack Particulate Concentration, mg/m<sup>3</sup></b> | <b>0.446</b>   |
| Particulate Mass rate, kg/hour                           | 0.006          |
| Emission Limit value                                     | <b>10</b>      |

| Sample Train Blank Results                                |      |
|---|------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 0.45 |
| Total Weight Gain, mg (Sample Train Blank)                | 0.54 |
| Blank Result Less than 10% of Limit Value                 | Y    |

### Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |       |                                       |
|--------------------------|-------|---------------------------------------|
| Determined Concentration | 0.446 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|-------|---------------------------------------|

#### Measured Values

|                         |         |                |
|-------------------------|---------|----------------|
| Sampled Volume          | 1.241   | m <sup>3</sup> |
| Sampled gas Temperature | 291.625 | K              |
| Sampled gas Pressure    | 96.94   | kPa            |
| Sampled gas Humidity    | 0       | % by volume    |
| Oxygen content          | 16.5    | % by volume    |
| Mass                    | 0.54    | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.00 | %  |
| Uncollected Mass | 0    | mg |

#### Standard Uncertainties for Measured Values

|                         |            |                |
|-------------------------|------------|----------------|
| Sampled Volume          | 0.001      | m <sup>3</sup> |
| Sampled gas Temperature | 2          | K              |
| Sampled gas Pressure    | 1          | kPa            |
| Sampled gas Humidity    | 1          | % by volume    |
| Oxygen content          | 0.1        | % by volume    |
| Mass                    | 0.14152385 | mg             |

| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.896                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0031                              |  | 0.0061                      | Oxygen Measurement                            | N/A                     |                      | N/A                         |
| Sampled gas Pressure                          | 0.0092                              |  | 0.0092                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0090                              |  | 0.0090                      |   |                         |                      |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0143                      |   |                         |                      |                             |
|   | Total U <sub>v</sub>                |  | 0.018                       |   |                         | Total U <sub>o</sub> | N/A                         |

| Uncertainty Contributions (Itemised) |       |                    |                         |                          |       |   |
|--------------------------------------|-------|--------------------|-------------------------|--------------------------|-------|---|
|                                      | Value |                    | Sensitivity coefficient | Uncertainty Contribution |       |   |
|                                      |       |                    |                         | Concentration            |       | % |
| Volume Correction                    | 1.121 | m <sup>3</sup>     | 0.40                    | 0.01 mg.m <sup>-3</sup>  | 1.58  | % |
| Mass (weighing)                      | 0.54  | mg                 | 0.83                    | 0.12 mg.m <sup>-3</sup>  | 26.21 | % |
| Oxygen Correction                    | N/A   |                    | 0.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00  | % |
| System Leak                          | 0.00  | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00  | % |
| Uncollected Mass                     | 0.00  | mg                 | 0.83                    | 0.00 mg.m <sup>-3</sup>  | 0.00  | % |
|                                      |       |                    | Total Uncertainty       | 0.12 mg.m <sup>-3</sup>  |       |   |

|                           |  |  |                    |
|---------------------------|--|--|--------------------|
| <b>Uncertainty Result</b> |  | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |
| Expanded Uncertainty =    |  | 0.2340   | mg.m <sup>-3</sup> |
| =>                        |  | 52.51  | % of Result        |
| =>                        |  | 2.34   | % of ELV           |

Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: Stack F

Date: 06/10/2015  
Run: Oxides of Nitrogen by FTIR - RUN 1

|                     | O <sub>2</sub><br>% |                         |  | N <sub>2</sub> O<br>mg/m <sup>3</sup> | N <sub>2</sub> O<br>kg/hr | NO <sub>2</sub><br>mg/m <sup>3</sup> | NO <sub>2</sub><br>kg/hr |
|---------------------|---------------------|-------------------------|--|---------------------------------------|---------------------------|--------------------------------------|--------------------------|
| Average             | #DIV/0!             |                         |  | 286.1                                 | 3.802                     | 13.7                                 | 0.18                     |
| Max                 | 0.00                |                         |  | 323.6                                 | 4.299                     | 18.1                                 | 0.24                     |
| Min                 | 0.00                |                         |  | 161.5                                 | 2.145                     | 8.3                                  | 0.1105                   |
| Emission Limit      |                     | N/A                     |  | N/A                                   |                           | N/A                                  |                          |
| Moisture, %         | 5.4                 | Barometric (mmHg) Start |  |                                       | 760                       |                                      |                          |
| Oxygen Reference, % | 0.0                 | Barometric (mmHg) End   |  |                                       | 760                       |                                      |                          |

|  |       |
|--|-------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691 |
|--|-------|

| Calibrations            | O <sub>2</sub> % | SO <sub>2</sub> ppm |     | C3H8 ppm   |
|-------------------------|------------------|---------------------|-----|------------|
| Analyser - Start Zero   | 0.00             |                     |     |            |
| Analyser - Start Span   | 14.60            |                     |     |            |
| Analyser - Zero Check   | 0                |                     |     |            |
| System - Zero Check     | 0.09             | 0.1                 |     | 0.1        |
| System - Span Check     | 14.67            | 173.0               |     | 92.6       |
| System - End Zero Check | 0.09             | 0.2                 |     |            |
| System - End Span Check | 14.61            | 172.5               |     |            |
| Cylinder Number         | 243111           | 187970              |     |            |
| Span Value              | 14.6             | 178                 |     | 93         |
| Analyser Range (0 - X)  | Select           | Select              | 250 | Not in Use |

| Equipment ID Nos  |      |
|-------------------|------|
| Analyser          | FTIR |
| Heated Line       | FTIR |
| H/Line Controller | FTIR |
| Logger            |      |
| Pitot             |      |
| Manometer         |      |
| T/couple          |      |
| T/couple Readout  |      |
| Barometer         |      |

Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: Stack F

Date: 06/10/2015  
Run: NO - RUN 1

|                     | O <sub>2</sub><br>% |                         | NO<br>mg/m <sup>3</sup> | NO<br>kg/hr |     |  |     |
|---------------------|---------------------|-------------------------|-------------------------|-------------|-----|--|-----|
| Average             | #DIV/0!             |                         | 116.4                   | 1.547       |     |  |     |
| Max                 | 0.00                |                         | 138.0                   | 1.833       |     |  |     |
| Min                 | 0.00                |                         | 69.0                    | 0.917       |     |  |     |
| Emission Limit      |                     |                         | N/A                     |             | N/A |  | N/A |
| Moisture, %         | 7.1                 | Barometric (mmHg) Start |                         |             | 760 |  |     |
| Oxygen Reference, % | 0.0                 | Barometric (mmHg) End   |                         |             | 760 |  |     |

|  |       |
|--|-------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691 |
|--|-------|

| Calibrations            | O <sub>2</sub> % |  |  | NO ppm |
|-------------------------|------------------|--|--|--------|
| Analyser - Start Zero   | 0.00             |  |  | 0.0    |
| Analyser - Start Span   | 14.60            |  |  | 76.0   |
| Analyser - Zero Check   | 0                |  |  | 0.0    |
| System - Zero Check     | 0.09             |  |  | 0.1    |
| System - Span Check     | 14.67            |  |  | 75.3   |
| System - End Zero Check | 0.09             |  |  | 0.3    |
| System - End Span Check | 14.61            |  |  | 75     |
| Cylinder Number         | 243111           |  |  | 221543 |
| Span Value              | 14.6             |  |  | 76     |
| Analyser Range (0 - X)  | 25               |  |  | 100    |

| Equipment ID Nos  |     |
|-------------------|-----|
| Analyser          | 928 |
| Heated Line       |     |
| H/Line Controller |     |
| Logger            |     |
| Pitot             |     |
| Manometer         |     |
| T/couple          |     |
| T/couple Readout  |     |
| Barometer         |     |

## Uncertainty calculation for Gaseous Measurement of Oxides of Nitrogen BS EN 14792

|                              |       |   |                     |              |
|------------------------------|-------|---|---------------------|--------------|
| Measured concentration - NOx | 125.3 | mg/m <sup>3</sup> (O <sub>2</sub> & H <sub>2</sub> O uncorrected) | Analyser Make/Model | Horiba PG250 |
| Range (Max Value)            | 205.4 | mg/m <sup>3</sup>   | ID Number           | FYS928       |

| Performance Characteristics            | Value     |  | specification          |
|--|-----------|--|------------------------|
| Response time                          | 14        | seconds  | < 180 s                |
| Logger sampling interval               | 15        | seconds  |                        |
| Measurement period                     | 260       | minutes  |                        |
| Number of readings in measurement      | 1040      | Assuming 15 Second Readings over 4.333333333333333 | hour period            |
| Repeatability at zero                  | 0.02      | % full range                                       | 0.2                    |
| Repeatability at span level            | 0.02      | % full range                                       | 2.0                    |
| Deviation from linearity               | 0.014     | % of Value   | 2                      |
| Zero drift (during measurement period) | 0.2631579 | % full range                                       | 2                      |
| Span drift (during measurement period) | -0.394737 | % full range                                       | 2                      |
| volume or pressure flow dependence     | 0         | % of fs / kPa                                      | 0.033                  |
| atmospheric pressure dependence        | 0         | % of fs/kPa  | 0.75                   |
| ambient temperature dependence         | -0.07     | % by volume /10K                                   | 0.3                    |
| CO <sub>2</sub> (% vol)                | 15        | 0  | % by volume per        |
| CH <sub>4</sub> (mg/m <sup>3</sup> )   | 57        | 0.1  | mg/m <sup>3</sup>      |
| NH <sub>3</sub> (mg/m <sup>3</sup> )   | 20        | 0  | mg/m <sup>3</sup>      |
| Converter Efficiency                   | 96        | %  | 95%                    |
| Dependence on voltage                  | 0.1       | % by volume /10V                                   | 2% Full Scale /10 volt |
| Losses in the line (leak)              | 2         | % of value   | 2% of value            |
| Uncertainty of calibration gas         | 2         | % of value   | 2% of value            |

| Performance characteristic                        | Uncertainty        | Value of uncertainty quantity | % vol                |
|---|--------------------|-------------------------------|----------------------|
| Standard deviation of repeatability at zero       | u <sub>r0</sub>    | for mean                      | Only use rep at span |
| Standard deviation of repeatability at span level | u <sub>rs</sub>    | for mean                      | 0.001                |
| Lack of fit                                       | u <sub>fit</sub>   |                               | 0.017                |
| Drift   | u <sub>odr</sub>   |                               | -0.095               |
| volume or pressure flow dependence                | u <sub>spres</sub> |                               | 0.000                |
| atmospheric pressure dependence                   | u <sub>apres</sub> |                               | 0.000                |
| ambient temperature dependence                    | u <sub>temp</sub>  |                               | 0.000                |
| CO <sub>2</sub>                                   |                    |                               | 0.000                |
| NO  |                    |                               | 0.000                |
| NO <sub>2</sub>                                   |                    |                               | 0.000                |
| Converter Efficiency                              | u <sub>eff</sub>   |                               | 0.12                 |
| dependence on voltage                             | u <sub>volt</sub>  |                               | 0.000                |
| losses in the line (leak)                         | u <sub>leak</sub>  |                               | 1.45                 |
| Uncertainty of calibration gas                    | u <sub>calib</sub> |                               | 1.45                 |

|  |        |                   |   |
|--|--------|-------------------|---|
| Measurement Concentration (as measured)            | 125.31 | mg/m <sup>3</sup> |   |
| Combined uncertainty                               | 2.05   | mg/m <sup>3</sup> |   |
| Coverage factor k = 2                              |        |                   |   |
| Expanded uncertainty (as measured)                 | 4.10   | mg/m <sup>3</sup> | (expressed with a level of confidence of 95%) |
| Expanded uncertainty (Corrected to Ref Conditions) | 3.81   | mg/m <sup>3</sup> |   |

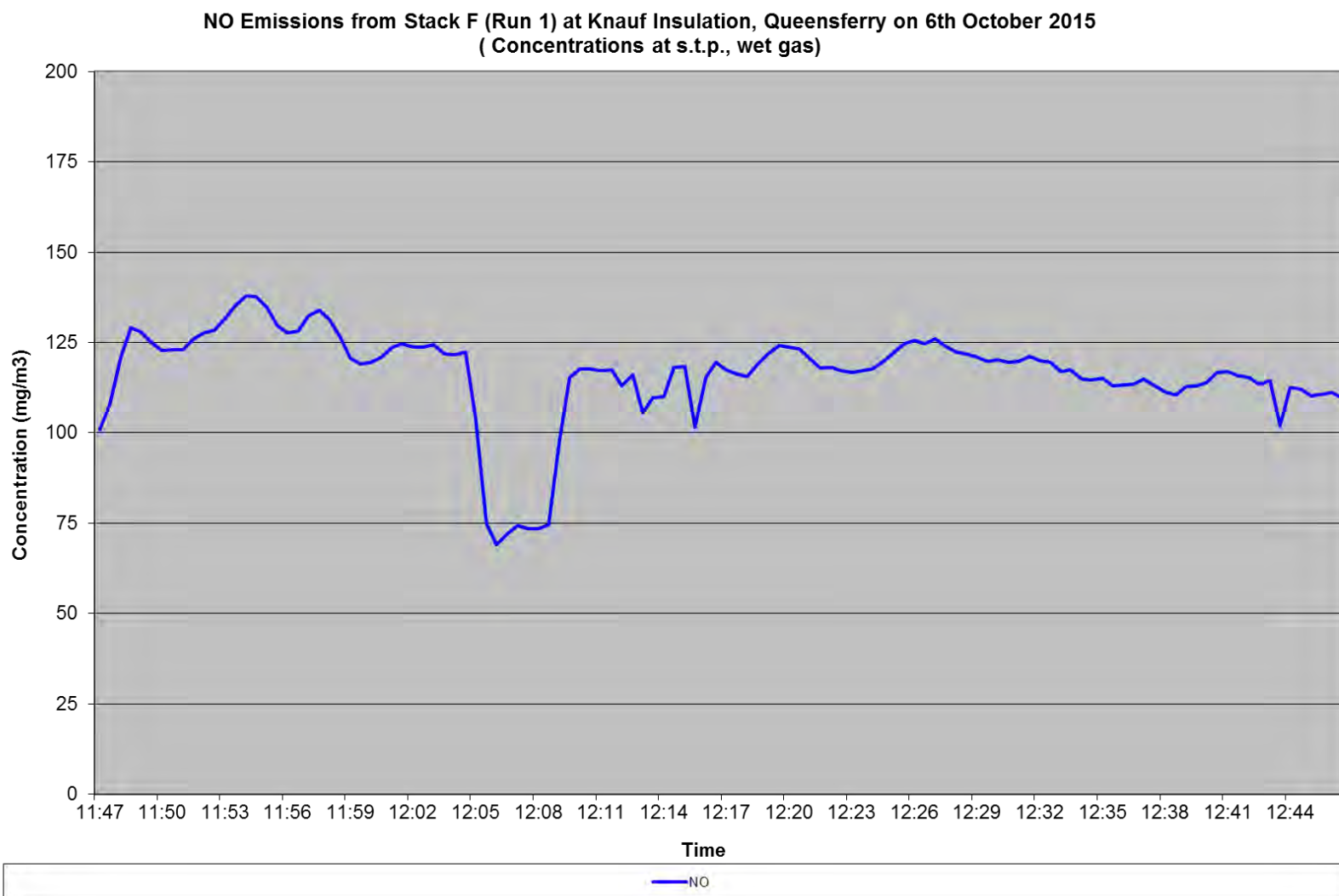
Estimating Uncertainty values for NO<sub>2</sub> at range: 14 mg/m<sup>3</sup>

| Symbol       | Source of Uncertainty               | Type | Value  | Distribution   | Divisor | Conversion factor | $u_i$ (mg/m <sup>3</sup> ) | $v_i$   |
|--------------|-------------------------------------|------|--------|----------------|---------|-------------------|----------------------------|---------|
| $u_{fit}$    | Lack of fit                         | B    | 1.700  | rectangular    | 1.732   | 0.14              | 0.14                       | -       |
| $u_{0,dr}$   | Zero drift                          | B    | -0.180 | rectangular    | 1.732   | 0.14              | -0.01                      | -       |
| $u_{s,dr}$   | Span drift                          | B    | 2.500  | rectangular    | 1.732   | 0.14              | 0.2                        | -       |
| $u_{apress}$ | Sensitivity to atm. Pressure        | B    | 0.500  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $u_{spress}$ | Sensitivity to sample gas pressure  | B    | 1.000  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $u_{temp}$   | Sensitivity to ambient temperature  | B    | 0.017  | rectangular    | 1.732   | 1.06              | 0.01                       | -       |
| $u_{volt}$   | Sensitivity to electrical voltage   | B    | 0.030  | rectangular    | 1.732   | 0.70              | 0.01                       | -       |
| $u_I$        | Interferents                        | B    | 3.100  | rectangular    | 1.732   | 0.14              | 0.25                       | -       |
| $u_{0,r}$    | STD of repeatability in LAB at zero | A    | 0.082  | normal         | 1       | 0.14              | 0.011                      | 19      |
| $u_{s,r}$    | STD of repeatability in LAB at span | A    | 0.106  | normal         | 1       | 0.14              | 0.015                      | 19      |
| $u_{cal}$    | Uncertainty of CRM                  | B    | 0.020  | normal         | 1       | 0.14              | 0                          | -       |
| $u_c$        | Combined uncertainty                |      |        | normal         |         |                   | 0.35                       | 4328637 |
| $u_{95}$     | Expanded uncertainty                |      |        | t-distribution |         |                   | 0.70                       |         |

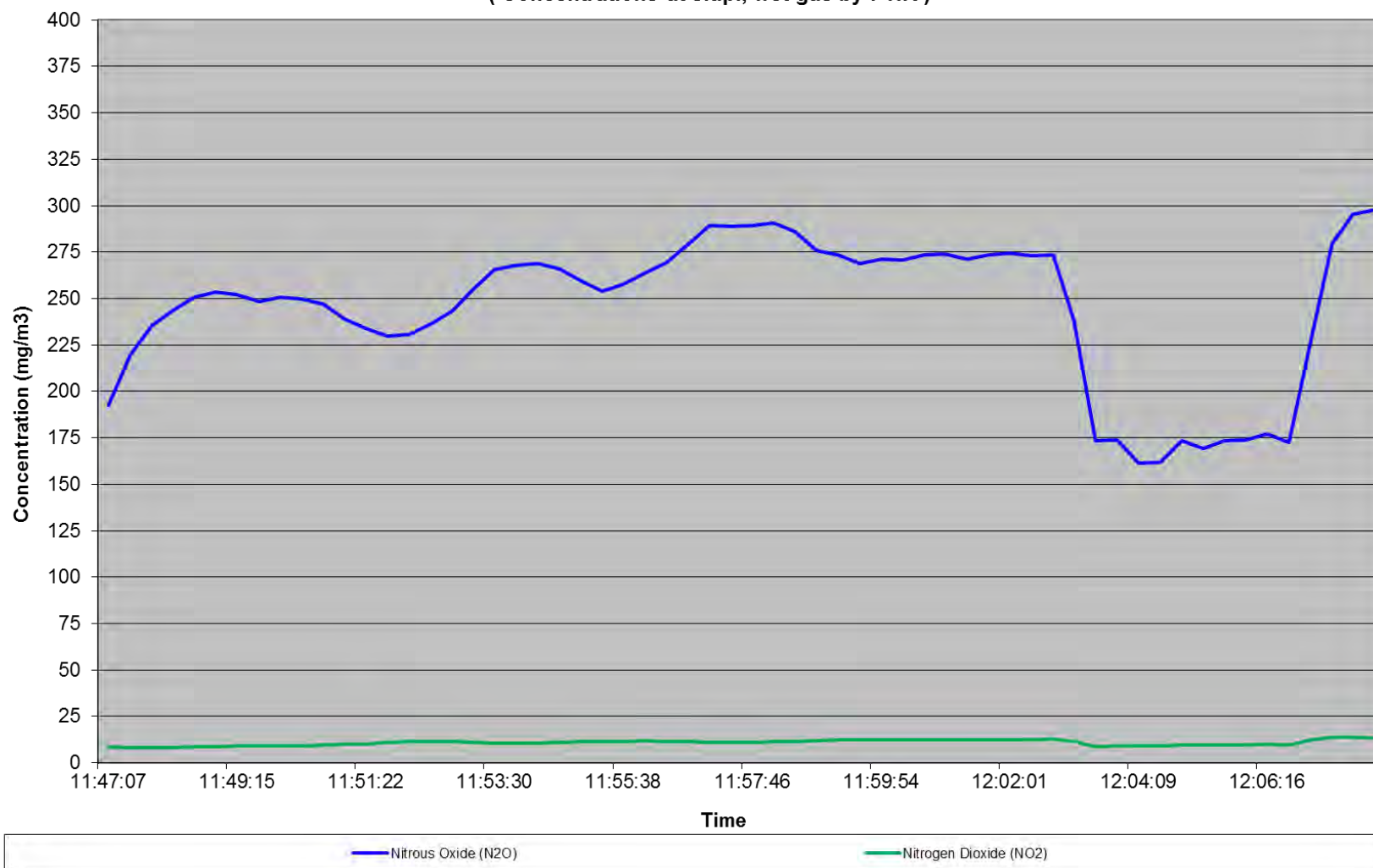
Estimating Uncertainty values for N<sub>2</sub>O at range: 286 mg/m<sup>3</sup>

| Symbol       | Source of Uncertainty               | Type | Value  | Distribution   | Divisor | Conversion factor | $u_i$ (mg/m <sup>3</sup> ) | $v_i$  |
|--------------|-------------------------------------|------|--------|----------------|---------|-------------------|----------------------------|--------|
| $u_{fit}$    | Lack of fit                         | B    | 0.600  | rectangular    | 1.732   | 2.86              | 0.99                       | -      |
| $u_{0,dr}$   | Zero drift                          | B    | 0.720  | rectangular    | 1.732   | 2.86              | 1.19                       | -      |
| $u_{s,dr}$   | Span drift                          | B    | 2.400  | rectangular    | 1.732   | 2.86              | 3.96                       | -      |
| $u_{apress}$ | Sensitivity to atm. Pressure        | B    | 0.500  | rectangular    | 1.732   | 0.00              | 0                          | -      |
| $u_{spress}$ | Sensitivity to sample gas pressure  | B    | 0.600  | rectangular    | 1.732   | 0.00              | 0                          | -      |
| $u_{temp}$   | Sensitivity to ambient temperature  | B    | 0.054  | rectangular    | 1.732   | 21.63             | 0.68                       | -      |
| $u_{volt}$   | Sensitivity to electrical voltage   | B    | -0.600 | rectangular    | 1.732   | 14.24             | -4.93                      | -      |
| $u_I$        | Interferents                        | B    | 2.700  | rectangular    | 1.732   | 2.86              | 4.46                       | -      |
| $u_{0,r}$    | STD of repeatability in LAB at zero | A    | 0.002  | normal         | 1       | 2.86              | 0.006                      | 19     |
| $u_{s,r}$    | STD of repeatability in LAB at span | A    | 0.247  | normal         | 1       | 2.86              | 0.706                      | 19     |
| $u_{cal}$    | Uncertainty of CRM                  | B    | 1.100  | normal         | 1       | 2.86              | 3.15                       | -      |
| $u_c$        | Combined uncertainty                |      |        | normal         |         |                   | 8.55                       | 407724 |
| $u_{95}$     | Expanded uncertainty                |      |        | t-distribution |         |                   | 17.10                      |        |





**N2O & NO2 Emissions from Stack F (Run 1) at Knauf Insulation, Queensferry on 6th October 2015**  
(Concentrations at s.t.p., wet gas by FTIR)



Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: Stack F

Date: 06/10/2015  
Run: NO - RUN 2

|                     | O <sub>2</sub><br>% |  | NO<br>mg/m <sup>3</sup> | NO<br>kg/hr |     |  |     |
|---------------------|---------------------|--|-------------------------|-------------|-----|--|-----|
| Average             | #DIV/0!             |  | 108.5                   | 1.442       |     |  |     |
| Max                 | 0.00                |  | 116.8                   | 1.552       |     |  |     |
| Min                 | 0.00                |  | 90.7                    | 1.205       |     |  |     |
| Emission Limit      |                     |  | N/A                     |             | N/A |  | N/A |
| Moisture, %         | 7.3                 |  | Barometric (mmHg) Start |             | 760 |  |     |
| Oxygen Reference, % | 0.0                 |  | Barometric (mmHg) End   |             | 760 |  |     |

|  |       |
|--|-------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691 |
|--|-------|

| Calibrations            | O <sub>2</sub> % |  | NO ppm |  |
|-------------------------|------------------|--|--------|--|
| Analyser - Start Zero   | 0.00             |  | 0.0    |  |
| Analyser - Start Span   | 14.60            |  | 76.0   |  |
| Analyser - Zero Check   | 0                |  | 0.0    |  |
| System - Zero Check     | 0.09             |  | 0.1    |  |
| System - Span Check     | 14.67            |  | 75.3   |  |
| System - End Zero Check | 0.09             |  | 0.3    |  |
| System - End Span Check | 14.61            |  | 75     |  |
| Cylinder Number         | 243111           |  | 221543 |  |
| Span Value              | 14.6             |  | 76     |  |
| Analyser Range (0 - X)  | 25               |  | 100    |  |

| Equipment ID Nos  |     |
|-------------------|-----|
| Analyser          | 928 |
| Heated Line       |     |
| H/Line Controller |     |
| Logger            |     |
| Pitot             |     |
| Manometer         |     |
| T/couple          |     |
| T/couple Readout  |     |
| Barometer         |     |

Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: Stack F

Date: 06/10/2015  
Run: Oxides of Nitrogen by FTIR - RUN 2

|                     | O <sub>2</sub><br>% |     |                         | N <sub>2</sub> O<br>mg/m <sup>3</sup> | N <sub>2</sub> O<br>kg/hr | NO <sub>2</sub><br>mg/m <sup>3</sup> | NO <sub>2</sub><br>kg/hr |
|---------------------|---------------------|-----|-------------------------|---------------------------------------|---------------------------|--------------------------------------|--------------------------|
| Average             | #DIV/0!             |     |                         | 318.2                                 | 4.228                     | 19.6                                 | 0.26                     |
| Max                 | 0.00                |     |                         | 338.6                                 | 4.499                     | 23.8                                 | 0.32                     |
| Min                 | 0.00                |     |                         | 294.6                                 | 3.914                     | 15.4                                 | 0.2047                   |
| Emission Limit      |                     | N/A |                         | N/A                                   |                           | N/A                                  |                          |
| Moisture, %         | 5.4                 |     | Barometric (mmHg) Start |                                       | 760                       |                                      |                          |
| Oxygen Reference, % | 0.0                 |     | Barometric (mmHg) End   |                                       | 760                       |                                      |                          |

|  |       |
|--|-------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691 |
|--|-------|

| Calibrations            | O <sub>2</sub> % | SO2 ppm |     | C3H8 ppm   |
|-------------------------|------------------|---------|-----|------------|
| Analyser - Start Zero   | 0.00             |         |     |            |
| Analyser - Start Span   | 14.60            |         |     |            |
| Analyser - Zero Check   | 0                |         |     |            |
| System - Zero Check     | 0.09             | 0.1     |     | 0.1        |
| System - Span Check     | 14.67            | 173.0   |     | 92.6       |
| System - End Zero Check | 0.09             | 0.2     |     |            |
| System - End Span Check | 14.61            | 172.5   |     |            |
| Cylinder Number         | 243111           | 187970  |     |            |
| Span Value              | 14.6             | 178     |     | 93         |
| Analyser Range (0 - X)  | Select           | Select  | 250 | Not in Use |

| Equipment ID Nos  |      |
|-------------------|------|
| Analyser          | FTIR |
| Heated Line       | FTIR |
| H/Line Controller | FTIR |
| Logger            |      |
| Pitot             |      |
| Manometer         |      |
| T/couple          |      |
| T/couple Readout  |      |
| Barometer         |      |

## Uncertainty calculation for Gaseous Measurement of Oxides of Nitrogen BS EN 14792

|                              |       |   |                     |              |
|------------------------------|-------|---|---------------------|--------------|
| Measured concentration - NOx | 117.1 | mg/m <sup>3</sup> (O <sub>2</sub> & H <sub>2</sub> O uncorrected) | Analyser Make/Model | Horiba PG250 |
| Range (Max Value)            | 205.4 | mg/m <sup>3</sup>   | ID Number           | FYS928       |

| Performance Characteristics            | Value     |   | specification          |
|--|-----------|---|------------------------|
| Response time                          | 14        | seconds   | < 180 s                |
| Logger sampling interval               | 15        | seconds   |                        |
| Measurement period                     | 260       | minutes   |                        |
| Number of readings in measurement      | 1040      | Assuming 15 Second Readings over 4.3333333333333333 | hour period            |
| Repeatability at zero                  | 0.02      | % full range  | 0.2                    |
| Repeatability at span level            | 0.02      | % full range  | 2.0                    |
| Deviation from linearity               | 2.000     | % of Value  | 2                      |
| Zero drift (during measurement period) | 0.2631579 | % full range  | 2                      |
| Span drift (during measurement period) | -0.394737 | % full range  | 2                      |
| volume or pressure flow dependence     | 0         | % of fs / kPa                                       | 0.033                  |
| atmospheric pressure dependence        | 0         | % of fs/kPa   | 0.75                   |
| ambient temperature dependence         | -0.07     | % by volume /10K                                    | 0.3                    |
| CO <sub>2</sub> (% vol)                | 15        | 0   | % by volume per        |
| CH <sub>4</sub> (mg/m <sup>3</sup> )   | 57        | 0.1   | mg/m <sup>3</sup>      |
| NH <sub>3</sub> (mg/m <sup>3</sup> )   | 20        | 0   | mg/m <sup>3</sup>      |
| Converter Efficiency                   | 96        | %   | 95%                    |
| Dependence on voltage                  | 0.1       | % by volume /10V                                    | 2% Full Scale /10 volt |
| Losses in the line (leak)              | 2         | % of value  | 2% of value            |
| Uncertainty of calibration gas         | 2         | % of value  | 2% of value            |

| Performance characteristic                        | Uncertainty        | Value of uncertainty quantity | % vol                |
|---|--------------------|-------------------------------|----------------------|
| Standard deviation of repeatability at zero       | u <sub>r0</sub>    | for mean                      | Only use rep at span |
| Standard deviation of repeatability at span level | u <sub>rs</sub>    | for mean                      | 0.001                |
| Lack of fit                                       | u <sub>fit</sub>   |                               | 2.371                |
| Drift   | u <sub>odr</sub>   |                               | -0.089               |
| volume or pressure flow dependence                | u <sub>spres</sub> |                               | 0.000                |
| atmospheric pressure dependence                   | u <sub>apres</sub> |                               | 0.000                |
| ambient temperature dependence                    | u <sub>temp</sub>  |                               | 0.000                |
| CO <sub>2</sub>                                   |                    |                               | 0.000                |
| NO  |                    |                               | 0.000                |
| NO <sub>2</sub>                                   |                    |                               | 0.000                |
| Converter Efficiency                              | u <sub>eff</sub>   |                               | 0.11                 |
| dependence on voltage                             | u <sub>volt</sub>  |                               | 0.000                |
| losses in the line (leak)                         | u <sub>leak</sub>  |                               | 1.35                 |
| Uncertainty of calibration gas                    | u <sub>calib</sub> |                               | 1.35                 |

|  |        |                   |   |
|--|--------|-------------------|---|
| Measurement Concentration (as measured)            | 117.07 | mg/m <sup>3</sup> |   |
| Combined uncertainty                               | 3.05   | mg/m <sup>3</sup> |   |
| Coverage factor k = 2                              |        |                   |   |
| Expanded uncertainty (as measured)                 | 6.10   | mg/m <sup>3</sup> | (expressed with a level of confidence of 95%) |
| Expanded uncertainty (Corrected to Ref Conditions) | 5.65   | mg/m <sup>3</sup> |   |

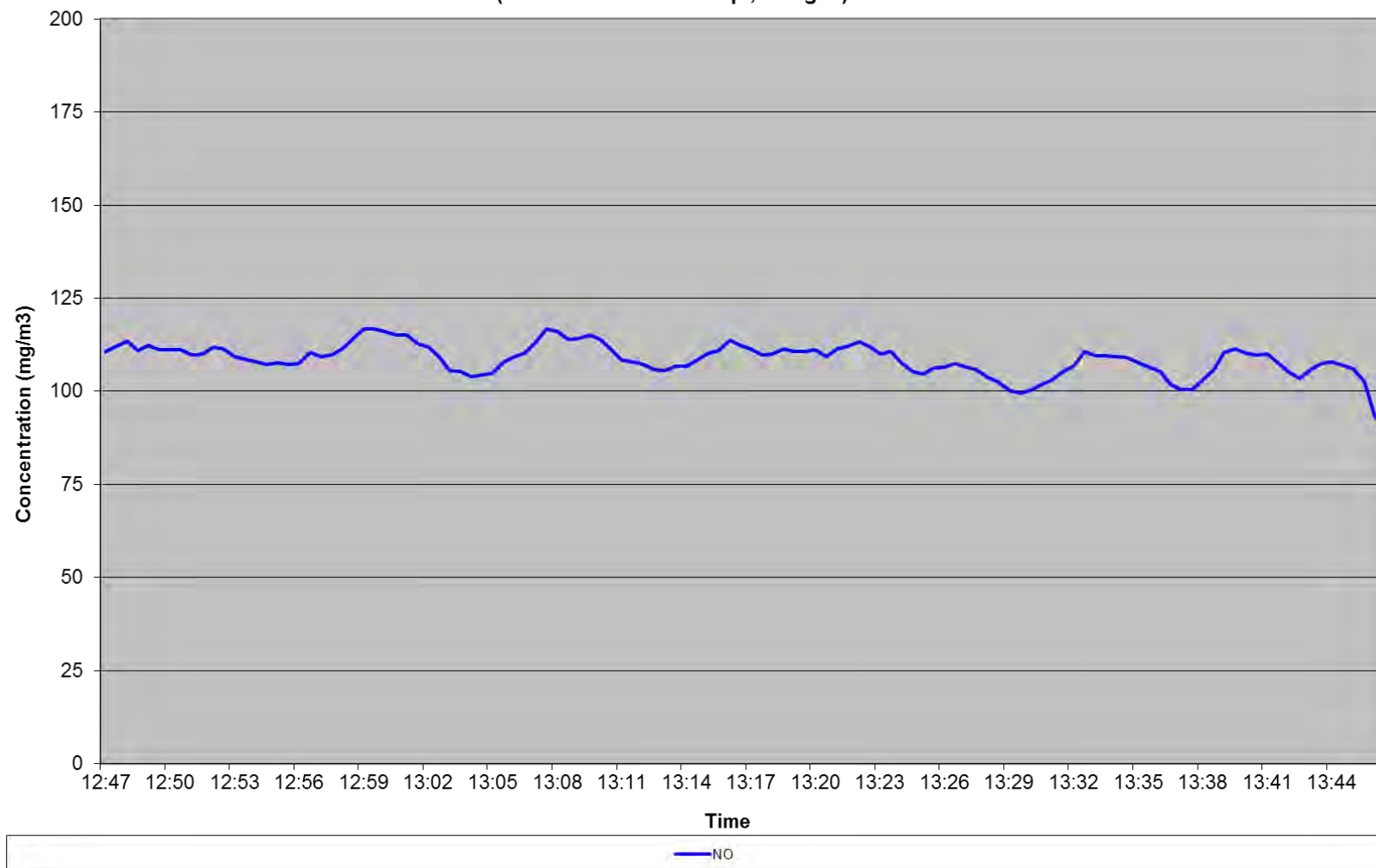
Estimating Uncertainty values for NO<sub>2</sub> at range: 20 mg/m<sup>3</sup>

| Symbol       | Source of Uncertainty               | Type | Value  | Distribution   | Divisor | Conversion factor | $u_i$ (mg/m <sup>3</sup> ) | $v_i$   |
|--------------|-------------------------------------|------|--------|----------------|---------|-------------------|----------------------------|---------|
| $u_{fit}$    | Lack of fit                         | B    | 1.700  | rectangular    | 1.732   | 0.20              | 0.2                        | -       |
| $u_{0,dr}$   | Zero drift                          | B    | -0.180 | rectangular    | 1.732   | 0.20              | -0.02                      | -       |
| $u_{s,dr}$   | Span drift                          | B    | 2.500  | rectangular    | 1.732   | 0.20              | 0.29                       | -       |
| $u_{apress}$ | Sensitivity to atm. Pressure        | B    | 0.500  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $u_{spress}$ | Sensitivity to sample gas pressure  | B    | 1.000  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $u_{temp}$   | Sensitivity to ambient temperature  | B    | 0.017  | rectangular    | 1.732   | 1.51              | 0.01                       | -       |
| $u_{volt}$   | Sensitivity to electrical voltage   | B    | 0.030  | rectangular    | 1.732   | 1.00              | 0.02                       | -       |
| $u_l$        | Interferents                        | B    | 3.100  | rectangular    | 1.732   | 0.20              | 0.36                       | -       |
| $u_{0,r}$    | STD of repeatability in LAB at zero | A    | 0.082  | normal         | 1       | 0.20              | 0.016                      | 19      |
| $u_{s,r}$    | STD of repeatability in LAB at span | A    | 0.106  | normal         | 1       | 0.20              | 0.021                      | 19      |
| $u_{cal}$    | Uncertainty of CRM                  | B    | 0.020  | normal         | 1       | 0.20              | 0                          | -       |
| $u_c$        | Combined uncertainty                |      |        | normal         |         |                   | 0.51                       | 4685456 |
| $u_{95}$     | Expanded uncertainty                |      |        | t-distribution |         |                   | 1.02                       |         |

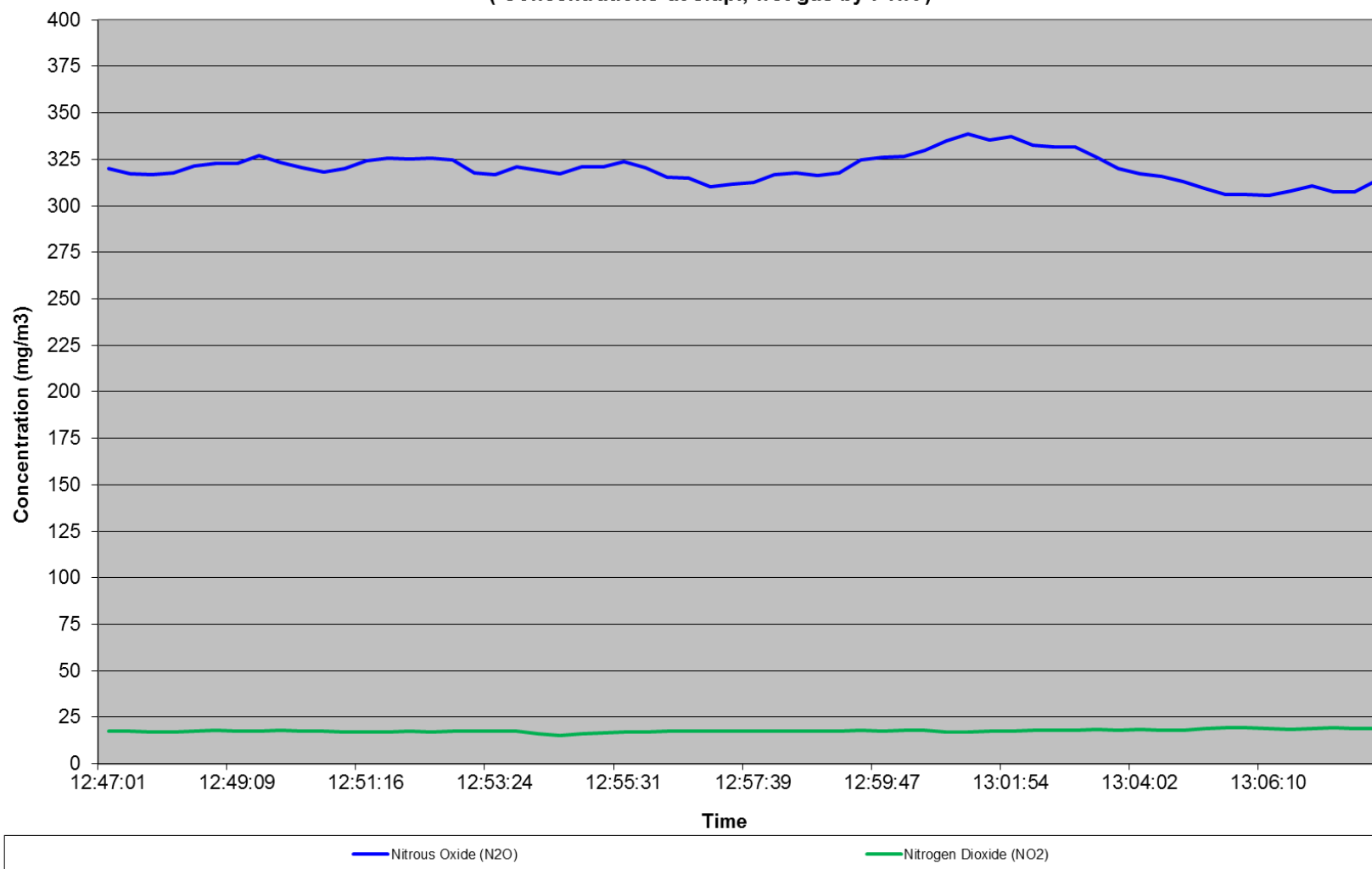
Estimating Uncertainty values for N<sub>2</sub>O at range: 318 mg/m<sup>3</sup>

| Symbol       | Source of Uncertainty               | Type | Value  | Distribution   | Divisor | Conversion factor | $u_i$ (mg/m <sup>3</sup> ) | $v_i$  |
|--------------|-------------------------------------|------|--------|----------------|---------|-------------------|----------------------------|--------|
| $u_{fit}$    | Lack of fit                         | B    | 0.600  | rectangular    | 1.732   | 3.18              | 1.1                        | -      |
| $u_{0,dr}$   | Zero drift                          | B    | 0.720  | rectangular    | 1.732   | 3.18              | 1.32                       | -      |
| $u_{s,dr}$   | Span drift                          | B    | 2.400  | rectangular    | 1.732   | 3.18              | 4.41                       | -      |
| $u_{apress}$ | Sensitivity to atm. Pressure        | B    | 0.500  | rectangular    | 1.732   | 0.00              | 0                          | -      |
| $u_{spress}$ | Sensitivity to sample gas pressure  | B    | 0.600  | rectangular    | 1.732   | 0.00              | 0                          | -      |
| $u_{temp}$   | Sensitivity to ambient temperature  | B    | 0.054  | rectangular    | 1.732   | 24.05             | 0.75                       | -      |
| $u_{volt}$   | Sensitivity to electrical voltage   | B    | -0.600 | rectangular    | 1.732   | 15.83             | -5.48                      | -      |
| $u_l$        | Interferents                        | B    | 2.700  | rectangular    | 1.732   | 3.18              | 4.96                       | -      |
| $u_{0,r}$    | STD of repeatability in LAB at zero | A    | 0.002  | normal         | 1       | 3.18              | 0.006                      | 19     |
| $u_{s,r}$    | STD of repeatability in LAB at span | A    | 0.247  | normal         | 1       | 3.18              | 0.785                      | 19     |
| $u_{cal}$    | Uncertainty of CRM                  | B    | 1.100  | normal         | 1       | 3.18              | 3.5                        | -      |
| $u_c$        | Combined uncertainty                |      |        | normal         |         |                   | 9.51                       | 408300 |
| $u_{95}$     | Expanded uncertainty                |      |        | t-distribution |         |                   | 19.02                      |        |

**NO Emissions from Stack F (Run 2) at Knauf Insulation, Queensferry on 6th October 2015**  
**(Concentrations at s.t.p., wet gas)**



**N2O & NO2 Emissions from Stack F (Run 2) at Knauf Insulation, Queensferry on 6th October 2015**  
( Concentrations at s.t.p., wet gas by FTIR )



Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: Stack F

Date: 06/10/2015  
Run: NO - RUN 3

|                     | O <sub>2</sub><br>% |  | NO<br>mg/m <sup>3</sup> | NO<br>kg/hr |     |  |     |
|---------------------|---------------------|--|-------------------------|-------------|-----|--|-----|
| Average             | #DIV/0!             |  | 100.0                   | 1.329       |     |  |     |
| Max                 | 0.00                |  | 111.4                   | 1.481       |     |  |     |
| Min                 | 0.00                |  | 68.8                    | 0.914       |     |  |     |
| Emission Limit      |                     |  | N/A                     |             | N/A |  | N/A |
| Moisture, %         | 7.9                 |  | Barometric (mmHg) Start |             | 760 |  |     |
| Oxygen Reference, % | 0.0                 |  | Barometric (mmHg) End   |             | 760 |  |     |

|  |       |
|--|-------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691 |
|--|-------|

| Calibrations            | O <sub>2</sub> % |  | NO ppm |  |
|-------------------------|------------------|--|--------|--|
| Analyser - Start Zero   | 0.00             |  | 0.0    |  |
| Analyser - Start Span   | 14.60            |  | 76.0   |  |
| Analyser - Zero Check   | 0                |  | 0.0    |  |
| System - Zero Check     | 0.09             |  | 0.1    |  |
| System - Span Check     | 14.67            |  | 75.3   |  |
| System - End Zero Check | 0.09             |  | 0.3    |  |
| System - End Span Check | 14.61            |  | 75     |  |
| Cylinder Number         | 243111           |  | 221543 |  |
| Span Value              | 14.6             |  | 76     |  |
| Analyser Range (0 - X)  | 25               |  | 100    |  |

| Equipment ID Nos  |     |
|-------------------|-----|
| Analyser          | 928 |
| Heated Line       |     |
| H/Line Controller |     |
| Logger            |     |
| Pitot             |     |
| Manometer         |     |
| T/couple          |     |
| T/couple Readout  |     |
| Barometer         |     |

Company Name: Knauf Insulation  
Site Ref: Queensferry  
Stack Ref: Stack F

Date: 06/10/2015  
Run: Oxides of Nitrogen by FTIR - RUN 3

|                     | O <sub>2</sub><br>% |     |                         | N <sub>2</sub> O<br>mg/m <sup>3</sup> | N <sub>2</sub> O<br>kg/hr | NO <sub>2</sub><br>mg/m <sup>3</sup> | NO <sub>2</sub><br>kg/hr |
|---------------------|---------------------|-----|-------------------------|---------------------------------------|---------------------------|--------------------------------------|--------------------------|
| Average             | #DIV/0!             |     |                         | 367.5                                 | 4.883                     | 21.9                                 | 0.29                     |
| Max                 | 0.00                |     |                         | 494.4                                 | 6.569                     | 25.6                                 | 0.34                     |
| Min                 | 0.00                |     |                         | 306.3                                 | 4.070                     | 14.8                                 | 0.1962                   |
| Emission Limit      |                     | N/A |                         | N/A                                   |                           | N/A                                  |                          |
| Moisture, %         | 5.4                 |     | Barometric (mmHg) Start |                                       | 760                       |                                      |                          |
| Oxygen Reference, % | 0.0                 |     | Barometric (mmHg) End   |                                       | 760                       |                                      |                          |

|  |       |
|--|-------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691 |
|--|-------|

| Calibrations            | O <sub>2</sub> % | SO2 ppm |     | C3H8 ppm   |
|-------------------------|------------------|---------|-----|------------|
| Analyser - Start Zero   | 0.00             |         |     |            |
| Analyser - Start Span   | 14.60            |         |     |            |
| Analyser - Zero Check   | 0                |         |     |            |
| System - Zero Check     | 0.09             | 0.1     |     | 0.1        |
| System - Span Check     | 14.67            | 173.0   |     | 92.6       |
| System - End Zero Check | 0.09             | 0.2     |     |            |
| System - End Span Check | 14.61            | 172.5   |     |            |
| Cylinder Number         | 243111           | 187970  |     |            |
| Span Value              | 14.6             | 178     |     | 93         |
| Analyser Range (0 - X)  | Select           | Select  | 250 | Not in Use |

| Equipment ID Nos  |      |
|-------------------|------|
| Analyser          | FTIR |
| Heated Line       | FTIR |
| H/Line Controller | FTIR |
| Logger            |      |
| Pitot             |      |
| Manometer         |      |
| T/couple          |      |
| T/couple Readout  |      |
| Barometer         |      |



Uncertainty calculation for Gaseous Measurement of Oxides of Nitrogen BS EN 14792

|                              |       |   |                     |              |
|------------------------------|-------|---|---------------------|--------------|
| Measured concentration - NOx | 108.6 | mg/m <sup>3</sup> (O <sub>2</sub> & H <sub>2</sub> O uncorrected) | Analyser Make/Model | Horiba PG250 |
| Range (Max Value)            | 205.4 | mg/m <sup>3</sup>   | ID Number           | FYS928       |

| Performance Characteristics            | Value     |   | specification          |
|--|-----------|---|------------------------|
| Response time                          | 14        | seconds   | < 180 s                |
| Logger sampling interval               | 15        | seconds   |                        |
| Measurement period                     | 260       | minutes   |                        |
| Number of readings in measurement      | 1040      | Assuming 15 Second Readings over 4.3333333333333333 | hour period            |
| Repeatability at zero                  | 0.02      | % full range  | 0.2                    |
| Repeatability at span level            | 0.02      | % full range  | 2.0                    |
| Deviation from linearity               | 2.000     | % of Value  | 2                      |
| Zero drift (during measurement period) | 0.2631579 | % full range  | 2                      |
| Span drift (during measurement period) | -0.394737 | % full range  | 2                      |
| volume or pressure flow dependence     | 0         | % of fs / kPa                                       | 0.033                  |
| atmospheric pressure dependence        | 0         | % of fs/kPa   | 0.75                   |
| ambient temperature dependence         | -0.07     | % by volume /10K                                    | 0.3                    |
| CO <sub>2</sub> (% vol)                | 15        | 0   | % by volume per        |
| CH <sub>4</sub> (mg/m <sup>3</sup> )   | 57        | 0.1   | mg/m <sup>3</sup>      |
| NH <sub>3</sub> (mg/m <sup>3</sup> )   | 20        | 0   | mg/m <sup>3</sup>      |
| Converter Efficiency                   | 96        | %   | 95%                    |
| Dependence on voltage                  | 0.1       | % by volume /10V                                    | 2% Full Scale /10 volt |
| Losses in the line (leak)              | 2         | % of value  | 2% of value            |
| Uncertainty of calibration gas         | 2         | % of value  | 2% of value            |

| Performance characteristic                        | Uncertainty        | Value of uncertainty quantity | % vol                |
|---|--------------------|-------------------------------|----------------------|
| Standard deviation of repeatability at zero       | u <sub>r0</sub>    | for mean                      | Only use rep at span |
| Standard deviation of repeatability at span level | u <sub>rs</sub>    | for mean                      | 0.001                |
| Lack of fit                                       | u <sub>fit</sub>   |                               | 2.371                |
| Drift   | u <sub>odr</sub>   |                               | -0.082               |
| volume or pressure flow dependence                | u <sub>spres</sub> |                               | 0.000                |
| atmospheric pressure dependence                   | u <sub>apres</sub> |                               | 0.000                |
| ambient temperature dependence                    | u <sub>temp</sub>  |                               | 0.000                |
| CO <sub>2</sub>                                   |                    |                               | 0.000                |
| NO  |                    |                               | 0.000                |
| NO <sub>2</sub>                                   |                    |                               | 0.000                |
| Converter Efficiency                              | u <sub>eff</sub>   |                               | 0.10                 |
| dependence on voltage                             | u <sub>volt</sub>  |                               | 0.000                |
| losses in the line (leak)                         | u <sub>leak</sub>  |                               | 1.25                 |
| Uncertainty of calibration gas                    | u <sub>calib</sub> |                               | 1.25                 |

|  |        |                   |   |
|--|--------|-------------------|---|
| Measurement Concentration (as measured)            | 108.57 | mg/m <sup>3</sup> |   |
| Combined uncertainty                               | 2.96   | mg/m <sup>3</sup> |   |
| Coverage factor k = 2                              |        |                   |   |
| Expanded uncertainty (as measured)                 | 5.93   | mg/m <sup>3</sup> | (expressed with a level of confidence of 95%) |
| Expanded uncertainty (Corrected to Ref Conditions) | 5.46   | mg/m <sup>3</sup> |   |

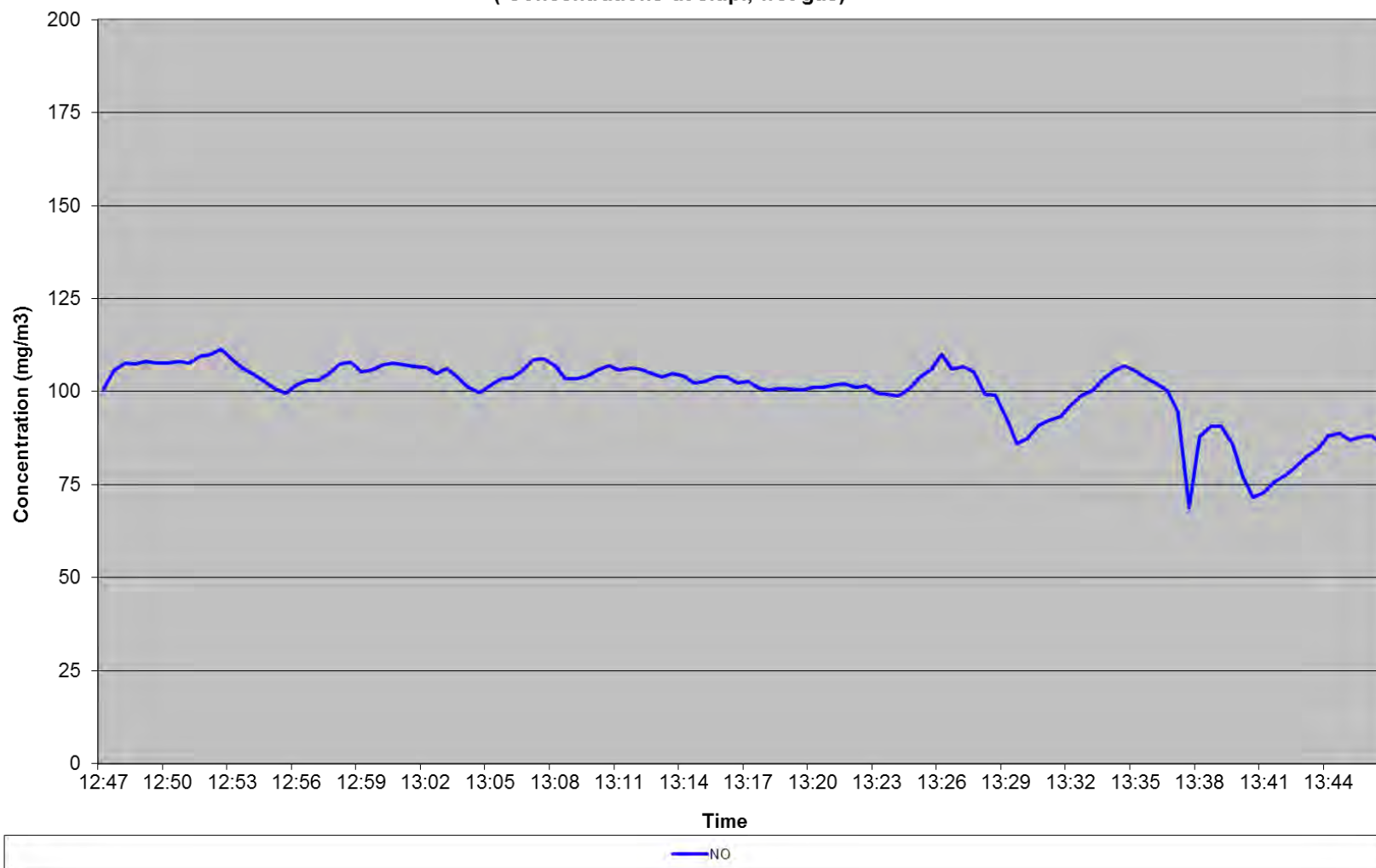
Estimating Uncertainty values for NO<sub>2</sub> at range: 22 mg/m<sup>3</sup>

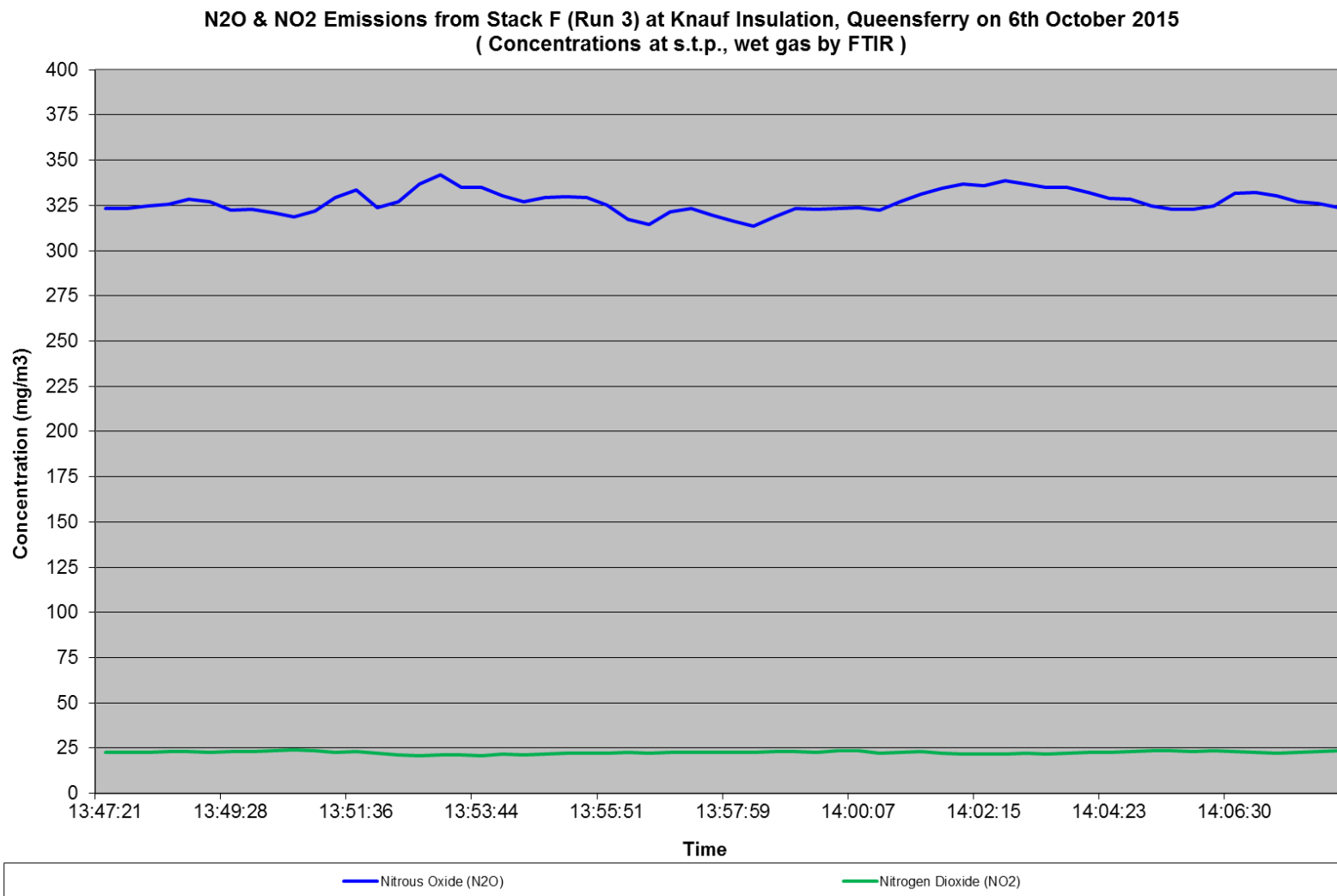
| Symbol       | Source of Uncertainty               | Type | Value  | Distribution   | Divisor | Conversion factor | $u_i$ (mg/m <sup>3</sup> ) | $\nu_i$ |
|--------------|-------------------------------------|------|--------|----------------|---------|-------------------|----------------------------|---------|
| $U_{fit}$    | Lack of fit                         | B    | 1.700  | rectangular    | 1.732   | 0.22              | 0.22                       | -       |
| $U_{0,dr}$   | Zero drift                          | B    | -0.180 | rectangular    | 1.732   | 0.22              | -0.02                      | -       |
| $U_{s,dr}$   | Span drift                          | B    | 2.500  | rectangular    | 1.732   | 0.22              | 0.32                       | -       |
| $U_{apress}$ | Sensitivity to atm. Pressure        | B    | 0.500  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $U_{spress}$ | Sensitivity to sample gas pressure  | B    | 1.000  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $U_{temp}$   | Sensitivity to ambient temperature  | B    | 0.017  | rectangular    | 1.732   | 1.66              | 0.02                       | -       |
| $U_{volt}$   | Sensitivity to electrical voltage   | B    | 0.030  | rectangular    | 1.732   | 1.10              | 0.02                       | -       |
| $U_I$        | Interferents                        | B    | 3.100  | rectangular    | 1.732   | 0.22              | 0.39                       | -       |
| $U_{0,r}$    | STD of repeatability in LAB at zero | A    | 0.082  | normal         | 1       | 0.22              | 0.018                      | 19      |
| $U_{s,r}$    | STD of repeatability in LAB at span | A    | 0.106  | normal         | 1       | 0.22              | 0.023                      | 19      |
| $U_{cal}$    | Uncertainty of CRM                  | B    | 0.020  | normal         | 1       | 0.22              | 0                          | -       |
| $U_c$        | Combined uncertainty                |      |        | normal         |         |                   | 0.55                       | 4328637 |
| $U_{95}$     | Expanded uncertainty                |      |        | t-distribution |         |                   | 1.10                       |         |

Estimating Uncertainty values for N<sub>2</sub>O at range: 368 mg/m<sup>3</sup>

| Symbol       | Source of Uncertainty               | Type | Value  | Distribution   | Divisor | Conversion factor | $u_i$ (mg/m <sup>3</sup> ) | $\nu_i$ |
|--------------|-------------------------------------|------|--------|----------------|---------|-------------------|----------------------------|---------|
| $U_{fit}$    | Lack of fit                         | B    | 0.600  | rectangular    | 1.732   | 3.68              | 1.27                       | -       |
| $U_{0,dr}$   | Zero drift                          | B    | 0.720  | rectangular    | 1.732   | 3.68              | 1.53                       | -       |
| $U_{s,dr}$   | Span drift                          | B    | 2.400  | rectangular    | 1.732   | 3.68              | 5.1                        | -       |
| $U_{apress}$ | Sensitivity to atm. Pressure        | B    | 0.500  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $U_{spress}$ | Sensitivity to sample gas pressure  | B    | 0.600  | rectangular    | 1.732   | 0.00              | 0                          | -       |
| $U_{temp}$   | Sensitivity to ambient temperature  | B    | 0.054  | rectangular    | 1.732   | 27.83             | 0.87                       | -       |
| $U_{volt}$   | Sensitivity to electrical voltage   | B    | -0.600 | rectangular    | 1.732   | 18.32             | -6.35                      | -       |
| $U_I$        | Interferents                        | B    | 2.700  | rectangular    | 1.732   | 3.68              | 5.74                       | -       |
| $U_{0,r}$    | STD of repeatability in LAB at zero | A    | 0.002  | normal         | 1       | 3.68              | 0.007                      | 19      |
| $U_{s,r}$    | STD of repeatability in LAB at span | A    | 0.247  | normal         | 1       | 3.68              | 0.909                      | 19      |
| $U_{cal}$    | Uncertainty of CRM                  | B    | 1.100  | normal         | 1       | 3.68              | 4.05                       | -       |
| $U_c$        | Combined uncertainty                |      |        | normal         |         |                   | 11.01                      | 409000  |
| $U_{95}$     | Expanded uncertainty                |      |        | t-distribution |         |                   | 22.02                      |         |

**NO Emissions from Stack F (Run 3) at Knauf Insulation, Queensferry on 6th October 2015**  
**(Concentrations at s.t.p., wet gas)**





Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: F

Date: 07/10/2015  
Run: TOC  
Start: 10:30  
Stop: 11:30

|                     | VOC (as Propane)<br>ppm | VOC (as Carbon)<br>mg/m3 | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m3 | VOC (as<br>Toluene) kg/h | Oxygen<br>% |
|---------------------|-------------------------|--------------------------|-------------------------|---------------------------|--------------------------|-------------|
| Average             | 2.81                    | 4.51                     | 0.06                    | 4.94                      | 0.07                     | #DIV/0!     |
| Max                 | 2.90                    | 4.66                     | 0.06                    | 5.10                      | 0.07                     | 0.00        |
| Min                 | 2.30                    | 3.70                     | 0.05                    | 4.05                      | 0.05                     | 0.00        |
| Emission Limit      |                         | 10.00                    |                         |                           |                          |             |
| Moisture, %         | 7.0                     |                          |                         |                           |                          |             |
| Oxygen Reference, % | 0.0                     |                          |                         |                           |                          |             |

|  |             |
|--|-------------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691333454 |
|--|-------------|

| Calibrations            | ppm    |
|-------------------------|--------|
| Analyser - Start Zero   | 0.00   |
| Analyser - Start Span   | 92.90  |
| Analyser - Zero Check   | 0.10   |
| System - Zero Check     | 0.10   |
| System - Span Check     | 92.40  |
| System - End Zero Check | 0.30   |
| System - End Span Check | 91.60  |
| Cylinder Number         | 116343 |
| Span Value              | 93.00  |
| Analyser Range (0 - X)  | 100.00 |

| Equipment ID                 |       |
|------------------------------|-------|
| FID                          | 01575 |
| Heated Line                  |       |
| H/Line Controller (if req'd) |       |
| Logger                       |       |
| Pitot                        |       |
| Manometer                    |       |
| T/couple                     |       |
| T/couple Readout             |       |
| Barometer                    | 00515 |

ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |             |
|--|-------------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 4.509297521 |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.7142857 |

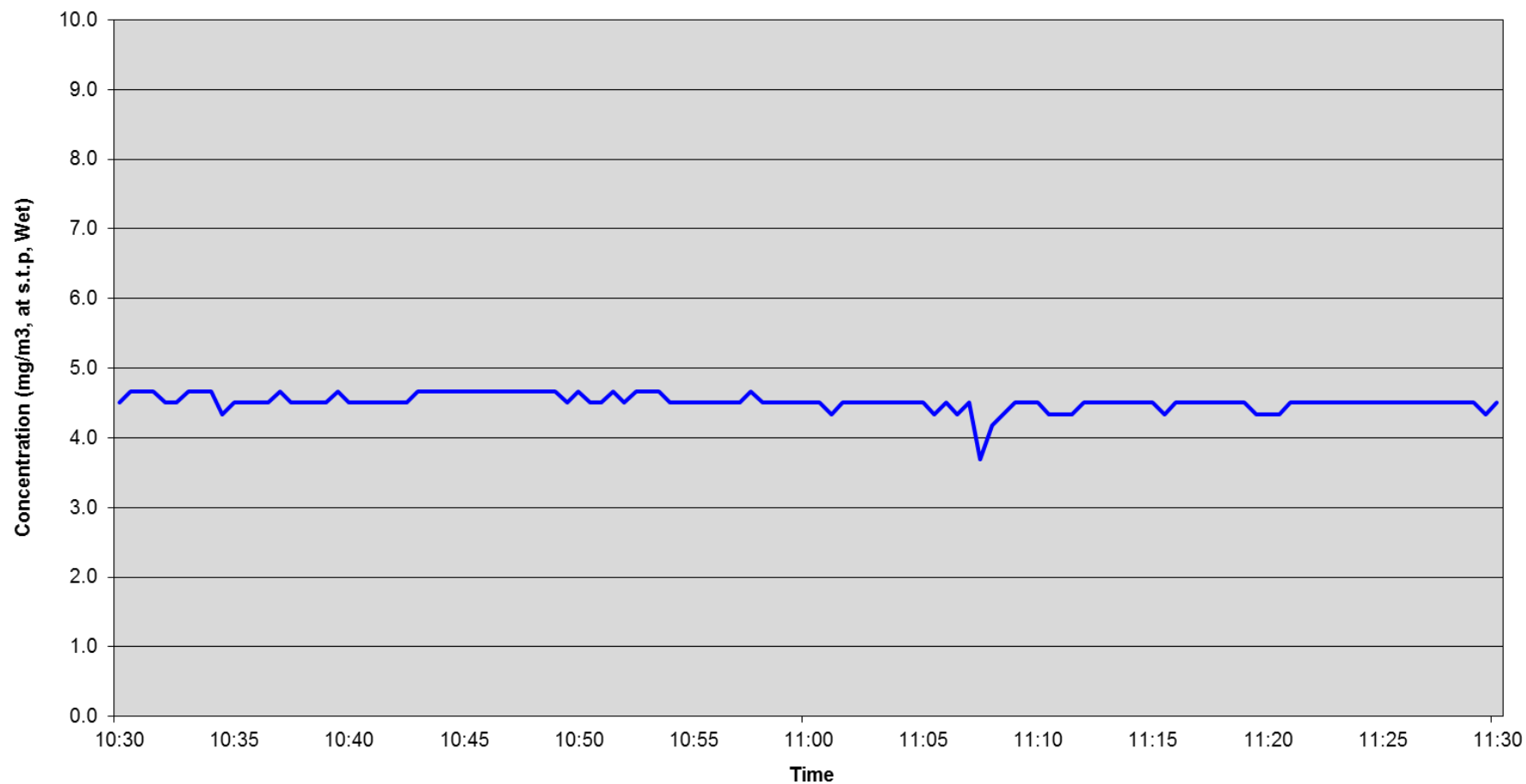
| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

| Selected Performance Characteristic | Value of Performance Characteristic |           |                | Operating Conditions compared to calibration condition |                                     |                |
|-------------------------------------|-------------------------------------|-----------|----------------|--|-------------------------------------|----------------|
|                                     | %                                   | Numerical | Units          | Required   | Variable due to sampling conditions | Units          |
| Deviation from Linearity            | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| 8 Hour Drift                        | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa          | 0.001  | 1                                   | % kPa          |
| Temperature Dependence              | 0.2                                 | 0.002     | %K             | 0.002  | 1                                   | %K             |
| Sum Interference                    | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Voltage Supply                      | 0.1                                 | 0.001     | %V             | 0.001  | 1                                   | %V             |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H2O Error | 0.01   | 2                                   | %Vol H2O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |

| Measurement Performance related to stationary conditions |  |                              |                               |            |                |         |          |                |
|--|--|------------------------------|-------------------------------|------------|----------------|---------|----------|----------------|
| Performance Characteristic                               |  | Uncertainty Quantity         | Value of Uncertainty Quantity |            |                |         |          |                |
|  |  |                              | Units                         | U          | U <sup>2</sup> | Units   | U        | U <sup>2</sup> |
| Deviation from Linearity                                 |  | U <sub>Fit</sub>             | % FS                          | 1.60714286 | 2.583          | % FS    | 0.045093 | 0.002          |
| Repeatability Standard Deviation                         |  | U <sub>R</sub>               | % FS                          | 0.026      | 0.001          | % FS    | 0.026    | 0.001          |
| 8 Hour Drift   |  | U <sub>drift</sub>           | %                             | 0.0521     | 0.003          | %       | 0.052    | 0.003          |
| Atmospheric Pressure Dependence                          |  | U <sub>Atmos</sub>           | % / kPa                       | 0.003      | 0.000          | % / kPa | 0.003    | 0.000          |
| Temperature Dependence                                   |  | U <sub>Temp</sub>            | % / K                         | 0.005      | 0.000          | % / K   | 0.005    | 0.000          |
| Sum Interference   |  | U <sub>Interference</sub>    | %                             | 0.052      | 0.003          | %       | 0.003    | 0.000          |
| Voltage Supply   |  | U <sub>Voltage</sub>         | % / V                         | 0.003      | 0.000          | % / V   | 0.003    | 0.000          |
| Uncertainty of Calibration Gas                           |  | U <sub>Calibration gas</sub> | %                             | 0.052      | 0.003          | %       | 0.052    | 0.003          |
| Loss in sample line (Leaks)                              |  | U <sub>Losses, leak</sub>    | %                             | 0.052      | 0.003          | %       | 0.104    | 0.011          |
| Sum  |  |                              |                               | 1.852      | 2.594          | Sum     | 0.292    | 0.019          |

|                                |             |                     |
|--------------------------------|-------------|---------------------|
| Measurement Uncertainty at     | 4.509297521 | mg/m <sup>3</sup> C |
| U <sub>tot</sub>               | 0.138       | mg/m <sup>3</sup> C |
| U <sub>tot</sub> <sup>IC</sup> | 3.059       | %                   |
| U <sub>limit</sub>             | 30          | %                   |

**TOC Run 1 Emissions Profile from Stack F on 7th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*



Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: F

Date: 07/10/2015  
Run: TOC 2  
Start: 11:30  
Stop: 12:30

|                     | VOC (as Propane)<br>ppm | VOC (as Carbon)<br>mg/m3 | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m3 | VOC (as<br>Toluene) kg/h | Oxygen<br>% |
|---------------------|-------------------------|--------------------------|-------------------------|---------------------------|--------------------------|-------------|
| Average             | 3.03                    | 4.88                     | 0.06                    | 5.34                      | 0.07                     | #DIV/0!     |
| Max                 | 3.60                    | 5.79                     | 0.08                    | 6.34                      | 0.08                     | 0.00        |
| Min                 | 1.10                    | 1.77                     | 0.02                    | 1.94                      | 0.03                     | 0.00        |
| Emission Limit      |                         | 10.00                    |                         |                           |                          |             |
| Moisture, %         | 7.0                     |                          |                         |                           |                          |             |
| Oxygen Reference, % | 0.0                     |                          |                         |                           |                          |             |

|  |             |
|--|-------------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691333454 |
|--|-------------|

| Calibrations            | ppm    |
|-------------------------|--------|
| Analyser - Start Zero   | 0.00   |
| Analyser - Start Span   | 92.90  |
| Analyser - Zero Check   | 0.10   |
| System - Zero Check     | 0.10   |
| System - Span Check     | 92.40  |
| System - End Zero Check | 0.30   |
| System - End Span Check | 91.60  |
| Cylinder Number         | 116343 |
| Span Value              | 93.00  |
| Analyser Range (0 - X)  | 100.00 |

| Equipment ID                 |       |
|------------------------------|-------|
| FID                          | 01575 |
| Heated Line                  |       |
| H/Line Controller (if req'd) |       |
| Logger                       |       |
| Pitot                        |       |
| Manometer                    |       |
| T/couple                     |       |
| T/couple Readout             |       |
| Barometer                    | 00515 |

ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |             |
|--|-------------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 4.877213695 |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.7142857 |

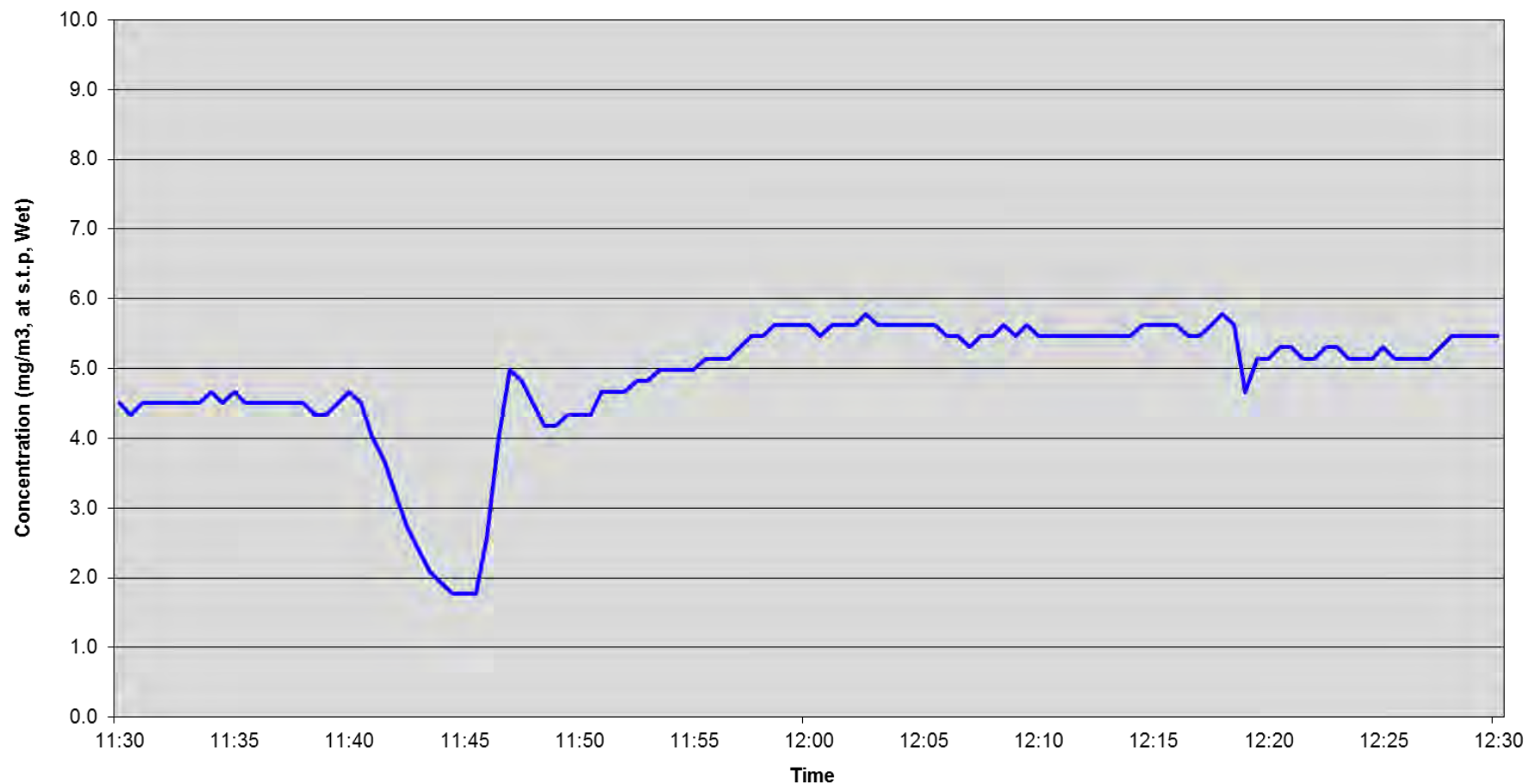
| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

| Selected Performance Characteristic | Value of Performance Characteristic |           |                | Operating Conditions compared to calibration condition |                                     |                |
|-------------------------------------|-------------------------------------|-----------|----------------|--|-------------------------------------|----------------|
|                                     | %                                   | Numerical | Units          | Required   | Variable due to sampling conditions | Units          |
| Deviation from Linearity            | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| 8 Hour Drift                        | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa          | 0.001  | 1                                   | % kPa          |
| Temperature Dependence              | 0.2                                 | 0.002     | %K             | 0.002  | 1                                   | %K             |
| Sum Interference                    | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Voltage Supply                      | 0.1                                 | 0.001     | %V             | 0.001  | 1                                   | %V             |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H2O Error | 0.01   | 2                                   | %Vol H2O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |

| Measurement Performance related to stationary conditions |  |                              |                               |            |                |                        |           |                |
|--|--|------------------------------|-------------------------------|------------|----------------|------------------------|-----------|----------------|
| Performance Characteristic                               |  | Uncertainty Quantity         | Value of Uncertainty Quantity |            |                |                        |           |                |
|  |  |                              | At Calibration Conditions     |            |                | At Sampling Conditions |           |                |
|  |  |                              | Units                         | U          | U <sup>2</sup> | Units                  | U         | U <sup>2</sup> |
| Deviation from Linearity                                 |  | U <sub>Fit</sub>             | % FS                          | 1.60714286 | 2.583          | % FS                   | 0.0487721 | 0.002          |
| Repeatability Standard Deviation                         |  | U <sub>R</sub>               | % FS                          | 0.028      | 0.001          | % FS                   | 0.028     | 0.001          |
| 8 Hour Drift   |  | U <sub>drift</sub>           | %                             | 0.0563     | 0.003          | %                      | 0.056     | 0.003          |
| Atmospheric Pressure Dependence                          |  | U <sub>Atmos</sub>           | % / kPa                       | 0.003      | 0.000          | % / kPa                | 0.003     | 0.000          |
| Temperature Dependence                                   |  | U <sub>temp</sub>            | % / K                         | 0.006      | 0.000          | % / K                  | 0.006     | 0.000          |
| Sum Interference   |  | U <sub>interference</sub>    | %                             | 0.056      | 0.003          | %                      | 0.003     | 0.000          |
| Voltage Supply   |  | U <sub>Voltage</sub>         | % / V                         | 0.003      | 0.000          | % / V                  | 0.003     | 0.000          |
| Uncertainty of Calibration Gas                           |  | U <sub>Calibration gas</sub> | %                             | 0.056      | 0.003          | %                      | 0.056     | 0.003          |
| Loss in sample line (Leaks)                              |  | U <sub>losses, leak</sub>    | %                             | 0.056      | 0.003          | %                      | 0.113     | 0.013          |
| Sum  |  |                              |                               | 1.872      | 2.596          | Sum                    | 0.316     | 0.022          |

|                                |             |                     |
|--------------------------------|-------------|---------------------|
| Measurement Uncertainty at     | 4.877213695 | mg/m <sup>3</sup> C |
| U <sub>tot</sub>               | 0.149       | mg/m <sup>3</sup> C |
| U <sub>tot</sub> <sup>/C</sup> | 3.059       | %                   |
| U <sub>limit</sub>             | 30          | %                   |

**TOC Run 2 Emissions Profile from Stack F on 7th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*





Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: F

Date: 07/10/2015  
Run: TOC 2  
Start: 11:30  
Stop: 12:30

|                     | VOC (as Propane)<br>ppm | VOC (as Carbon)<br>mg/m3 | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m3 | VOC (as<br>Toluene) kg/h | Oxygen<br>% |
|---------------------|-------------------------|--------------------------|-------------------------|---------------------------|--------------------------|-------------|
| Average             | 3.41                    | 5.48                     | 0.07                    | 6.00                      | 0.08                     | #DIV/0!     |
| Max                 | 4.10                    | 6.59                     | 0.09                    | 7.22                      | 0.10                     | 0.00        |
| Min                 | 2.90                    | 4.66                     | 0.06                    | 5.10                      | 0.07                     | 0.00        |
| Emission Limit      |                         | 10.00                    |                         |                           |                          |             |
| Moisture, %         | 7.0                     |                          |                         |                           |                          |             |
| Oxygen Reference, % | 0.0                     |                          |                         |                           |                          |             |

|  |             |
|--|-------------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.691333454 |
|--|-------------|

| Calibrations            | ppm    |
|-------------------------|--------|
| Analyser - Start Zero   | 0.00   |
| Analyser - Start Span   | 92.90  |
| Analyser - Zero Check   | 0.10   |
| System - Zero Check     | 0.10   |
| System - Span Check     | 92.40  |
| System - End Zero Check | 0.30   |
| System - End Span Check | 91.60  |
| Cylinder Number         | 116343 |
| Span Value              | 93.00  |
| Analyser Range (0 - X)  | 100.00 |

| Equipment ID                 |       |
|------------------------------|-------|
| FID                          | 01575 |
| Heated Line                  |       |
| H/Line Controller (if req'd) |       |
| Logger                       |       |
| Pitot                        |       |
| Manometer                    |       |
| T/couple                     |       |
| T/couple Readout             |       |
| Barometer                    | 00515 |

ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |             |
|--|-------------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 5.480224321 |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.7142857 |

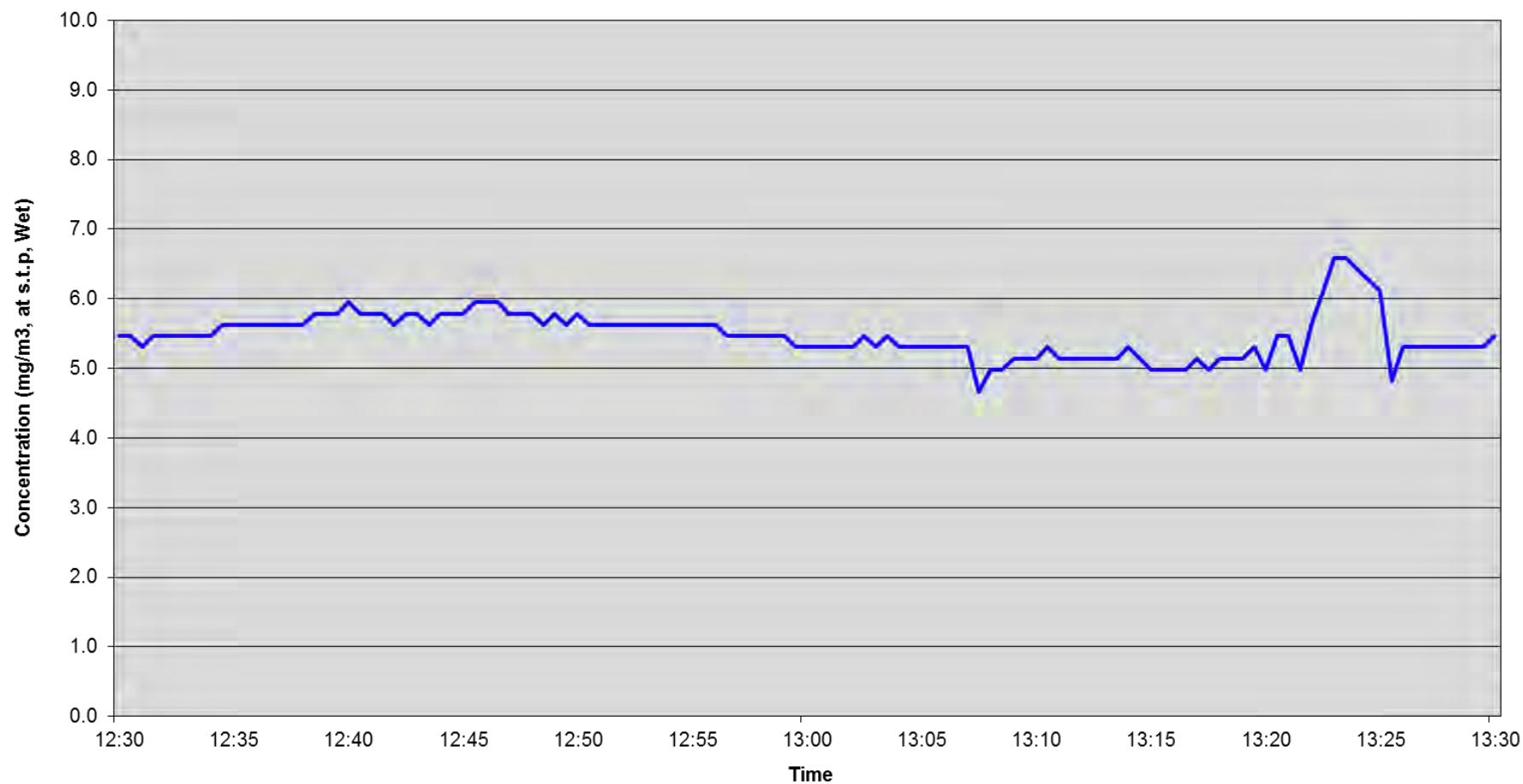
| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

| Selected Performance Characteristic | Value of Performance Characteristic |           |                | Operating Conditions compared to calibration condition |                                     |                |
|-------------------------------------|-------------------------------------|-----------|----------------|--|-------------------------------------|----------------|
|                                     | %                                   | Numerical | Units          | Required   | Variable due to sampling conditions | Units          |
| Deviation from Linearity            | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| 8 Hour Drift                        | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa          | 0.001  | 1                                   | % kPa          |
| Temperature Dependence              | 0.2                                 | 0.002     | %K             | 0.002  | 1                                   | %K             |
| Sum Interference                    | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Voltage Supply                      | 0.1                                 | 0.001     | %V             | 0.001  | 1                                   | %V             |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H2O Error | 0.01   | 2                                   | %Vol H2O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |

| Measurement Performance related to stationary conditions |                              |                               |            |                |                        |           |                |
|--|------------------------------|-------------------------------|------------|----------------|------------------------|-----------|----------------|
|  |                              | Value of Uncertainty Quantity |            |                |                        |           |                |
| Performance Characteristic                               | Uncertainty Quantity         | At Calibration Conditions     |            |                | At Sampling Conditions |           |                |
|  |                              | Units                         | U          | U <sup>2</sup> | Units                  | U         | U <sup>2</sup> |
| Deviation from Linearity                                 | U <sub>FL</sub>              | % FS                          | 1.60714286 | 2.583          | % FS                   | 0.0548022 | 0.003          |
| Repeatability Standard Deviation                         | U <sub>R</sub>               | % FS                          | 0.032      | 0.001          | % FS                   | 0.032     | 0.001          |
| 8 Hour Drift   | U <sub>drift</sub>           | %                             | 0.0633     | 0.004          | %                      | 0.063     | 0.004          |
| Atmospheric Pressure Dependence                          | U <sub>Atmos</sub>           | % / kPa                       | 0.003      | 0.000          | % / kPa                | 0.003     | 0.000          |
| Temperature Dependence                                   | U <sub>temp</sub>            | % / K                         | 0.006      | 0.000          | % / K                  | 0.006     | 0.000          |
| Sum Interference   | U <sub>interference</sub>    | %                             | 0.063      | 0.004          | %                      | 0.003     | 0.000          |
| Voltage Supply   | U <sub>voltage</sub>         | % / V                         | 0.003      | 0.000          | % / V                  | 0.003     | 0.000          |
| Uncertainty of Calibration Gas                           | U <sub>calibration gas</sub> | %                             | 0.063      | 0.004          | %                      | 0.063     | 0.004          |
| Loss in sample line (Leaks)                              | U <sub>losses, leak</sub>    | %                             | 0.063      | 0.004          | %                      | 0.127     | 0.016          |
| Sum  |                              |                               | 1.905      | 2.600          | Sum                    | 0.355     | 0.028          |

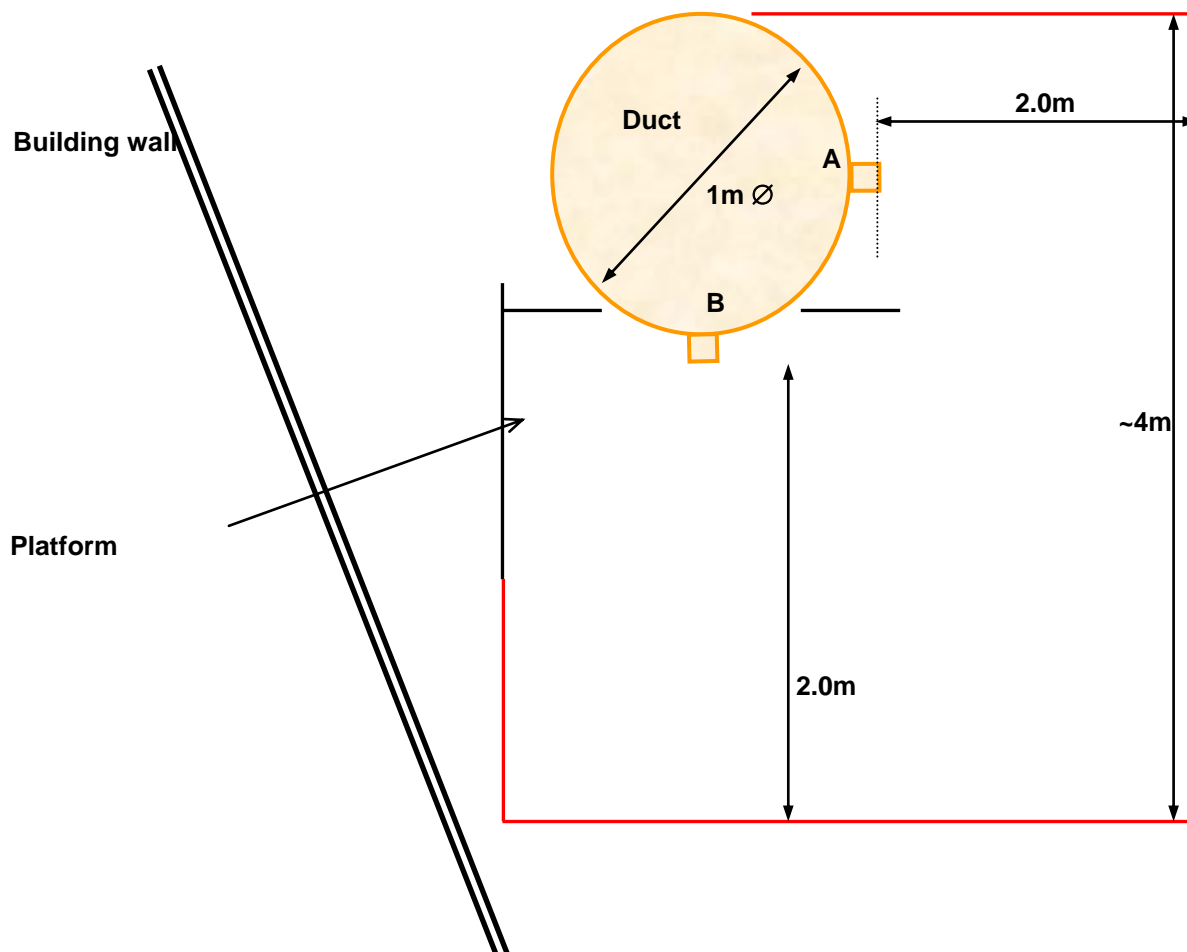
|                                |             |                     |                    |    |   |
|--------------------------------|-------------|---------------------|--------------------|----|---|
| Measurement Uncertainty at     | 5.480224321 | mg/m <sup>3</sup> C |                    |    |   |
| U <sub>tot</sub>               | 0.168       | mg/m <sup>3</sup> C |                    |    |   |
| U <sub>tot</sub> <sup>/C</sup> | 3.059       | %                   | U <sub>limit</sub> | 30 | % |

**TOC Run 3 Emissions Profile from Stack F on 7th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*



## **APPENDIX 4: G Sampling, Analysis & Uncertainty Data**

## Sample Point Diagram



Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: G

Date: 05/10/2015  
Run:

| Static Press, mm H <sub>2</sub> O: |                     | 1.2        |                                  | Stack Diamter (m)    |               | 1.00         |                                  |           |               |
|------------------------------------|---------------------|------------|----------------------------------|----------------------|---------------|--------------|----------------------------------|-----------|---------------|
| Barometric press, mm Hg:           |                     | 750        |                                  | Pitot Tube Constant: |               | 0.824        |                                  |           |               |
| Traverse                           | Traverse            | Port A     |                                  |                      |               | Port B       |                                  |           |               |
| Point No.                          | Point (m)           | Δ p, mmH2O | Conversion for pitot coefficient | Root Δ p.            | Stack Temp °C | Δ p, mmH2O   | Conversion for coefficient and t | Root Δ p. | Stack Temp °C |
| 1                                  | 0.15                | 2.4        | 16.3                             | 4.037                | 27            | 2.4          | 16.3                             | 4.037     | 27            |
| 2                                  | 0.85                | 2.4        | 16.3                             | 4.037                | 27            | 2.4          | 16.3                             | 4.037     | 27            |
| 3                                  | N/A                 |            |                                  |                      |               |              |                                  |           |               |
| 4                                  | N/A                 |            |                                  |                      |               |              |                                  |           |               |
| 5                                  | N/A                 |            |                                  |                      |               |              |                                  |           |               |
| 6                                  | N/A                 |            |                                  |                      |               |              |                                  |           |               |
| 7                                  | N/A                 |            |                                  |                      |               |              |                                  |           |               |
| 8                                  | N/A                 |            |                                  |                      |               |              |                                  |           |               |
| 9                                  | N/A                 |            |                                  |                      |               |              |                                  |           |               |
| 10                                 | N/A                 |            |                                  |                      |               |              |                                  |           |               |
|                                    | Minimum             | 2.4        | 16.3                             | 4.037                | 27.0          | 2.4          | 16.3                             | 4.037     | 27.0          |
|                                    | Maximum             | 2.4        | 16.3                             | 4.037                | 27.0          | 2.4          | 16.3                             | 4.037     | 27.0          |
|                                    | Mean                | 2.4        | 16.3                             | 4.037                | 27.0          | 2.4          | 16.3                             | 4.037     | 27.0          |
|                                    | Sum                 | 4.8        | 32.6                             | 8.074                | 54.0          | 4.8          | 32.6                             | 8.074     | 54.0          |
|                                    | Total Sum           |            |                                  |                      |               |              |                                  |           |               |
|                                    | Max. pitot press. = | 16.3       |                                  |                      |               | Max. Temp. = |                                  | 27.0      |               |
|                                    | Min. pitot press. = | 16.3       |                                  |                      |               | Min. Temp. = |                                  | 27.0      |               |
|                                    | Ratio Max:Min =     | 1.0 :1     |                                  |                      |               | Mean Temp. = |                                  | 27.0      |               |

Mean Root D p 4.037

Mean Stack Temperature, °C 27.00

Traverse Stack Velocity, m/s 5.244

Stack Area, m<sup>2</sup> 0.785

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (acms) 4.119

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms wet) 3.697

Stack Gas Volume Flow Rate, m<sup>3</sup>/s (scms WET) O<sub>2</sub> Corrected 3.697

Moisture 3.5

Stack Pressure, mm Hg 750.09

#### Gas Data

|                   |      |
|-------------------|------|
| Oxygen %          | 20.9 |
| CO <sub>2</sub> % | N/A  |

#### Oxygen Correction

|                                       |       |
|---------------------------------------|-------|
| Required Correction Value (%)         | 0     |
| Oxygen Factor                         | 1.000 |
| Enter 0 if correction is not required |       |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: G<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: EP DL                             |                   |         |
|  |                |          | Date of Sampling: 5/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Amines - 226-10                              |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 20.9     |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 13:20          | 14:20    |  |                   |         |
| Barometric   | kPa            | 100.0    | Measured Volume                              | m <sup>3</sup>    | 0.032   |
| Static Pressure  | Pa             | 11.8     | Volume at STP                                | m <sup>3</sup>    | 0.029   |
| Duct Diameter  | m              | 1.00     | Area of Duct                                 | m <sup>2</sup>    | 0.785   |
| Average Stack Temperature  | °C             | 27.00    | Duct Pressure                                | kPa               | 100.002 |
| Meter Correction Yd  | -              | 0.993    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 23       | Velocity                                     | m/s               | 5.24444 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 4.11897 |
| Meter Volume (End)   | m <sup>3</sup> | 0.032357 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.69721 |
| Pitot Coefficient  | -              | 0.82     | Mass Emission                                | kg/hr             | 0.00220 |
| Measured Oxygen  | %              | 20.9     | Moisture Content                             | %                 | 3.50000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Amines   | mg             | 0.005    | Amines                                       | mg/m <sup>3</sup> | 0.165   |
| Blank Amines   | mg             | 0.005    | Amines (As Toluene)                          | mg/m <sup>3</sup> | 0.165   |

## ISO 14956 Calculation Sheet - BS EN 13649

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.16 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.032999                  | 0.001089       | 0.032999               | 0.001089       |
| O2 Correction                    | U <sub>correction</sub>    | 0.003300                  | 0.000011       | 0.003300               | 0.000011       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.001905                  | 0.000004       | 0.001905               | 0.000004       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.000953                  | 0.000001       | 0.000191               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.000381                  | 0.000000       | 0.001905               | 0.000004       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.009526                  | 0.000091       | 0.009526               | 0.000091       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.000953                  | 0.000001       | 0.000953               | 0.000001       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.001905                  | 0.000004       | 0.001905               | 0.000004       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 0.164994295 | mg/m3 |
| U <sub>tot</sub>           | 0.035       | mg/m3 |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: G<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: EP DL                             |                   |         |
|  |                |          | Date of Sampling: 5/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Amines - 226-10                              |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 20.9     |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 14:24          | 15:24    |  |                   |         |
| Barometric   | kPa            | 100.0    | Measured Volume                              | m <sup>3</sup>    | 0.037   |
| Static Pressure  | Pa             | 11.8     | Volume at STP                                | m <sup>3</sup>    | 0.034   |
| Duct Diameter  | m              | 1        | Area of Duct                                 | m <sup>2</sup>    | 0.785   |
| Average Stack Temperature  | °C             | 27.00    | Duct Pressure                                | kPa               | 100.002 |
| Meter Correction Yd  | -              | 0.993    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 23       | Velocity                                     | m/s               | 5.24444 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 4.11897 |
| Meter Volume (End)   | m <sup>3</sup> | 0.037337 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.69721 |
| Pitot Coefficient  | -              | 0.82     | Mass Emission                                | kg/hr             | 0.00190 |
| Measured Oxygen  | %              | 20.9     | Moisture Content                             | %                 | 3.50000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Amines   | mg             | 0.005    | Amines                                       | mg/m <sup>3</sup> | 0.143   |
| Blank Amines   | mg             | 0.005    | Amines (As Toluene)                          | mg/m <sup>3</sup> | 0.143   |

## ISO 14956 Calculation Sheet - BS EN 13649

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.14 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.028597                  | 0.000818       | 0.028597               | 0.000818       |
| O2 Correction                    | U <sub>correction</sub>    | 0.002860                  | 0.000008       | 0.002860               | 0.000008       |
| Gas Meter Volume, sampling rate  | U <sub>volum</sub>         | 0.001651                  | 0.000003       | 0.001651               | 0.000003       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.000826                  | 0.000001       | 0.000165               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.000330                  | 0.000000       | 0.001651               | 0.000003       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.008255                  | 0.000068       | 0.008255               | 0.000068       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.000826                  | 0.000001       | 0.000826               | 0.000001       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.001651                  | 0.000003       | 0.001651               | 0.000003       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 0.142987396 | mg/m3 |
| U <sub>tot</sub>           | 0.030       | mg/m3 |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: G<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: EP DL                             |                   |         |
|  |                |          | Date of Sampling: 5/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Amines - 226-10                              |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 20.9     |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 15:25          | 16:25    |  |                   |         |
| Barometric   | kPa            | 100.0    | Measured Volume                              | m <sup>3</sup>    | 0.038   |
| Static Pressure  | Pa             | 11.8     | Volume at STP                                | m <sup>3</sup>    | 0.035   |
| Duct Diameter  | m              | 1        | Area of Duct                                 | m <sup>2</sup>    | 0.785   |
| Average Stack Temperature  | °C             | 27.00    | Duct Pressure                                | kPa               | 100.002 |
| Meter Correction Yd  | -              | 0.993    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 23       | Velocity                                     | m/s               | 5.24444 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 4.11897 |
| Meter Volume (End)   | m <sup>3</sup> | 0.038413 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.69721 |
| Pitot Coefficient  | -              | 0.82     | Mass Emission                                | kg/hr             | 0.00185 |
| Measured Oxygen  | %              | 20.9     | Moisture Content                             | %                 | 3.50000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Amines   | mg             | 0.005    | Amines                                       | mg/m <sup>3</sup> | 0.139   |
| Blank Amines   | mg             | 0.005    | Amines (As Toluene)                          | mg/m <sup>3</sup> | 0.139   |

## ISO 14956 Calculation Sheet - BS EN 13649

|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.14 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.027796                  | 0.000773       | 0.027796               | 0.000773       |
| O2 Correction                    | U <sub>correction</sub>    | 0.002780                  | 0.000008       | 0.002780               | 0.000008       |
| Gas Meter Volume, sampling rate  | U <sub>v volume</sub>      | 0.001605                  | 0.000003       | 0.001605               | 0.000003       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.000802                  | 0.000001       | 0.000160               | 0.000000       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.000321                  | 0.000000       | 0.001605               | 0.000003       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.008024                  | 0.000064       | 0.008024               | 0.000064       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.000802                  | 0.000001       | 0.000802               | 0.000001       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.001605                  | 0.000003       | 0.001605               | 0.000003       |

|                            |             |                   |
|----------------------------|-------------|-------------------|
| Measurement Uncertainty at | 0.138982126 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 0.029       | mg/m <sup>3</sup> |



|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: G<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: EP DL                             |                   |         |
|  |                |          | Date of Sampling: 6/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Phenols - 226 - 95                           |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 20.9     |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 08:52          | 09:52    |  |                   |         |
| Barometric   | kPa            | 100.0    | Measured Volume                              | m <sup>3</sup>    | 0.041   |
| Static Pressure  | Pa             | 11.8     | Volume at STP                                | m <sup>3</sup>    | 0.038   |
| Duct Diameter  | m              | 1        | Area of Duct                                 | m <sup>2</sup>    | 0.785   |
| Average Stack Temperature  | °C             | 27.00    | Duct Pressure                                | kPa               | 100.002 |
| Meter Correction Yd  | -              | 0.993    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 17       | Velocity                                     | m/s               | 5.24444 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 4.11897 |
| Meter Volume (End)   | m <sup>3</sup> | 0.040807 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 3.69721 |
| Pitot Coefficient  | -              | 0.82     | Mass Emission                                | kg/hr             | 0.00853 |
| Measured Oxygen  | %              | 20.9     | Moisture Content                             | %                 | 3.50000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Phenol   | mg             | 0.025    | Phenol                                       | mg/m <sup>3</sup> | 0.641   |
| Blank Phenol   | mg             | 0.025    | Phenol (As Toluene)                          | mg/m <sup>3</sup> | 0.641   |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.64 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.128177                  | 0.016429       | 0.128177               | 0.016429       |
| O2 Correction                    | U <sub>correction</sub>    | 0.012818                  | 0.000164       | 0.012818               | 0.000164       |
| Gas Meter Volume, sampling rate  | U <sub>v volume</sub>      | 0.007400                  | 0.000055       | 0.007400               | 0.000055       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.003700                  | 0.000014       | 0.000740               | 0.000001       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.001480                  | 0.000002       | 0.007400               | 0.000055       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.037001                  | 0.001369       | 0.037001               | 0.001369       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.003700                  | 0.000014       | 0.003700               | 0.000014       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.007400                  | 0.000055       | 0.007400               | 0.000055       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 0.640883072 | mg/m3 |
| U <sub>tot</sub>           | 0.13        | mg/m3 |

|  |                |         |  |                   |         |                 |                |       |
|--|----------------|---------|--|-------------------|---------|-----------------|----------------|-------|
| Sampling Point Ref: G<br>Company Name:Knauf<br>Site Name:Queensferry |                |         | Personnel:                                   |                   | EP DL   |                 |                |       |
|  |                |         | Date of Sampling:                            |                   | 6/10/15 |                 |                |       |
|  |                |         | Sampling Comments                            |                   |         |                 |                |       |
|  |                |         | Phenols - 226 - 95                           |                   |         |                 |                |       |
| Ref Moisture   | -              | Wet     |  |                   |         |                 |                |       |
| Ref Temp   | K              | 273     |  |                   |         |                 |                |       |
| Ref Pressure   | kPa            | 101.325 |  |                   |         |                 |                |       |
| Ref Oxygen   | %              | 20.9    |  |                   |         |                 |                |       |
|  | Start          | End     |  |                   |         |                 |                |       |
| Sample Times   | 09:53          | 12:28   |  |                   |         |                 |                |       |
| Barometric   | kPa            | 100.0   |  |                   |         | Measured Volume | m <sup>3</sup> | 0.036 |
| Static Pressure  | Pa             | 11.8    |  |                   |         | Volume at STP   | m <sup>3</sup> | 0.033 |
| Duct Diameter  | m              | 1       |  |                   |         | Area of Duct    | m <sup>2</sup> | 0.785 |
| Average Stack Temperature  | °C             | 20.00   | Duct Pressure                                | kPa               | 100.002 |                 |                |       |
| Meter Correction Yd  | -              | 0.993   | Mean Sum SQRT Delta P                        | Pa                | 0.00    |                 |                |       |
| Meter Temp Average   | °C             | 19      | Velocity                                     | m/s               | 3.34554 |                 |                |       |
| Meter Volume (Start)   | m <sup>3</sup> | 0       | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 2.62758 |                 |                |       |
| Meter Volume (End)   | m <sup>3</sup> | 0.03646 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 2.41488 |                 |                |       |
| Pitot Coefficient  | -              | 0.82    | Mass Emission                                | kg/hr             | 0.00628 |                 |                |       |
| Measured Oxygen  | %              | 20.9    | Moisture Content                             | %                 | 3.50000 |                 |                |       |
| Laboratory Data  |                |         | Mass Concentration (at reference conditions) |                   |         |                 |                |       |
| Phenol   | mg             | 0.025   | Phenol                                       | mg/m <sup>3</sup> | 0.722   |                 |                |       |
| Blank Phenol   | mg             | 0.025   | Phenol (As Toluene)                          | mg/m <sup>3</sup> | 0.773   |                 |                |       |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.72 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.144448                  | 0.020865       | 0.144448               | 0.020865       |
| O2 Correction                    | U <sub>correction</sub>    | 0.014445                  | 0.000209       | 0.014445               | 0.000209       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.008340                  | 0.000070       | 0.008340               | 0.000070       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.004170                  | 0.000017       | 0.000834               | 0.000001       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.001668                  | 0.000003       | 0.008340               | 0.000070       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.041699                  | 0.001739       | 0.041699               | 0.001739       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.004170                  | 0.000017       | 0.004170               | 0.000017       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.008340                  | 0.000070       | 0.008340               | 0.000070       |

|                            |           |                   |
|----------------------------|-----------|-------------------|
| Measurement Uncertainty at | 0.7222402 | mg/m <sup>3</sup> |
| U <sub>tot</sub>           | 0.15      | mg/m <sup>3</sup> |

|  |                |          |  |                   |         |
|--|----------------|----------|--|-------------------|---------|
| Sampling Point Ref: G<br>Company Name: Knauf<br>Site Name: Queensferry |                |          | Personnel: EP DL                             |                   |         |
|  |                |          | Date of Sampling: 6/10/15                    |                   |         |
|  |                |          | Sampling Comments                            |                   |         |
|  |                |          | Phenols - 226 - 95                           |                   |         |
| Ref Moisture   | -              | Wet      |  |                   |         |
| Ref Temp   | K              | 273      |  |                   |         |
| Ref Pressure   | kPa            | 101.325  |  |                   |         |
| Ref Oxygen   | %              | 20.9     |  |                   |         |
|  | Start          | End      |  |                   |         |
| Sample Times   | 12:29          | 13:29    |  |                   |         |
| Barometric   | kPa            | 100.0    | Measured Volume                              | m <sup>3</sup>    | 0.040   |
| Static Pressure  | Pa             | 11.8     | Volume at STP                                | m <sup>3</sup>    | 0.036   |
| Duct Diameter  | m              | 1        | Area of Duct                                 | m <sup>2</sup>    | 0.785   |
| Average Stack Temperature  | °C             | 20.00    | Duct Pressure                                | kPa               | 100.002 |
| Meter Correction Yd  | -              | 0.993    | Mean Sum SQRT Delta P                        | Pa                | 0.00    |
| Meter Temp Average   | °C             | 22       | Velocity                                     | m/s               | 3.34554 |
| Meter Volume (Start)   | m <sup>3</sup> | 0        | Vol Flow (as Measured)                       | m <sup>3</sup> /s | 2.62758 |
| Meter Volume (End)   | m <sup>3</sup> | 0.039846 | Vol Flow (corrected)                         | m <sup>3</sup> /s | 2.41488 |
| Pitot Coefficient  | -              | 0.82     | Mass Emission                                | kg/hr             | 0.00580 |
| Measured Oxygen  | %              | 20.9     | Moisture Content                             | %                 | 3.50000 |
| Laboratory Data  |                |          | Mass Concentration (at reference conditions) |                   |         |
| Phenol   | mg             | 0.025    | Phenol                                       | mg/m <sup>3</sup> | 0.668   |
| Blank Phenol   | mg             | 0.025    | Phenol (As Toluene)                          | mg/m <sup>3</sup> | 0.668   |

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|  |      |
|--|------|
| Studied Concentration (mg/m <sup>3</sup> ) | 0.67 |
|--|------|

| Selected Performance Characteristic | Value | Units | Variability due to sampling | Manual Method |
|-------------------------------------|-------|-------|-----------------------------|---------------|
| Laboratory Analysis                 | 20    | %     |                             |               |
| O2 Correction                       | 0.2   | %     |                             |               |
| Gas Meter Volume, sampling rate     | 2     | %     |                             |               |
| Atmospheric Pressure Dependence     | 1     | %/KPa | 0.2                         | kPa           |
| Temperature Dependence              | 0.4   | % K   | 5                           | C             |
| Desorption Efficiency               | 10    | %     |                             |               |
| Sample Handling (Handling)          | 1     | %     |                             |               |
| Losses in Sample Train (Leakage)    | 2     | %     |                             |               |

| Performance Characteristic       | Uncertainty Quantity       | At Calibration Conditions |                | At Sampling Conditions |                |
|----------------------------------|----------------------------|---------------------------|----------------|------------------------|----------------|
|                                  |                            | U                         | U <sup>2</sup> | U                      | U <sup>2</sup> |
| Laboratory Analysis              | U <sub>analysis</sub>      | 0.133531                  | 0.017831       | 0.133531               | 0.017831       |
| O2 Correction                    | U <sub>correction</sub>    | 0.013353                  | 0.000178       | 0.013353               | 0.000178       |
| Gas Meter Volume, sampling rate  | U <sub>volume</sub>        | 0.007709                  | 0.000059       | 0.007709               | 0.000059       |
| Atmospheric Pressure Dependence  | U <sub>pres</sub>          | 0.003855                  | 0.000015       | 0.000771               | 0.000001       |
| Temperature Dependence           | U <sub>temp</sub>          | 0.001542                  | 0.000002       | 0.007709               | 0.000059       |
| Desorption Efficiency            | U <sub>des</sub>           | 0.038547                  | 0.001486       | 0.038547               | 0.001486       |
| Sample Handling (transport etc)  | U <sub>handling</sub>      | 0.003855                  | 0.000015       | 0.003855               | 0.000015       |
| Losses in Sample Train (Leakage) | U <sub>losses, leaks</sub> | 0.007709                  | 0.000059       | 0.007709               | 0.000059       |

|                            |             |       |
|----------------------------|-------------|-------|
| Measurement Uncertainty at | 0.667655999 | mg/m3 |
| U <sub>tot</sub>           | 0.14        | mg/m3 |

Company Name: Knauf  
Site Name: Queensferry  
Sampling Point Ref: G  
Date: 07/10/15  
Run: Ammonia  
Project Reference: FTBS 35216

In-stack Filter? n Bar. Press. mm H<sub>2</sub>O 750  
Outstack Filter? y Cp 0.827  
Operators EP DL Bws% 3.5

K Factor N/A  
Dn used N/A  
Nozzle No. N/A  
Meter Correction Yd 0.997

Ambient Temp. 15 Leak Rate (fin / %) 0  
Start Time 09:48 Leak Rate (start / %) 0  
Stop Time 10:48 Box/Probe setting 160 +/- 5 °C

Sample Impinger & Wash Solution Analysis

| Sample ID | Sample Conc (mg/l) | Sample Vol (litre) | Blank Conc (mg/l) | Blank Vol (litre) | Blank ID |
|-----------|--------------------|--------------------|-------------------|-------------------|----------|
| 30008729  | 15.9               | 0.062              | 0.1000            | 0.0910            | 30008728 |
| 30008730  | 0.37               | 0.036              |                   |                   |          |

Sample Impinger & Wash Solution Mass Determination

| Analysis Result (mg) | Analysis Blank Results (mg) | Result (mg) |
|----------------------|-----------------------------|-------------|
| 0.9858               | 0.0091                      | 0.9858      |
| 0.01332              | 0                           | 0.0133      |

Impinger Weighings

| Weights    | Initial | Final | Increase, mg |
|------------|---------|-------|--------------|
| Impinger 1 | 730     | 733.3 | 3.3          |
| Impinger 2 |         |       | 0            |
| Impinger 3 |         |       | 0            |
| Impinger 4 |         |       | 0            |
| Impinger 5 |         |       | 0            |
| Silica Gel |         |       | 0            |
|            |         | Total | 3.3          |

| Sample Point | Clock Time min | Pitot Δ p, mm H <sub>2</sub> O | Stack Temp, °C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading m <sup>3</sup> | Temp at Gas Meter Outlet °C | Filter Box Temp °C | Probe Temp °C | Pump Vacuum Inches Hg | Impinger Stem Temp, °C | Root Δ p. |
|--------------|----------------|--------------------------------|----------------|----------------------------------|--------|----------------------------------|-----------------------------|--------------------|---------------|-----------------------|------------------------|-----------|
|              |                |                                |                | Desired                          | Actual |                                  |                             |                    |               |                       |                        |           |
|              | 0              |                                |                | 2                                | 2      | 0                                | 17                          | 150                | 150           | 0                     | 16                     | 0.000     |
|              | 15             |                                |                | 2                                | 2      |                                  | 17                          | 150                | 150           | 0                     | 16                     | 0.000     |
|              | 30             |                                |                | 2                                | 2      |                                  | 17                          | 150                | 150           | 0                     | 16                     | 0.000     |
|              | 45             |                                |                | 2                                | 2      |                                  | 17                          | 150                | 150           | 0                     | 16                     | 0.000     |
| Endpoint     | 60             |                                | 30             |                                  |        | 125.229                          |                             |                    |               |                       |                        |           |
|              | 60.00          | #DIV/0!                        | 30.0           | 2.0                              | 2.0    | 0.125                            | 17.0                        | 150.0              | 150.0         | 0.0                   | 16.0                   | 0.0       |

Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: G

Date: 07/10/15

|                                 |               |
|---------------------------------|---------------|
| Project Reference: FTBS 35216   | Ammonia       |
| Meter Volume Sampled, acm       | 0.125         |
| Sample Run Start Time           | 9:48          |
| Sample Run End Time             | 10:48         |
| Total Actual Sampling Time, min | 60.0          |
| Barometric Pressure, mm Hg      | 750.00        |
| Stack Pressure, mm Hg           | 750.09        |
| Average Stack Temp, °C          | 30.0          |
| Meter Volume at STP, scm        | 0.116         |
| Meter Volume at Wet STP, scm    | 0.120         |
| Stack Moisture Content, %       | 3.4           |
| Average Stack Velocity, m/sec   | 5.335         |
| Stack Flow Rate, acms           | 4.190         |
| Stack Flow Rate, scms wet       | 3.724         |
| Stack Flow Rate, scms dry,STP   | 3.596         |
| Emission Limit value            | <b>10.000</b> |

#### SAMPLE RUN CONCENTRATIONS & MASS EMISSION RATES

| Sample ID                     |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|-------------------------------|--|--------------------------------------|-----------------------|
| 30008729                      |  | 8.2113                               | <b>0.1101</b>         |
| 30008730                      |  | 0.1109                               | <b>0.0015</b>         |
| % of Analyte in<br>Impinger 2 |  | 1.3332                               |                       |
| <b>SUM</b>                    |  | <b>8.3222</b>                        | <b>0.1116</b>         |

#### SAMPLE BLANK CONCENTRATIONS & MASS EMISSIONS RATES

| Sample ID  |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|------------|--|--------------------------------------|-----------------------|
| 30008728   |  | 0.0758                               | <b>0.0010</b>         |
| 0          |  | 0.0000                               | <b>0.0000</b>         |
| <b>SUM</b> |  | <b>0.0758</b>                        | <b>0.0010</b>         |

### Uncertainty Calculation for Ammonia

|                          |     |                                       |
|--------------------------|-----|---------------------------------------|
| Determined Concentration | 8.3 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|-----|---------------------------------------|

| Measured Values             |          |                |
|-----------------------------|----------|----------------|
| Sampled Volume              | 0.125229 | m <sup>3</sup> |
| Sampled gas Temperature     | 290      | K              |
| Sampled gas Pressure        | 100.01   | kPa            |
| Sampled gas Humidity        | 0        | % by volume    |
| Oxygen content              | 20.9     | % by volume    |
| Concentration in Impinger 1 | 15.9     | mg/l           |
| Concentration in Impinger 2 | 0.37     | mg/l           |
| Volume in Impingers         | 0.098    | litre          |
| Total Mass                  | 0.999    | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.00 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |                |
|--|-------|----------------|
| Sampled Volume                             | 0.001 | m <sup>3</sup> |
| Sampled gas Temperature                    | 2     | K              |
| Sampled gas Pressure                       | 1     | kPa            |
| Sampled gas Humidity                       | 1     | % by volume    |
| Oxygen content                             | 0.1   | % by volume    |
| Concentration in Impinger                  | 4     | %              |
| Volume in Impinger                         | 0.001 | litre          |
| Mass                                       | 0.041 | mg             |

| Uncertainty Calculation for Volume Correction |                          |  |                             | Uncertainty Calculation for Oxygen Correction |                         |  |                             |
|---|--------------------------|--|-----------------------------|---|-------------------------|--|-----------------------------|
| Volume Correction Factor                      | 0.929                    |  |                             | Oxygen Correction Factor                      | 1.0000                  |  |                             |
|   | Sensitivity Coefficient  |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |  | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0032                   |  | 0.0064                      | Oxygen Measurement                            | 1                       |  | 0                           |
| Sampled gas Pressure                          | 0.0093                   |  | 0.0093                      |   |                         |  |                             |
| Sampled gas Humidity                          | 0.0093                   |  | 0.0093                      |   |                         |  |                             |
|   | Sqrt (U <sub>v</sub> )*2 |  | 0.0146                      |   |                         |  |                             |
|   | Total U <sub>v</sub>     |  | 0.002                       |   | Total U <sub>o</sub>    |  | 0                           |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.116  | m <sup>3</sup>     | 71.78                   | 0.15 mg.m <sup>-3</sup>  | 1.80 % |
| Mass Analyte                         | 1.00   | mg                 | 8.33                    | 0.34 mg.m <sup>-3</sup>  | 4.13 % |
| Oxygen Correction                    | 1.0000 |                    | 8.32                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                                      |        |                    | Total Uncertainty       | 0.37 mg.m <sup>-3</sup>  |        |

| Uncertainty Result |                        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |
|--------------------|------------------------|--|--------------------|
|                    | Expanded Uncertainty = | 0.7492   | mg.m <sup>-3</sup> |
|                    | =>                     | 9.00   | % of Result        |
|                    | =>                     | 7.49   | % of ELV           |

Company Name: Knauf  
Site Name: Queensferry  
Sampling Point Ref: G  
Date: 07/10/15  
Run: Ammonia  
Project Reference: FTBS 35216

In-stack Filter? n Bar. Press. mm Hg 750  
Outstack Filter? y Cp 0.827  
Operators EP DL Bws% 3.5

K Factor N/A  
Dn used N/A  
Nozzle No. N/A  
Meter Correction Yd 0.997

Ambient Temp. 17.5 Leak Rate (fin / %) 0  
Start Time 11:14 Leak Rate (start / %) 0  
Stop Time 12:14 Box/Probe setting 160 +/- 5 °C

#### Sample Impinger & Wash Solution Analysis

| Sample ID | Sample Conc (mg/l) | Sample Vol (litre) | Blank Conc (mg/l) | Blank Vol (litre) | Blank ID |
|-----------|--------------------|--------------------|-------------------|-------------------|----------|
| 30008734  | 18.8               | 0.087              | 0.1000            | 0.0910            | 30008728 |

#### Sample Impinger & Wash Solution Mass Determination

| Analysis Result (mg) | Analysis Blank Results (mg) | Result (mg) |
|----------------------|-----------------------------|-------------|
| 1.6356               | 0.0091                      | 1.6356      |
| 0                    | 0                           | 0.0000      |

#### Impinger Weighings

| Weights    | Initial | Final | Increase, mg |
|------------|---------|-------|--------------|
| Impinger 1 | 725.4   | 728.4 | 3            |
| Impinger 2 |         |       | 0            |
| Impinger 3 |         |       | 0            |
| Impinger 4 |         |       | 0            |
| Impinger 5 |         |       | 0            |
| Silica Gel |         |       | 0            |
| Total      |         |       | 3            |

| Sample Point | Clock Time min | Pitot Δ p, mm H <sub>2</sub> O | Stack Temp, °C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading m <sup>3</sup> | Temp at Gas Meter Outlet °C | Filter Box Temp °C | Probe Temp °C | Pump Vacuum Inches Hg | Impinger Stem Temp, °C | Root Δ p. |
|--------------|----------------|--------------------------------|----------------|----------------------------------|--------|----------------------------------|-----------------------------|--------------------|---------------|-----------------------|------------------------|-----------|
|              |                |                                |                | Desired                          | Actual |                                  |                             |                    |               |                       |                        |           |
|              | 0              |                                | 30             | 2                                | 2      | 0                                | 19                          | 150                | 150           | 0                     |                        | 0.000     |
|              | 15             |                                |                | 2                                | 2      |                                  | 19                          | 150                | 150           | 0                     |                        | 0.000     |
|              | 30             |                                |                | 2                                | 2      |                                  | 20                          | 150                | 150           | 0                     |                        | 0.000     |
|              | 45             |                                |                | 2                                | 2      |                                  | 20                          | 150                | 150           | 0                     |                        | 0.000     |
| Endpoint     | 60             |                                |                |                                  |        | 112.974                          |                             |                    |               |                       |                        |           |
|              | 60.00          | #DIV/0!                        | 30.0           | 2.0                              | 2.0    | 0.113                            | 19.5                        | 150.0              | 150.0         | 0.0                   | #DIV/0!                | 0.0       |



Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: G

Date: 07/10/15

|                                 |               |
|---------------------------------|---------------|
| Project Reference: FTBS 35216   | Ammonia 2     |
| Meter Volume Sampled, acm       | 0.113         |
| Sample Run Start Time           | 11:14         |
| Sample Run End Time             | 12:14         |
| Total Actual Sampling Time, min | 60.0          |
| Barometric Pressure, mm Hg      | 750.00        |
| Stack Pressure, mm Hg           | 750.09        |
| Average Stack Temp, °C          | 30.0          |
| Meter Volume at STP, scm        | 0.104         |
| Meter Volume at Wet STP, scm    | 0.107         |
| Stack Moisture Content, %       | 3.5           |
| Average Stack Velocity, m/sec   | 5.336         |
| Stack Flow Rate, acms           | 4.191         |
| Stack Flow Rate, scms wet       | 3.724         |
| Stack Flow Rate, scms dry,STP   | 3.595         |
| Emission Limit value            | <b>10.000</b> |

#### SAMPLE RUN CONCENTRATIONS & MASS EMISSION RATES

| Sample ID                     |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|-------------------------------|--|--------------------------------------|-----------------------|
| 30008734                      |  | 15.2233                              | <b>0.2041</b>         |
| 0                             |  | 0.0000                               | <b>0.0000</b>         |
| % of Analyte in<br>Impinger 2 |  | 0.0000                               |                       |
| <b>SUM</b>                    |  | <b>15.2233</b>                       | <b>0.2041</b>         |

#### SAMPLE BLANK CONCENTRATIONS & MASS EMISSIONS RATES

| Sample ID  |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|------------|--|--------------------------------------|-----------------------|
| 30008728   |  | 0.0847                               | <b>0.0011</b>         |
| 0          |  | 0.0000                               | <b>0.0000</b>         |
| <b>SUM</b> |  | <b>0.0847</b>                        | <b>0.0011</b>         |



## Uncertainty Calculation for Ammonia 2

|                          |      |                                       |
|--------------------------|------|---------------------------------------|
| Determined Concentration | 15.2 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|------|---------------------------------------|

| Measured Values             |          |                |
|-----------------------------|----------|----------------|
| Sampled Volume              | 0.112974 | m <sup>3</sup> |
| Sampled gas Temperature     | 292.5    | K              |
| Sampled gas Pressure        | 100.01   | kPa            |
| Sampled gas Humidity        | 0        | % by volume    |
| Oxygen content              | 20.9     | % by volume    |
| Concentration in Impinger 1 | 18.8     | mg/l           |
| Concentration in Impinger 2 | 0        | mg/l           |
| Volume in Impingers         | 0.087    | litre          |
| Total Mass                  | 1.636    | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.00 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |                |
|--|-------|----------------|
| Sampled Volume                             | 0.001 | m <sup>3</sup> |
| Sampled gas Temperature                    | 2     | K              |
| Sampled gas Pressure                       | 1     | kPa            |
| Sampled gas Humidity                       | 1     | % by volume    |
| Oxygen content                             | 0.1   | % by volume    |
| Concentration in Impinger                  | 4     | %              |
| Volume in Impinger                         | 0.001 | litre          |
| Mass                                       | 0.068 | mg             |

| Uncertainty Calculation for Volume Correction |                          |  |                             | Uncertainty Calculation for Oxygen Correction |                         |  |                             |
|---|--------------------------|--|-----------------------------|---|-------------------------|--|-----------------------------|
| Volume Correction Factor                      | 0.921                    |  |                             | Oxygen Correction Factor                      | 1.0000                  |  |                             |
|   | Sensitivity Coefficient  |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |  | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0032                   |  | 0.0063                      | Oxygen Measurement                            | 1                       |  | 0                           |
| Sampled gas Pressure                          | 0.0092                   |  | 0.0092                      |   |                         |  |                             |
| Sampled gas Humidity                          | 0.0092                   |  | 0.0092                      |   |                         |  |                             |
|   | Sqrt (U <sub>v</sub> )*2 |  | 0.0145                      |   |                         |  |                             |
|   | Total U <sub>v</sub>     |  | 0.002                       |   | Total U <sub>o</sub>    |  | 0                           |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.104  | m <sup>3</sup>     | 146.80                  | 0.28 mg.m <sup>-3</sup>  | 1.85 % |
| Mass Analyte                         | 1.64   | mg                 | 9.31                    | 0.63 mg.m <sup>-3</sup>  | 4.14 % |
| Oxygen Correction                    | 1.0000 |                    | 15.22                   | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                                      |        |                    | Total Uncertainty       | 0.69 mg.m <sup>-3</sup>  |        |

| Uncertainty Result     |        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |
|------------------------|--------|--|
| Expanded Uncertainty = | 1.3807 | mg.m <sup>-3</sup>   |
| =>                     | 9.07   | % of Result  |
| =>                     | 13.81  | % of ELV   |

Company Name: Knauf  
Site Name: Queensferry  
Sampling Point Ref: G  
Date: 07/10/15  
Run: Ammonia  
Project Reference: FTBS 35216

In-stack Filter? **n** Bar. Press. mm H<sub>2</sub>O **750**  
Outstack Filter? **y** Cp **0.827**  
Operators **EP DL** Bws% **3.5**

K Factor **N/A**  
Dn used **N/A**  
Nozzle No. **N/A**  
Meter Correction Yd **0.997**

Ambient Temp. **14.5** Leak Rate (fin / %) **0**  
Start Time **12:34** Leak Rate (start / %) **0**  
Stop Time **13:34** Box/Probe setting **160 +/- 5 °C**

Sample Impinger & Wash Solution Analysis

| Sample ID | Sample Conc (mg/l) | Sample Vol (litre) | Blank Conc (mg/l) | Blank Vol (litre) | Blank ID |
|-----------|--------------------|--------------------|-------------------|-------------------|----------|
| 30008736  | 31.8               | 0.082              | 0.1000            | 0.0910            | 30008728 |

Sample Impinger & Wash Solution Mass Determination

| Analysis Result (mg) | Analysis Blank Results (mg) | Result (mg) |
|----------------------|-----------------------------|-------------|
| 2.6076               | 0.0091                      | 2.6076      |
| 0                    | 0                           | 0.0000      |

Impinger Weighings

| Weights    | Initial | Final | Increase, mg |
|------------|---------|-------|--------------|
| Impinger 1 | 723.2   | 726.9 | 3.7          |
| Impinger 2 |         |       | 0            |
| Impinger 3 |         |       | 0            |
| Impinger 4 |         |       | 0            |
| Impinger 5 |         |       | 0            |
| Silica Gel |         |       | 0            |
|            |         | Total | 3.7          |

| Sample Point | Clock Time min | Pitot Δ p, mm H <sub>2</sub> O | Stack Temp, °C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading m <sup>3</sup> | Temp at Gas Meter Outlet °C | Filter Box Temp °C | Probe Temp °C | Pump Vacuum Inches Hg | Impinger Stem Temp, °C | Root Δ p. |
|--------------|----------------|--------------------------------|----------------|----------------------------------|--------|----------------------------------|-----------------------------|--------------------|---------------|-----------------------|------------------------|-----------|
|              |                |                                |                | Desired                          | Actual |                                  |                             |                    |               |                       |                        |           |
|              | 0              |                                |                | 2                                | 2      | 0                                | 18                          | 150                | 150           | 0                     | 14                     | 0.000     |
|              | 15             |                                |                | 2                                | 2      |                                  | 18                          | 150                | 150           | 0                     | 15                     | 0.000     |
|              | 30             |                                |                | 2                                | 2      |                                  | 15                          | 150                | 150           | 0                     | 15                     | 0.000     |
|              | 45             |                                |                | 2                                | 2      |                                  | 15                          | 150                | 150           | 0                     | 15                     | 0.000     |
| Endpoint     | 60             |                                | 30             |                                  |        | 120.692                          |                             |                    |               |                       |                        |           |
|              | 60.00          | #DIV/0!                        | 30.0           | 2.0                              | 2.0    | 0.121                            | 16.5                        | 150.0              | 150.0         | 0.0                   | 14.8                   | 0.0       |

Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: G

Date: 07/10/15

|                                 |               |
|---------------------------------|---------------|
| Project Reference: FTBS 35216   | Ammonia       |
| Meter Volume Sampled, acm       | 0.121         |
| Sample Run Start Time           | 12:34         |
| Sample Run End Time             | 13:34         |
| Total Actual Sampling Time, min | 60.0          |
| Barometric Pressure, mm Hg      | 750.00        |
| Stack Pressure, mm Hg           | 750.09        |
| Average Stack Temp, °C          | 30.0          |
| Meter Volume at STP, scm        | 0.112         |
| Meter Volume at Wet STP, scm    | 0.117         |
| Stack Moisture Content, %       | 4.0           |
| Average Stack Velocity, m/sec   | 5.341         |
| Stack Flow Rate, acms           | 4.194         |
| Stack Flow Rate, scms wet       | 3.728         |
| Stack Flow Rate, scms dry,STP   | 3.580         |
| Emission Limit value            | <b>10.000</b> |

#### SAMPLE RUN CONCENTRATIONS & MASS EMISSION RATES

| Sample ID                     |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|-------------------------------|--|--------------------------------------|-----------------------|
| 30008736                      |  | 22.3742                              | <b>0.3003</b>         |
| 0                             |  | 0.0000                               | <b>0.0000</b>         |
| % of Analyte in<br>Impinger 2 |  | 0.0000                               |                       |
| <b>SUM</b>                    |  | <b>22.3742</b>                       | <b>0.3003</b>         |

#### SAMPLE BLANK CONCENTRATIONS & MASS EMISSIONS RATES

| Sample ID  |  | Concentration, mg/m3<br>Vapour Phase | Mass Emissions, Kg/hr |
|------------|--|--------------------------------------|-----------------------|
| 30008728   |  | 0.0781                               | <b>0.0010</b>         |
| 0          |  | 0.0000                               | <b>0.0000</b>         |
| <b>SUM</b> |  | <b>0.0781</b>                        | <b>0.0010</b>         |

### Uncertainty Calculation for Ammonia

|                          |      |                                       |
|--------------------------|------|---------------------------------------|
| Determined Concentration | 22.4 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|------|---------------------------------------|

| Measured Values             |          |                |
|-----------------------------|----------|----------------|
| Sampled Volume              | 0.120692 | m <sup>3</sup> |
| Sampled gas Temperature     | 289.5    | K              |
| Sampled gas Pressure        | 100.01   | kPa            |
| Sampled gas Humidity        | 0        | % by volume    |
| Oxygen content              | 20.9     | % by volume    |
| Concentration in Impinger 1 | 31.8     | mg/l           |
| Concentration in Impinger 2 | 0        | mg/l           |
| Volume in Impingers         | 0.082    | litre          |
| Total Mass                  | 2.608    | mg             |

|      |      |   |
|------|------|---|
| Leak | 0.00 | % |
|------|------|---|

| Standard Uncertainties for Measured Values |       |                |
|--|-------|----------------|
| Sampled Volume                             | 0.001 | m <sup>3</sup> |
| Sampled gas Temperature                    | 2     | K              |
| Sampled gas Pressure                       | 1     | kPa            |
| Sampled gas Humidity                       | 1     | % by volume    |
| Oxygen content                             | 0.1   | % by volume    |
| Concentration in Impinger                  | 4     | %              |
| Volume in Impinger                         | 0.001 | litre          |
| Mass                                       | 0.108 | mg             |

| Uncertainty Calculation for Volume Correction |                          |  |                             | Uncertainty Calculation for Oxygen Correction |                         |  |                             |
|---|--------------------------|--|-----------------------------|---|-------------------------|--|-----------------------------|
| Volume Correction Factor                      | 0.931                    |  |                             | Oxygen Correction Factor                      | 1.0000                  |  |                             |
|   | Sensitivity Coefficient  |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |  | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0032                   |  | 0.0064                      | Oxygen Measurement                            | 1                       |  | 0                           |
| Sampled gas Pressure                          | 0.0093                   |  | 0.0093                      |   |                         |  |                             |
| Sampled gas Humidity                          | 0.0093                   |  | 0.0093                      |   |                         |  |                             |
|   | Sqrt (U <sub>v</sub> )*2 |  | 0.0147                      |   |                         |  |                             |
|   | Total U <sub>v</sub>     |  | 0.002                       |   | Total U <sub>o</sub>    |  | 0                           |

| Uncertainty Contributions (Itemised) |        |                    |                         |                          |        |
|--------------------------------------|--------|--------------------|-------------------------|--------------------------|--------|
|                                      | Value  |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|                                      |        |                    |                         | Concentration            | %      |
| Volume Correction                    | 0.112  | m <sup>3</sup>     | 199.89                  | 0.41 mg.m <sup>-3</sup>  | 1.81 % |
| Mass Analyte                         | 2.61   | mg                 | 8.58                    | 0.93 mg.m <sup>-3</sup>  | 4.15 % |
| Oxygen Correction                    | 1.0000 |                    | 22.37                   | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak                          | 0.00   | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                                      |        |                    | Total Uncertainty       | 1.01 mg.m <sup>-3</sup>  |        |

| Uncertainty Result |                        | (Uncertainty has been expanded with a coveragefactor of 2 (K=2)) |                    |
|--------------------|------------------------|--|--------------------|
|                    | Expanded Uncertainty = | 2.0267   | mg.m <sup>-3</sup> |
|                    | =>                     | 9.06   | % of Result        |
|                    | =>                     | 20.27  | % of ELV           |

|                               |   |  |   |   |   |
|-------------------------------|---|--|---|---|---|
| Company Name: Knauf           | In-stack Filter? <input type="text" value="y"/> | Bar. Press. mm Hg <input type="text" value="750"/>     | K Factor <input type="text" value="49.18362167"/> | Ambient Temp. <input type="text" value="13.625"/> | Leak Rate (fin / %) <input type="text" value="0.00"/>       |
| Site Name: Queensferry        | Outstack Filter? <input type="text" value="n"/> | Cp <input type="text" value="0.827"/>                  | Dn used <input type="text" value="11.917"/>       | Start Time <input type="text" value="09:10"/>     | Leak Rate (start / %) <input type="text" value="0.00"/>     |
| Project Reference: FTBS 35216 | Date: <input type="text" value="06/10/15"/>     | Operators <input type="text" value="EP DL"/>           | Nozzle No. <input type="text" value="00729"/>     | Stop Time <input type="text" value="10:10"/>      | Box/Probe setting <input type="text" value="160 +/- 5 °C"/> |
| Run: TPM                      | Bws% <input type="text" value="3.5"/>           | Meter Correction Yd <input type="text" value="0.971"/> |   |   |   |
| Sampling Point Ref: G         |   |  |   |   |   |

| Sample Filter Weights |            |              |       |
|-----------------------|------------|--------------|-------|
| Sample ID             | Laboratory | Increase, mg |       |
| Filter                | 126236     | RPS          | 22.57 |
| Probe Washings        | 30008725   | RPS          | 0.54  |

| Sample Filter Blank Weighings |            |              |      |
|-------------------------------|------------|--------------|------|
| Sample ID                     | Laboratory | Increase, mg |      |
| Filter                        | 126247     | RPS          | 0.25 |
| Probe Wash                    | 30008724   | RPS          | 0.5  |

| Impinger Weights |         |       |             |
|------------------|---------|-------|-------------|
| Weights          | Initial | Final | Increase, g |
| Impinger 1       |         |       | 0.0         |
| Impinger 2       |         |       | 0.0         |
| Impinger 3       |         |       | 0.0         |
| Impinger 4       |         |       | 0.0         |
| Impinger 5       |         |       | 0.0         |
| Silica Gel       |         |       | 0.0         |
| Total            |         |       | 55.0        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p,<br>°C |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |                 |
|              | 0                 | 2.4                               | 27                | 118.040692                       | 118    | 3105090                             | 12                                | N/A                      | N/A                      | N/A                 | 2                           | 12                           | 1.549           |
|              | 7.5               | 2                                 | 28                | 98.36724333                      | 98     |                                     | 14                                | N/A                      | N/A                      | N/A                 | 2                           | 17                           | 1.414           |
|              | 15                | 2.2                               | 27                | 108.2039677                      | 108    |                                     | 15                                | N/A                      | N/A                      | N/A                 | 2                           | 18                           | 1.483           |
|              | 22.5              | 2                                 | 30                | 98.36724333                      | 98     |                                     | 15                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.414           |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |                 |
|              | 0                 | 2                                 | 29                | 98.36724333                      | 98     |                                     | 16                                | N/A                      | N/A                      | N/A                 | 2                           | 18                           | 1.414           |
|              | 7.5               | 1.8                               | 28                | 88.530519                        | 89     |                                     | 16                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.342           |
|              | 15                | 2.2                               | 28                | 108.2039677                      | 108    |                                     | 18                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.483           |
|              | 22.5              | 2.4                               | 26                | 118.040692                       | 118    |                                     | 19                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.549           |
| Endpoint     | 30                |                                   |                   |                                  |        | 3107124.8                           |                                   |                          |                          |                     |                             |                              |                 |
|              | 60.00             | 2.125                             | 27.9              | 104.5                            | 104.5  | 2.035                               | 15.6                              | #DIV/0!                  | #DIV/0!                  | #DIV/0!             | 2.0                         | 17.6                         | 1.5             |

Company Name:Knauf  
Site Name:Queensferry  
Project Reference: FTBS 35216

Date: 06/10/15

|  |               |
|--|---------------|
| Sampling Point Ref: G                                    | Run: TPM      |
| Meter Volume Sampled, acm                                | 2.035         |
| Sample Run Start Time                                    | 9:10          |
| Sample Run End Time                                      | 10:10         |
| Total Actual Sampling Time, min                          | 60.0          |
| Barometric Pressure, mm Hg                               | 750.00        |
| Stack Pressure, mm Hg                                    | 750.09        |
| Average Stack Temp, °C                                   | 27.9          |
| Meter Volume at STP, scm                                 | 1.862         |
| Stack Moisture Content, %                                | 3.5           |
| %O <sub>2</sub>  | 20.90         |
| Average Stack Velocity, m/sec                            | 4.998         |
| Stack Flow Rate, scms wet, STP                           | 3.513         |
| Stack Flow Rate, scms dry,STP                            | 3.389         |
| Nozzle Diameter, mm                                      | 11.92         |
| <b>% Isokinetic Variation</b>                            | <b>107.3</b>  |
| Total Mass of Particulate, mg                            | 23.1          |
| Percentage of Total Particulate Collected on Filter      | 97.7          |
| <b>Stack Particulate Concentration, mg/m<sup>3</sup></b> | <b>11.971</b> |
| Particulate Mass rate, kg/hour                           | 0.151         |
| Emission Limit value                                     | 10            |

| Sample Train Blank Results                                |      |
|---|------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 0.39 |
| Total Weight Gain, mg (Sample Train Blank)                | 0.75 |
| Blank Result Less than 10% of Limit Value                 | Y    |

## Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |        |                                       |
|--------------------------|--------|---------------------------------------|
| Determined Concentration | 11.971 | mg/m <sup>3</sup> (at Reference Cond) |
|--------------------------|--------|---------------------------------------|

### Measured Values

|                         |         |                |
|-------------------------|---------|----------------|
| Sampled Volume          | 2.0348  | m <sup>3</sup> |
| Sampled gas Temperature | 288.625 | K              |
| Sampled gas Pressure    | 100.01  | kPa            |
| Sampled gas Humidity    | 0       | % by volume    |
| Oxygen content          | 20.9    | % by volume    |
| Mass                    | 23.11   | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.00 | %  |
| Uncollected Mass | 0    | mg |

### Standard Uncertainties for Measured Values

|                         |            |                |
|-------------------------|------------|----------------|
| Sampled Volume          | 0.001      | m <sup>3</sup> |
| Sampled gas Temperature | 2          | K              |
| Sampled gas Pressure    | 1          | kPa            |
| Sampled gas Humidity    | 1          | % by volume    |
| Oxygen content          | 0.1        | % by volume    |
| Mass                    | 0.14152385 | mg             |

| Uncertainty Calculation for Volume Correction |                                     |  |                             | Uncertainty Calculation for Oxygen Correction |                         |                      |                             |
|---|-------------------------------------|--|-----------------------------|---|-------------------------|----------------------|-----------------------------|
| Volume Correction Factor                      | 0.934                               |  |                             | Oxygen Correction Factor                      | 1.0000                  |                      |                             |
|   | Sensitivity Coefficient             |  | Uncertainty, U <sub>v</sub> |   | Sensitivity Coefficient |                      | Uncertainty, U <sub>o</sub> |
| Sampled gas Temperature                       | 0.0032                              |  | 0.0065                      | Oxygen Measurement                            | N/A                     |                      | N/A                         |
| Sampled gas Pressure                          | 0.0093                              |  | 0.0093                      |   |                         |                      |                             |
| Sampled gas Humidity                          | 0.0093                              |  | 0.0093                      |   |                         |                      |                             |
|   | Sqrt (U <sub>v</sub> ) <sup>2</sup> |  | 0.0147                      |   |                         |                      |                             |
|   | Total U <sub>v</sub>                |  | 0.030                       |   |                         | Total U <sub>o</sub> | N/A                         |

### Uncertainty Contributions (Itemised)

|                   | Value |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|-------------------|-------|--------------------|-------------------------|--------------------------|--------|
|                   |       |                    |                         | Concentration            | %      |
| Volume Correction | 1.862 | m <sup>3</sup>     | 6.43                    | 0.19 mg.m <sup>-3</sup>  | 1.61 % |
| Mass (weighing)   | 23.11 | mg                 | 0.52                    | 0.07 mg.m <sup>-3</sup>  | 0.61 % |
| Oxygen Correction | N/A   |                    | 0.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak       | 0.00  | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| Uncollected Mass  | 0.00  | mg                 | 0.52                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                   |       |                    | Total Uncertainty       | 0.21 mg.m <sup>-3</sup>  |        |

### Uncertainty Result

(Uncertainty has been expanded with a coverage factor of 2 (K=2))

|                        |        |                    |
|------------------------|--------|--------------------|
| Expanded Uncertainty = | 0.4119 | mg.m <sup>-3</sup> |
| =>                     | 3.44   | % of Result        |
| =>                     | 4.12   | % of ELV           |

Company Name: Knauf  
Site Name: Queensferry  
Project Reference: FTBS 35216  
Date: 06/10/15  
Run: TPM  
Sampling Point Ref: G

In-stack Filter?  Bar. Press.mm Hg   
Outstack Filter?  Cp   
Operators  Bws%   
Meter Correction Yd

K Factor   
Dn used   
Nozzle No.

Ambient Temp.   
Start Time   
Stop Time

Leak Rate (fin / %)   
Leak Rate (start / %)   
Box/Probe setting

| Sample Filter Weights |           |            |              |
|-----------------------|-----------|------------|--------------|
|                       | Sample ID | Laboratory | Increase, mg |
| Filter                | 126251    | RPS        | 30.28        |
| Probe Washings        | 30008726  | RPS        | 0.54         |

| Sample Filter Blank Weighings |           |            |              |
|-------------------------------|-----------|------------|--------------|
|                               | Sample ID | Laboratory | Increase, mg |
| Filter                        | 126247    | RPS        | 0.25         |
| Probe Wash                    | 30008724  | RPS        | 0.5          |

| Impinger Weights |         |       |             |
|------------------|---------|-------|-------------|
| Weights          | Initial | Final | Increase, g |
| Impinger 1       |         |       | 0.0         |
| Impinger 2       |         |       | 0.0         |
| Impinger 3       |         |       | 0.0         |
| Impinger 4       |         |       | 0.0         |
| Impinger 5       |         |       | 0.0         |
| Silica Gel       |         |       | 0.0         |
| Total            |         |       | 50.0        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                              |           |
|              | 0                 | 2.8                               | 28                | 98.7784377                       | 99     | 3107132.4                           | 19                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.673     |
|              | 7.5               | 2.8                               | 27                | 98.7784377                       | 99     |                                     | 20                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.673     |
|              | 15                | 2.4                               | 28                | 84.66723231                      | 85     |                                     | 20                                | N/A                      | N/A                      | N/A                 | 2                           | 18                           | 1.549     |
|              | 22.5              | 2.8                               | 29                | 98.7784377                       | 99     |                                     | 20                                | N/A                      | N/A                      | N/A                 | 2                           | 17                           | 1.673     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
|              | 0                 | 3                                 | 31                | 105.8340404                      | 106    | 3109056.5                           | 20                                | N/A                      | N/A                      | N/A                 | 2                           | 18                           | 1.732     |
|              | 7.5               | 3                                 | 32                | 105.8340404                      | 106    |                                     | 21                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.732     |
|              | 15                | 2.8                               | 32                | 98.7784377                       | 99     |                                     | 21                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.673     |
|              | 22.5              | 2.4                               | 33                | 84.66723231                      | 85     |                                     | 21                                | N/A                      | N/A                      | N/A                 | 2                           | 19                           | 1.549     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                              |           |
|              | 60.00             | 2.750                             | 30.0              | 97.0                             | 97.0   | 1.924                               | 20.3                              | #DIV/0!                  | #DIV/0!                  | #DIV/0!             | 2.0                         | 18.5                         | 1.7       |



Company Name:Knauf  
Site Name:Queensferry  
Project Reference: FTBS 35216

Date: 06/10/15

|  |               |
|--|---------------|
| Sampling Point Ref: G                                    | Run: TPM      |
| Meter Volume Sampled, acm                                | 1.924         |
| Sample Run Start Time                                    | 11:53         |
| Sample Run End Time                                      | 12:53         |
| Total Actual Sampling Time, min                          | 60.0          |
| Barometric Pressure, mm Hg                               | 750.00        |
| Stack Pressure, mm Hg                                    | 750.09        |
| Average Stack Temp, °C                                   | 30.0          |
| Meter Volume at STP, scm                                 | 1.732         |
| Stack Moisture Content, %                                | 3.5           |
| %O <sub>2</sub>  | 20.90         |
| Average Stack Velocity, m/sec                            | 5.707         |
| Nozzle Diameter, mm                                      | 10.97         |
| <b>% Isokinetic Variation</b>                            | <b>103.8</b>  |
| Total Mass of Particulate, mg                            | 30.8          |
| Percentage of Total Particulate Collected on Filter      | 98.2          |
| <b>Stack Particulate Concentration, mg/m<sup>3</sup></b> | <b>17.179</b> |
| Particulate Mass rate, kg/hour                           | 0.246         |
| Emission Limit value                                     | <b>10</b>     |

| Sample Train Blank Results                                |      |
|---|------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 0.42 |
| Total Weight Gain, mg (Sample Train Blank)                | 0.75 |
| Blank Result Less than 10% of Limit Value                 | Y    |

## Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |        |                           |
|--------------------------|--------|---------------------------|
| Determined Concentration | 17.179 | mg/m3 (at Reference Cond) |
|--------------------------|--------|---------------------------|

### Measured Values

|                         |        |                |
|-------------------------|--------|----------------|
| Sampled Volume          | 1.9241 | m <sup>3</sup> |
| Sampled gas Temperature | 293.25 | K              |
| Sampled gas Pressure    | 100.01 | kPa            |
| Sampled gas Humidity    | 0      | % by volume    |
| Oxygen content          | 20.9   | % by volume    |
| Mass                    | 30.82  | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.00 | %  |
| Uncollected Mass | 0    | mg |

### Standard Uncertainties for Measured Values

|                         |            |             |
|-------------------------|------------|-------------|
| Sampled Volume          | 0.001      | m3          |
| Sampled gas Temperature | 2          | K           |
| Sampled gas Pressure    | 1          | kPa         |
| Sampled gas Humidity    | 1          | % by volume |
| Oxygen content          | 0.1        | % by volume |
| Mass                    | 0.14152385 | mg          |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |          |                 |
|---|-------------------------|--|-----------------|---|-------------------------|----------|-----------------|
| Volume Correction Factor                      | 0.919                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |          |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |          | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0031                  |  | 0.0063          | Oxygen Measurement                            | N/A                     |          | N/A             |
| Sampled gas Pressure                          | 0.0092                  |  | 0.0092          |   |                         |          |                 |
| Sampled gas Humidity                          | 0.0092                  |  | 0.0092          |   |                         |          |                 |
|   | Sqrt (Uv)^2             |  | 0.0144          |   |                         |          |                 |
|   | Total Uv                |  | 0.028           |   |                         | Total Uo | N/A             |

### Uncertainty Contributions (Itemised)

|                   | Value |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|-------------------|-------|--------------------|-------------------------|--------------------------|--------|
|                   |       |                    |                         | Concentration            | %      |
| Volume Correction | 1.732 | m3                 | 9.92                    | 0.28 mg.m <sup>-3</sup>  | 1.60 % |
| Mass (weighing)   | 30.82 | mg                 | 0.56                    | 0.08 mg.m <sup>-3</sup>  | 0.46 % |
| Oxygen Correction | N/A   |                    | 0.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak       | 0.00  | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| Uncollected Mass  | 0.00  | mg                 | 0.56                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                   |       |                    | Total Uncertainty       | 0.29 mg.m <sup>-3</sup>  |        |

### Uncertainty Result

(Uncertainty has been expanded with a coverage factor of 2 (K=2))

|                        |        |                    |
|------------------------|--------|--------------------|
| Expanded Uncertainty = | 0.5734 | mg.m <sup>-3</sup> |
| =>                     | 3.34   | % of Result        |
| =>                     | 5.73   | % of ELV           |

Company Name: Knauf  
Site Name: Queensferry  
Project Reference: FTBS35216  
Date: 06/10/15  
Run: TPM  
Sampling Point Ref: G

In-stack Filter?  Bar. Press. mm Hg  K Factor   
Outstack Filter?  Cp  Dn used   
Operators  Bws%  Nozzle No.   
Meter Correction Yd

Ambient Temp.  Leak Rate (fin / %)   
Start Time  Leak Rate (start / %)   
Stop Time  Box/Probe setting

Sample Filter Weights

|                | Sample ID | Laboratory | Increase, mg |
|----------------|-----------|------------|--------------|
| Filter         | 125999    | RPS        | 26.31        |
| Probe Washings | 30008727  | RPS        | 0.5          |

Sample Filter Blank Weighings

|            | Sample ID | Laboratory | Increase, mg |
|------------|-----------|------------|--------------|
| Filter     | 126247    | RPS        | 0.25         |
| Probe Wash | 30008724  | RPS        | 0.5          |

Impinger Weights

| Weights    | Initial | Final | Increase, g |
|------------|---------|-------|-------------|
| Impinger 1 |         |       | 0.0         |
| Impinger 2 |         |       | 0.0         |
| Impinger 3 |         |       | 0.0         |
| Impinger 4 |         |       | 0.0         |
| Impinger 5 |         |       | 0.0         |
| Silica Gel |         |       | 0.0         |
| Total      |         |       | 45.0        |

| Sample Point | Clock Time<br>min | Pitot Δ p,<br>mm H <sub>2</sub> O | Stack Temp,<br>°C | Orifice Δ H, mm H <sub>2</sub> O |        | Gas Meter Reading<br>m <sup>3</sup> | Temp at Gas<br>Meter Outlet<br>°C | Condenser<br>Temp,<br>°C | Filter Box<br>Temp<br>°C | Probe<br>Temp<br>°C | Pump<br>Vacuum<br>Inches Hg | Impinger<br>Stem Temp.,<br>°C | Root Δ p, |
|--------------|-------------------|-----------------------------------|-------------------|----------------------------------|--------|-------------------------------------|-----------------------------------|--------------------------|--------------------------|---------------------|-----------------------------|-------------------------------|-----------|
|              |                   |                                   |                   | Desired                          | Actual |                                     |                                   |                          |                          |                     |                             |                               |           |
|              | 0                 | 2.6                               | 34                | 91.722835                        | 92     | 3109065.4                           | 21                                | N/A                      | N/A                      | N/A                 | 3                           | 17                            | 1.612     |
|              | 7.5               | 2.4                               | 34                | 84.66723231                      | 85     |                                     | 21                                | N/A                      | N/A                      | N/A                 | 3                           | 19                            | 1.549     |
|              | 15                | 2.4                               | 34                | 84.66723231                      | 85     |                                     | 21                                | N/A                      | N/A                      | N/A                 | 3                           | 18                            | 1.549     |
|              | 22.5              | 2.6                               | 34                | 91.722835                        | 92     |                                     | 21                                | N/A                      | N/A                      | N/A                 | 3                           | 18                            | 1.612     |
| Endpoint     | 30                |                                   |                   |                                  |        |                                     |                                   |                          |                          |                     |                             |                               |           |
|              | 0                 | 2.8                               | 34                | 98.7784377                       | 99     |                                     | 21                                | N/A                      | N/A                      | N/A                 | 3                           | 19                            | 1.673     |
|              | 7.5               | 2.8                               | 34                | 98.7784377                       | 99     |                                     | 22                                | N/A                      | N/A                      | N/A                 | 3                           | 18                            | 1.673     |
|              | 15                | 2.6                               | 34                | 91.722835                        | 92     |                                     | 22                                | N/A                      | N/A                      | N/A                 | 3                           | 19                            | 1.612     |
|              | 22.5              | 2.6                               | 34                | 91.722835                        | 92     |                                     | 22                                | N/A                      | N/A                      | N/A                 | 3                           | 19                            | 1.612     |
| Endpoint     | 30                |                                   |                   |                                  |        | 3110811.8                           |                                   |                          |                          |                     |                             |                               |           |
|              | 60.00             | 2.600                             | 34.0              | 91.7                             | 91.7   | 1.746                               | 21.4                              | #DIV/0!                  | #DIV/0!                  | #DIV/0!             | 3.0                         | 18.4                          | 1.6       |

Company Name:Knauf  
Site Name:Queensferry  
Project Reference: FTBS35216

Date: 06/10/15

|  |               |
|--|---------------|
| Sampling Point Ref: G                                    | Run: TPM      |
| Meter Volume Sampled, acm                                | 1.746         |
| Sample Run Start Time                                    | 13:08         |
| Sample Run End Time                                      | 14:08         |
| Total Actual Sampling Time, min                          | 60.0          |
| Barometric Pressure, mm Hg                               | 750.00        |
| Stack Pressure, mm Hg                                    | 750.09        |
| Average Stack Temp, °C                                   | 34.0          |
| Meter Volume at STP, scm                                 | 1.565         |
| Stack Moisture Content, %                                | 3.5           |
| %O <sub>2</sub>  | 20.90         |
| Average Stack Velocity, m/sec                            | 5.588         |
| Nozzle Diameter, mm                                      | 10.97         |
| <b>% Isokinetic Variation</b>                            | <b>97.1</b>   |
| Total Mass of Particulate, mg                            | 26.8          |
| Percentage of Total Particulate Collected on Filter      | 98.1          |
| <b>Stack Particulate Concentration, mg/m<sup>3</sup></b> | <b>16.539</b> |
| Particulate Mass rate, kg/hour                           | 0.229         |
| Emission Limit value                                     | <b>10</b>     |

| Sample Train Blank Results                                |      |
|---|------|
| Sample Blank Particulate Concentration, mg/m <sup>3</sup> | 0.46 |
| Total Weight Gain, mg (Sample Train Blank)                | 0.75 |
| Blank Result Less than 10% of Limit Value                 | Y    |

## Uncertainty Calculation for Total Particulate Matter to BS EN 13284-1

|                          |        |                           |
|--------------------------|--------|---------------------------|
| Determined Concentration | 16.539 | mg/m3 (at Reference Cond) |
|--------------------------|--------|---------------------------|

### Measured Values

|                         |         |                |
|-------------------------|---------|----------------|
| Sampled Volume          | 1.7464  | m <sup>3</sup> |
| Sampled gas Temperature | 294.375 | K              |
| Sampled gas Pressure    | 100.01  | kPa            |
| Sampled gas Humidity    | 0       | % by volume    |
| Oxygen content          | 20.9    | % by volume    |
| Mass                    | 26.81   | mg             |

|                  |      |    |
|------------------|------|----|
| Leak             | 0.00 | %  |
| Uncollected Mass | 0    | mg |

### Standard Uncertainties for Measured Values

|                         |            |             |
|-------------------------|------------|-------------|
| Sampled Volume          | 0.001      | m3          |
| Sampled gas Temperature | 2          | K           |
| Sampled gas Pressure    | 1          | kPa         |
| Sampled gas Humidity    | 1          | % by volume |
| Oxygen content          | 0.1        | % by volume |
| Mass                    | 0.14152385 | mg          |

| Uncertainty Calculation for Volume Correction |                         |  |                 | Uncertainty Calculation for Oxygen Correction |                         |  |                 |
|---|-------------------------|--|-----------------|---|-------------------------|--|-----------------|
| Volume Correction Factor                      | 0.916                   |  |                 | Oxygen Correction Factor                      | 1.0000                  |  |                 |
|   | Sensitivity Coefficient |  | Uncertainty, Uv |   | Sensitivity Coefficient |  | Uncertainty, Uo |
| Sampled gas Temperature                       | 0.0031                  |  | 0.0062          | Oxygen Measurement                            | N/A                     |  | N/A             |
| Sampled gas Pressure                          | 0.0092                  |  | 0.0092          |   |                         |  |                 |
| Sampled gas Humidity                          | 0.0092                  |  | 0.0092          |   |                         |  |                 |
|   | Sqrt (Uv)^2             |  | 0.0144          |   |                         |  |                 |
|   | Total Uv                |  | 0.025           |   | Total Uo                |  | N/A             |

### Uncertainty Contributions (Itemised)

|                   | Value |                    | Sensitivity coefficient | Uncertainty Contribution |        |
|-------------------|-------|--------------------|-------------------------|--------------------------|--------|
|                   |       |                    |                         | Concentration            | %      |
| Volume Correction | 1.565 | m3                 | 10.57                   | 0.27 mg.m <sup>-3</sup>  | 1.60 % |
| Mass (weighing)   | 26.81 | mg                 | 0.62                    | 0.09 mg.m <sup>-3</sup>  | 0.53 % |
| Oxygen Correction | N/A   |                    | 0.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| System Leak       | 0.00  | mg.m <sup>-3</sup> | 1.00                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
| Uncollected Mass  | 0.00  | mg                 | 0.62                    | 0.00 mg.m <sup>-3</sup>  | 0.00 % |
|                   |       |                    | Total Uncertainty       | 0.28 mg.m <sup>-3</sup>  |        |

### Uncertainty Result

(Uncertainty has been expanded with a coverage factor of 2 (K=2))

|                        |        |                    |
|------------------------|--------|--------------------|
| Expanded Uncertainty = | 0.5586 | mg.m <sup>-3</sup> |
| =>                     | 3.38   | % of Result        |
| =>                     | 5.59   | % of ELV           |

Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: G

Date: 06/10/2015  
Run: 1  
Start: 11:55:00  
Stop: 12:55:00

|                     | VOC (as Propane)<br>ppm | VOC (as Carbon)<br>mg/m3 | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m3 | VOC (as<br>Toluene) kg/h | Oxygen<br>% |
|---------------------|-------------------------|--------------------------|-------------------------|---------------------------|--------------------------|-------------|
| Average             | 0.211                   | 0.339                    | 0.00453                 | 0.371                     | 0.00496                  | #DIV/0!     |
| Max                 | 0.400                   | 0.643                    | 0.00859                 | 0.704                     | 0.00941                  | 0.00        |
| Min                 | 0.000                   | 0.000                    | 0.00000                 | 0.000                     | 0.00000                  | 0.00        |
| Emission Limit      |                         | N/A                      |                         |                           |                          |             |
| Moisture, %         | 3.5                     |                          |                         |                           |                          |             |
| Oxygen Reference, % | 0.0                     |                          |                         |                           |                          |             |

|  |             |
|--|-------------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.710673911 |
|--|-------------|

| Calibrations            | ppm       |
|-------------------------|-----------|
| Analyser - Start Zero   | 0.00      |
| Analyser - Start Span   | 93.00     |
| Analyser - Zero Check   | 0.00      |
| System - Zero Check     | 0.00      |
| System - Span Check     | 93.00     |
| System - End Zero Check | -0.80     |
| System - End Span Check | 89.00     |
| Cylinder Number         | 116345.00 |
| Span Value              | 93.00     |
| Analyser Range (0 - X)  | 100.00    |

| Equipment ID                 |       |
|------------------------------|-------|
| FID                          | 01591 |
| Heated Line                  |       |
| H/Line Controller (if req'd) |       |
| Logger                       |       |
| Pitot                        |       |
| Manometer                    |       |
| T/couple                     |       |
| T/couple Readout             |       |
| Barometer                    | 00515 |

ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |             |
|--|-------------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 0.338839286 |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.7142857 |

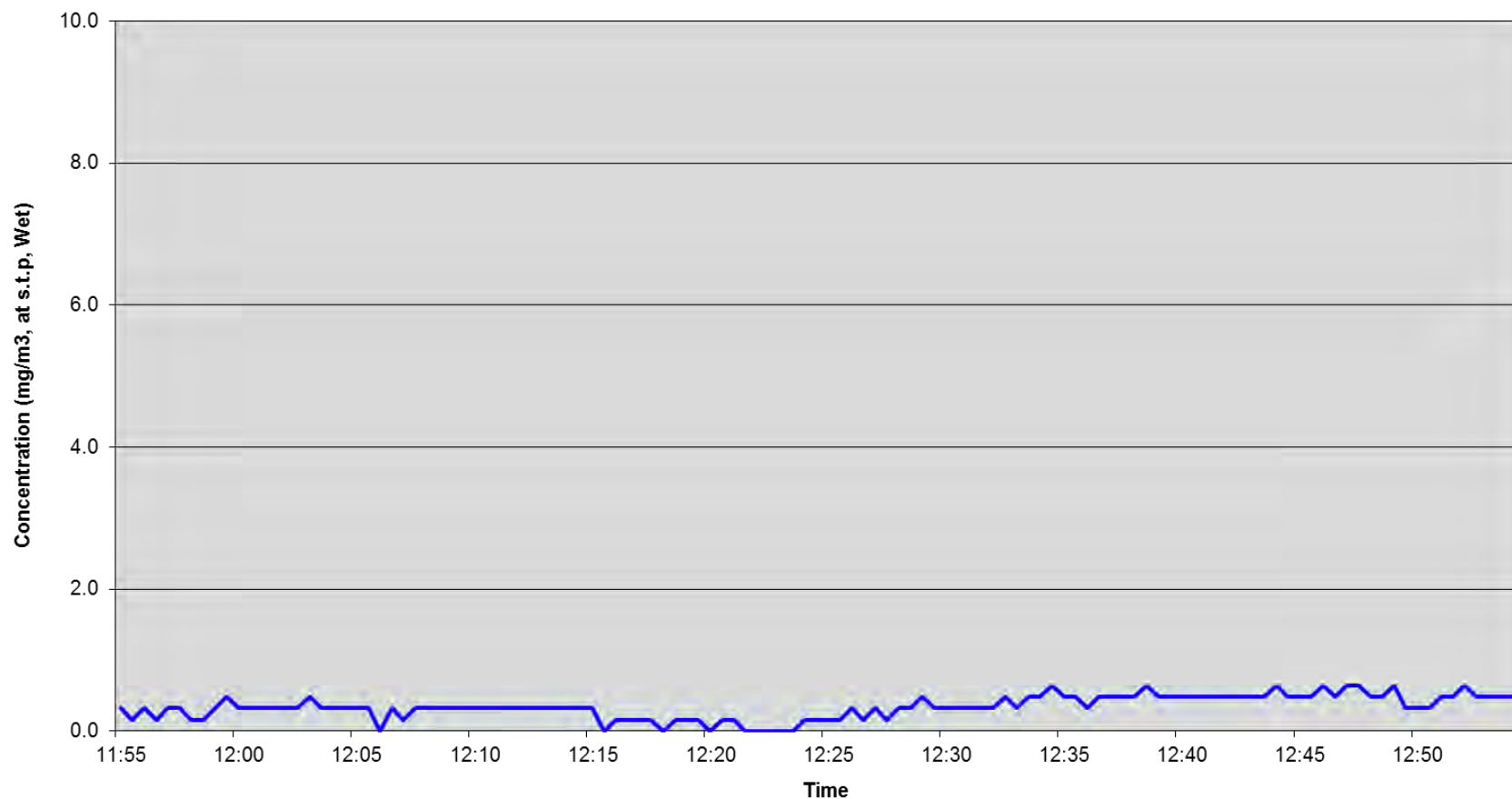
| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

| Selected Performance Characteristic | Value of Performance Characteristic |           |                | Operating Conditions compared to calibration condition |                                     |                |
|-------------------------------------|-------------------------------------|-----------|----------------|--|-------------------------------------|----------------|
|                                     | %                                   | Numerical | Units          | Required   | Variable due to sampling conditions | Units          |
| Deviation from Linearity            | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| 8 Hour Drift                        | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa          | 0.001  | 1                                   | % kPa          |
| Temperature Dependence              | 0.2                                 | 0.002     | %K             | 0.002  | 1                                   | %K             |
| Sum Interference                    | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Voltage Supply                      | 0.1                                 | 0.001     | %V             | 0.001  | 1                                   | %V             |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H2O Error | 0.01   | 2                                   | %Vol H2O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |

| Measurement Performance related to stationary conditions |                              |                               |         |            |                |  |                        |           |                |
|--|------------------------------|-------------------------------|---------|------------|----------------|--|------------------------|-----------|----------------|
|  |                              | Value of Uncertainty Quantity |         |            |                |  |                        |           |                |
|  |                              | At Calibration Conditions     |         |            |                |  | At Sampling Conditions |           |                |
| Performance Characteristic                               | Uncertainty Quantity         |                               | Units   | U          | U <sup>2</sup> |  | Units                  | U         | U <sup>2</sup> |
| Deviation from Linearity                                 | U <sub>Fit</sub>             |                               | % FS    | 1.60714286 | 2.583          |  | % FS                   | 0.0033884 | 0.000          |
| Repeatability Standard Deviation                         | U <sub>R</sub>               |                               | % FS    | 0.002      | 0.000          |  | % FS                   | 0.002     | 0.000          |
| 8 Hour Drift   | U <sub>drift</sub>           |                               | %       | 0.0039     | 0.000          |  | %                      | 0.004     | 0.000          |
| Atmospheric Pressure Dependence                          | U <sub>Atmos</sub>           |                               | % / kPa | 0.000      | 0.000          |  | % / kPa                | 0.000     | 0.000          |
| Temperature Dependence                                   | U <sub>Temp</sub>            |                               | % / K   | 0.000      | 0.000          |  | % / K                  | 0.000     | 0.000          |
| Sum Interference   | U <sub>Interference</sub>    |                               | %       | 0.004      | 0.000          |  | %                      | 0.000     | 0.000          |
| Voltage Supply   | U <sub>Voltage</sub>         |                               | % / V   | 0.000      | 0.000          |  | % / V                  | 0.000     | 0.000          |
| Uncertainty of Calibration Gas                           | U <sub>Calibration gas</sub> |                               | %       | 0.004      | 0.000          |  | %                      | 0.004     | 0.000          |
| Loss in sample line (Leaks)                              | U <sub>Losses, leak</sub>    |                               | %       | 0.004      | 0.000          |  | %                      | 0.008     | 0.000          |
|  |                              |                               | Sum     | 1.626      | 2.583          |  | Sum                    | 0.022     | 0.000          |

|                                |             |                     |
|--------------------------------|-------------|---------------------|
| Measurement Uncertainty at     | 0.338839286 | mg/m <sup>3</sup> C |
| U <sub>tot</sub>               | 0.010       | mg/m <sup>3</sup> C |
| U <sub>tot</sub> <sup>/C</sup> | 3.059       | %                   |
| U <sub>limit</sub>             | 30          | %                   |

**TOC Run 1 Emissions Profile from Stack G on 6th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*



Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: G

Date: 06/10/2015  
Run: 2  
Start: 12:55:00  
Stop: 13:55:00

|                     | VOC (as Propane)<br>ppm | VOC (as Carbon)<br>mg/m3 | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m3 | VOC (as<br>Toluene) kg/h | Oxygen<br>% |
|---------------------|-------------------------|--------------------------|-------------------------|---------------------------|--------------------------|-------------|
| Average             | 0.532                   | 0.856                    | 0.01143                 | 0.937                     | 0.01252                  | #DIV/0!     |
| Max                 | 0.900                   | 1.446                    | 0.01932                 | 1.584                     | 0.02116                  | 0.00        |
| Min                 | 0.000                   | 0.000                    | 0.00000                 | 0.000                     | 0.00000                  | 0.00        |
| Emission Limit      |                         | N/A                      |                         |                           |                          |             |
| Moisture, %         | 3.5                     |                          |                         |                           |                          |             |
| Oxygen Reference, % | 0.0                     |                          |                         |                           |                          |             |

|  |             |
|--|-------------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.710673911 |
|--|-------------|

| Calibrations            | ppm       |
|-------------------------|-----------|
| Analyser - Start Zero   | 0.00      |
| Analyser - Start Span   | 93.00     |
| Analyser - Zero Check   | 0.00      |
| System - Zero Check     | 0.00      |
| System - Span Check     | 93.00     |
| System - End Zero Check | -0.80     |
| System - End Span Check | 89.00     |
| Cylinder Number         | 116345.00 |
| Span Value              | 93.00     |
| Analyser Range (0 - X)  | 100.00    |

| Equipment ID                 |       |
|------------------------------|-------|
| FID                          | 01591 |
| Heated Line                  |       |
| H/Line Controller (if req'd) |       |
| Logger                       |       |
| Pitot                        |       |
| Manometer                    |       |
| T/couple                     |       |
| T/couple Readout             |       |
| Barometer                    | 00515 |

#### ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |             |
|--|-------------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 0.855803571 |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.7142857 |

| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

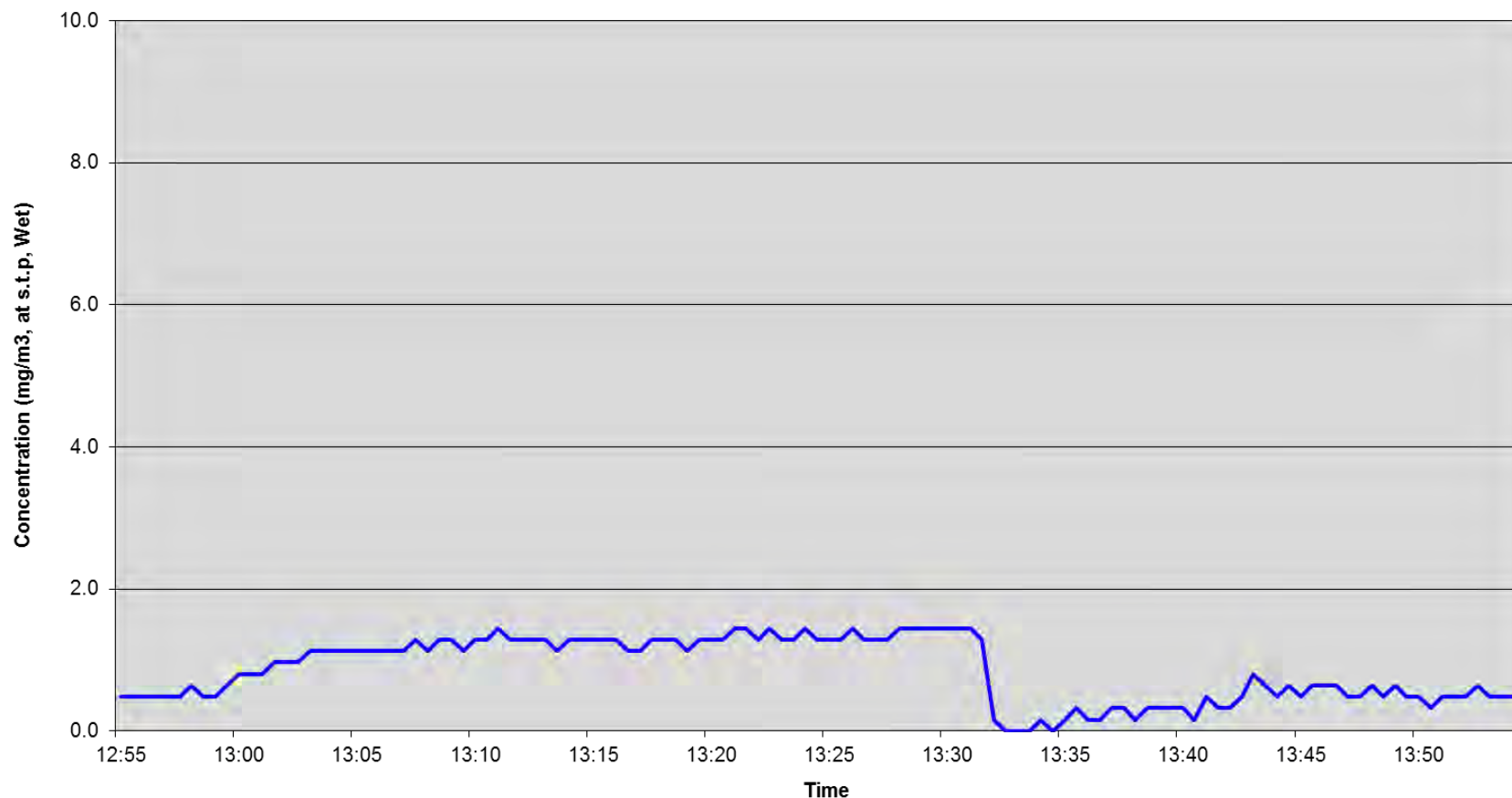
| Selected Performance Characteristic | Value of Performance Characteristic |           |                | Operating Conditions compared to calibration condition |                                     |                |
|-------------------------------------|-------------------------------------|-----------|----------------|--|-------------------------------------|----------------|
|                                     | %                                   | Numerical | Units          | Required   | Variable due to sampling conditions | Units          |
| Deviation from Linearity            | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| 8 Hour Drift                        | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa          | 0.001  | 1                                   | % kPa          |
| Temperature Dependence              | 0.2                                 | 0.002     | %K             | 0.002  | 1                                   | %K             |
| Sum Interference                    | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Voltage Supply                      | 0.1                                 | 0.001     | %V             | 0.001  | 1                                   | %V             |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H2O Error | 0.01   | 2                                   | %Vol H2O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |

| Measurement Performance related to stationary conditions |                              |                               |            |                |                        |          |                |  |
|--|------------------------------|-------------------------------|------------|----------------|------------------------|----------|----------------|--|
|  |                              | Value of Uncertainty Quantity |            |                |                        |          |                |  |
| Performance Characteristic                               | Uncertainty Quantity         | At Calibration Conditions     |            |                | At Sampling Conditions |          |                |  |
|  |                              | Units                         | U          | U <sup>2</sup> | Units                  | U        | U <sup>2</sup> |  |
| Deviation from Linearity                                 | U <sub>Fit</sub>             | % FS                          | 1.60714286 | 2.583          | % FS                   | 0.008558 | 0.000          |  |
| Repeatability Standard Deviation                         | U <sub>R</sub>               | % FS                          | 0.005      | 0.000          | % FS                   | 0.005    | 0.000          |  |
| 8 Hour Drift   | U <sub>drift</sub>           | %                             | 0.0099     | 0.000          | %                      | 0.010    | 0.000          |  |
| Atmospheric Pressure Dependence                          | U <sub>Atmos</sub>           | % / kPa                       | 0.000      | 0.000          | % / kPa                | 0.000    | 0.000          |  |
| Temperature Dependence                                   | U <sub>Temp</sub>            | % / K                         | 0.001      | 0.000          | % / K                  | 0.001    | 0.000          |  |
| Sum Interference   | U <sub>Interference</sub>    | %                             | 0.010      | 0.000          | %                      | 0.000    | 0.000          |  |
| Voltage Supply   | U <sub>Voltage</sub>         | % / V                         | 0.000      | 0.000          | % / V                  | 0.000    | 0.000          |  |
| Uncertainty of Calibration Gas                           | U <sub>Calibration gas</sub> | %                             | 0.010      | 0.000          | %                      | 0.010    | 0.000          |  |
| Loss in sample line (Leaks)                              | U <sub>Losses, leak</sub>    | %                             | 0.010      | 0.000          | %                      | 0.020    | 0.000          |  |
| Sum  |                              |                               | 1.654      | 2.583          | Sum                    | 0.055    | 0.001          |  |

|                                |             |                     |                    |      |
|--------------------------------|-------------|---------------------|--------------------|------|
| Measurement Uncertainty at     | 0.855803571 | mg/m <sup>3</sup> C |                    |      |
| U <sub>tot</sub>               | 0.026       | mg/m <sup>3</sup> C |                    |      |
| U <sub>tot</sub> <sup>IC</sup> | 3.059       | %                   | U <sub>limit</sub> | 30 % |



**TOC Run 2 Emissions Profile from Stack G on 6th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*



Company Name:Knauf  
Site Name:Queensferry  
Sampling Point Ref: G

Date: 06/10/2015  
Run: 3  
Start: 13:55:00  
Stop: 14:55:00

|                     | VOC (as Propane)<br>ppm | VOC (as Carbon)<br>mg/m3 | VOC (as Carbon)<br>kg/h | VOC (as<br>Toluene) mg/m3 | VOC (as<br>Toluene) kg/h | Oxygen<br>% |
|---------------------|-------------------------|--------------------------|-------------------------|---------------------------|--------------------------|-------------|
| Average             | 0.289                   | 0.465                    | 0.00621                 | 0.509                     | 0.00680                  | #DIV/0!     |
| Max                 | 0.700                   | 1.125                    | 0.01503                 | 1.232                     | 0.01646                  | 0.00        |
| Min                 | 0.000                   | 0.000                    | 0.00000                 | 0.000                     | 0.00000                  | 0.00        |
| Emission Limit      |                         | N/A                      |                         |                           |                          |             |
| Moisture, %         | 3.5                     |                          |                         |                           |                          |             |
| Oxygen Reference, % | 0.0                     |                          |                         |                           |                          |             |

|  |             |
|--|-------------|
| Stack Gas Volume Flow Rate, m3/s (scms WET) O2 Corrected | 3.710673911 |
|--|-------------|

| Calibrations            | ppm       |
|-------------------------|-----------|
| Analyser - Start Zero   | 0.00      |
| Analyser - Start Span   | 93.00     |
| Analyser - Zero Check   | 0.00      |
| System - Zero Check     | 0.00      |
| System - Span Check     | 93.00     |
| System - End Zero Check | -0.80     |
| System - End Span Check | 89.00     |
| Cylinder Number         | 116345.00 |
| Span Value              | 93.00     |
| Analyser Range (0 - X)  | 100.00    |

| Equipment ID                 |       |
|------------------------------|-------|
| FID                          | 01591 |
| Heated Line                  |       |
| H/Line Controller (if req'd) |       |
| Logger                       |       |
| Pitot                        |       |
| Manometer                    |       |
| T/couple                     |       |
| T/couple Readout             |       |
| Barometer                    | 00515 |

#### ISO 14956 Calculation Sheet - TOC (BS EN 12619)

|  |             |
|--|-------------|
| Studied Concentration (mg/m <sup>3</sup> As C) | 0.464732143 |
| Range of Instrument (mg/m <sup>3</sup> as C)   | 160.7142857 |

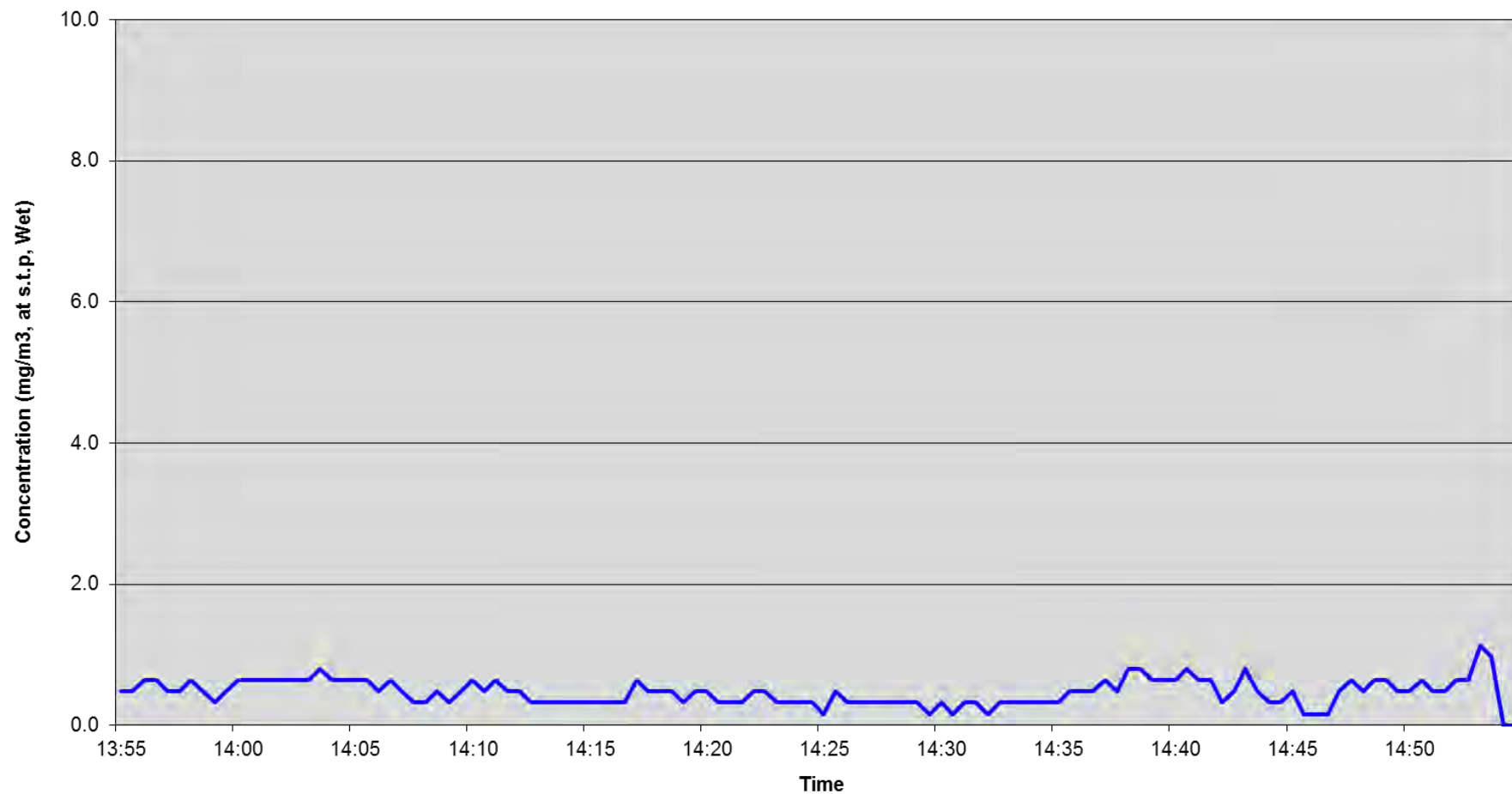
| Sampling Parameters to be met                | Requirement Met? |
|--|------------------|
| Response Time < 60s                          | Yes              |
| Operating temperature (5 - 45°C)             | Yes              |
| Atmospheric pressure (700 - 1240 mbar)       | Yes              |
| Relative Humidity (10 - 90%, non condensing) | Yes              |
| Altitude (< 2000 m)                          | Yes              |
| Zero Drift < 0.4 mg/m <sup>3</sup>           | Yes              |
| Span Drift < 0.7 mg/m <sup>3</sup>           | Yes              |

| Selected Performance Characteristic | Value of Performance Characteristic |           |                | Operating Conditions compared to calibration condition |                                     |                |
|-------------------------------------|-------------------------------------|-----------|----------------|--|-------------------------------------|----------------|
|                                     | %                                   | Numerical | Units          | Required   | Variable due to sampling conditions | Units          |
| Deviation from Linearity            | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| Repeatability Standard Deviation    | 1                                   | 0.01      | % FS           | 0.01   | 1                                   | % FS           |
| 8 Hour Drift                        | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Atmospheric Pressure Dependence     | 0.1                                 | 0.001     | % kPa          | 0.001  | 1                                   | % kPa          |
| Temperature Dependence              | 0.2                                 | 0.002     | %K             | 0.002  | 1                                   | %K             |
| Sum Interference                    | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |
| Voltage Supply                      | 0.1                                 | 0.001     | %V             | 0.001  | 1                                   | %V             |
| Uncertainty of Calibration Gas      | 2                                   | 0.02      | %              | 0.02   | 1                                   | %              |
| Moisture Effect                     | 1                                   | 0.01      | %Vol H2O Error | 0.01   | 2                                   | %Vol H2O Error |
| Loss in sample line (Leaks)         | 2                                   | 0.02      | %              | 0.02   | 2                                   | %              |

| Measurement Performance related to stationary conditions |                              |                               |            |                |                        |           |                |  |
|--|------------------------------|-------------------------------|------------|----------------|------------------------|-----------|----------------|--|
|  |                              | Value of Uncertainty Quantity |            |                |                        |           |                |  |
| Performance Characteristic                               | Uncertainty Quantity         | At Calibration Conditions     |            |                | At Sampling Conditions |           |                |  |
|  |                              | Units                         | U          | U <sup>2</sup> | Units                  | U         | U <sup>2</sup> |  |
| Deviation from Linearity                                 | U <sub>Fit</sub>             | % FS                          | 1.60714286 | 2.583          | % FS                   | 0.0046473 | 0.000          |  |
| Repeatability Standard Deviation                         | U <sub>R</sub>               | % FS                          | 0.003      | 0.000          | % FS                   | 0.003     | 0.000          |  |
| 8 Hour Drift   | U <sub>drift</sub>           | %                             | 0.0054     | 0.000          | %                      | 0.005     | 0.000          |  |
| Atmospheric Pressure Dependence                          | U <sub>Atmos</sub>           | % / kPa                       | 0.000      | 0.000          | % / kPa                | 0.000     | 0.000          |  |
| Temperature Dependence                                   | U <sub>Temp</sub>            | % / K                         | 0.001      | 0.000          | % / K                  | 0.001     | 0.000          |  |
| Sum Interference   | U <sub>Interference</sub>    | %                             | 0.005      | 0.000          | %                      | 0.000     | 0.000          |  |
| Voltage Supply   | U <sub>Voltage</sub>         | % / V                         | 0.000      | 0.000          | % / V                  | 0.000     | 0.000          |  |
| Uncertainty of Calibration Gas                           | U <sub>Calibration gas</sub> | %                             | 0.005      | 0.000          | %                      | 0.005     | 0.000          |  |
| Loss in sample line (Leaks)                              | U <sub>Losses, leak</sub>    | %                             | 0.005      | 0.000          | %                      | 0.011     | 0.000          |  |
| Sum  |                              |                               | 1.632      | 2.583          | Sum                    | 0.030     | 0.000          |  |

|                                |             |                     |                    |      |
|--------------------------------|-------------|---------------------|--------------------|------|
| Measurement Uncertainty at     | 0.464732143 | mg/m <sup>3</sup> C |                    |      |
| U <sub>tot</sub>               | 0.014       | mg/m <sup>3</sup> C |                    |      |
| U <sub>tot</sub> <sup>IC</sup> | 3.059       | %                   | U <sub>limit</sub> | 30 % |

**TOC Run 3 Emissions Profile from Stack G on 6th October 2015 at Knauf, Queensferry**  
*reference conditions expressed as 273K, 101.3 kPa, without correction for oxygen or moisture content.*





## **APPENDIX 5: Upwind Sampling and Analysis Data**

|  |              |              |   |                   |          |
|--|--------------|--------------|---|-------------------|----------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Boundary - Upwind</b> |              |              | Personnel: EP                                       |                   |          |
|  |              |              | Date of Sampling: 02/12/2015                        |                   |          |
|  |              |              | Sampling Comments                                   |                   |          |
|  |              |              | <b>Upwind : Ammonia 226-10-06</b>                   |                   |          |
| Ref Moisture   | -            | Wet          |   |                   |          |
| Ref Temp   | K            | 273          |   |                   |          |
| Ref Pressure   | kPa          | 101.325      |   |                   |          |
| Ref Oxygen   | %            | 0            |   |                   |          |
|  | Start        | End          |   |                   |          |
| <b>Sample Times</b>  | <b>10:40</b> | <b>14:40</b> |   |                   |          |
| <b>Barometric</b>  | <b>kPa</b>   | <b>101.3</b> |   |                   |          |
|  |              |              |   |                   |          |
|  |              |              | Measured Volume                                     | m <sup>3</sup>    | 0.096    |
|  |              |              | Volume at STP                                       | m <sup>3</sup>    | 0.092    |
|  |              |              |   |                   |          |
| Ambient Temperature  | °C           | 16           |   |                   |          |
| Meter Correction Yd  | -            | 1            |   |                   |          |
| Meter Temp Average   | °C           | 12           |   |                   |          |
| Meter Volume (Start)   | litres       | 0            |   |                   |          |
| Meter Volume (End)   | litres       | 96           |   |                   |          |
| Pitot Coefficient  | -            |              |   |                   |          |
| Measured Oxygen  | %            |              | Moisture Content                                    | %                 | 0.0      |
| <b>Sample Laboratory Data</b>  |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |          |
| Ammonia  | mg           | 0.00020      | Ammonia   | mg/m <sup>3</sup> | 0.002175 |
|  |              |              |   |                   |          |
| <b>Blank Laboratory Data</b>   |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |          |
| 5685501358   | mg           | 0.0002       | Ammonia   | mg/m <sup>3</sup> | 0.0022   |
|  |              |              |   |                   |          |

reported at limit of detection

|  |              |               |   |                         |                |
|--|--------------|---------------|---|-------------------------|----------------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Boundary - Upwind</b> |              |               | Personnel: EP                                       |                         |                |
|  |              |               | Date of Sampling: 07/10/2015                        |                         |                |
|  |              |               | Sampling Comments                                   |                         |                |
|  |              |               | <b>Upwind : Formaldehyde 226-119</b>                |                         |                |
| Ref Moisture   | -            | Wet           |   |                         |                |
| Ref Temp   | K            | 273           |   |                         |                |
| Ref Pressure   | kPa          | 101.325       |   |                         |                |
| Ref Oxygen   | %            | 0             |   |                         |                |
|  | Start        | End           |   |                         |                |
| <b>Sample Times</b>  | <b>09:55</b> | <b>13:55</b>  |   |                         |                |
| <b>Barometric</b>  | <b>kPa</b>   | <b>101.3</b>  | Measured Volume                                     | m <sup>3</sup>          | 0.096          |
|  |              |               | Volume at STP                                       | m <sup>3</sup>          | 0.092          |
|  |              |               |   |                         |                |
| Ambient Temperature  | °C           | 16            |   |                         |                |
| Meter Correction Yd  | -            | 1             |   |                         |                |
| Meter Temp Average   | °C           | 12            |   |                         |                |
| Meter Volume (Start)   | litres       | 0             |   |                         |                |
| Meter Volume (End)   | litres       | 96            |   |                         |                |
| Pitot Coefficient  | -            |               |   |                         |                |
| Measured Oxygen  | %            |               | Moisture Content                                    | %                       | 0.0            |
| <b>Sample Laboratory Data</b>  |              |               | <b>Mass Concentration (at reference conditions)</b> |                         |                |
| <b>Formaldehyde</b>  | <b>mg</b>    | <b>0.0001</b> | <b>Formaldehyde</b>                                 | <b>mg/m<sup>3</sup></b> | <b>0.00109</b> |
|  |              |               |   |                         |                |
| <b>Blank Laboratory Data</b>   |              |               | <b>Mass Concentration (at reference conditions)</b> |                         |                |
| Formaldehyde   | mg           | 0.0001        | Formaldehyde  | mg/m <sup>3</sup>       | <b>0.00109</b> |
|  |              |               |   |                         |                |

reported at limit of detection

|  |              |              |   |                   |        |
|--|--------------|--------------|---|-------------------|--------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Boundary - Upwind</b> |              |              | Personnel: EP                                       |                   |        |
|  |              |              | Date of Sampling: 07/10/2015                        |                   |        |
|  |              |              | Sampling Comments                                   |                   |        |
|  |              |              | <b>Upwind : Phenols 226-95</b>                      |                   |        |
| Ref Moisture   | -            | Wet          |   |                   |        |
| Ref Temp   | K            | 273          |   |                   |        |
| Ref Pressure   | kPa          | 101.325      |   |                   |        |
| Ref Oxygen   | %            | 0            |   |                   |        |
|  | Start        | End          |   |                   |        |
| <b>Sample Times</b>  | <b>08:30</b> | <b>15:55</b> |   |                   |        |
| <b>Barometric</b>  | <b>kPa</b>   | <b>101.3</b> |   |                   |        |
|  |              |              |   |                   |        |
|  |              |              |   |                   |        |
| Ambient Temperature  | °C           | 12           | Measured Volume                                     | m <sup>3</sup>    | 0.096  |
| Meter Correction Yd  | -            | 1            | Volume at STP                                       | m <sup>3</sup>    | 0.092  |
| Meter Temp Average   | °C           | 12           |   |                   |        |
| Meter Volume (Start)   | litres       | 0            |   |                   |        |
| Meter Volume (End)   | litres       | 96           |   |                   |        |
| Pitot Coefficient  | -            |              |   |                   |        |
| Measured Oxygen  | %            |              | Moisture Content                                    | %                 | 0.0    |
| <b>Sample Laboratory Data</b>  |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |        |
| Phenol   | mg           | 0.003        | Phenol  | mg/m <sup>3</sup> | 0.0272 |
|  |              |              |   |                   |        |
| <b>Blank Laboratory Data</b>   |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |        |
| 6897_8   | mg           | 0.005        | Phenol  |                   | 0.054  |
|  |              |              |   |                   |        |

reported at limit of detection



## **APPENDIX 6: Downwind Sampling and Analysis Data**

|  |              |              |   |                   |          |                 |                |       |
|--|--------------|--------------|---|-------------------|----------|-----------------|----------------|-------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Boundary - Downwind</b> |              |              | Personnel: EP                                       |                   |          |                 |                |       |
|  |              |              | Date of Sampling:                                   |                   |          |                 |                |       |
|  |              |              | Sampling Comments                                   |                   |          |                 |                |       |
|  |              |              | <b>Downwind : Formaldehyde 226-119</b>              |                   |          |                 |                |       |
| Ref Moisture   | -            | Wet          |   |                   |          |                 |                |       |
| Ref Temp   | K            | 273          |   |                   |          |                 |                |       |
| Ref Pressure   | kPa          | 101.325      |   |                   |          |                 |                |       |
| Ref Oxygen   | %            | 0            |   |                   |          |                 |                |       |
|  | Start        | End          |   |                   |          |                 |                |       |
| <b>Sample Times</b>  | <b>08:30</b> | <b>15:55</b> |   |                   |          |                 |                |       |
| <b>Barometric</b>  | <b>kPa</b>   | <b>101.3</b> |   |                   |          | Measured Volume | m <sup>3</sup> | 0.096 |
|  |              |              |   |                   |          | Volume at STP   | m <sup>3</sup> | 0.092 |
|  |              |              |   |                   |          |                 |                |       |
| Ambient Temperature  | °C           | 12           |   |                   |          |                 |                |       |
| Meter Correction Yd  | -            | 1            |   |                   |          |                 |                |       |
| Meter Temp Average   | °C           | 12           |   |                   |          |                 |                |       |
| Meter Volume (Start)   | litres       | 0            |   |                   |          |                 |                |       |
| Meter Volume (End)   | litres       | 96           |   |                   |          |                 |                |       |
| Pitot Coefficient  | -            |              |   |                   |          |                 |                |       |
| Measured Oxygen  | %            |              | Moisture Content                                    | %                 | 0.0      |                 |                |       |
| <b>Sample Laboratory Data</b>  |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |          |                 |                |       |
| Formaldehyde   | mg           | 0.0027       | Formaldehyde  | mg/m <sup>3</sup> | 0.029354 |                 |                |       |
|  |              |              |   |                   |          |                 |                |       |
| <b>Blank Laboratory Data</b>   |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |          |                 |                |       |
| Formaldehyde   |              | 0.0001       | Formaldehyde  | mg/m <sup>3</sup> | 0.001087 |                 |                |       |
|  |              |              |   |                   |          |                 |                |       |

reported at limit of detection

|  |              |                |   |                         |                |
|--|--------------|----------------|---|-------------------------|----------------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Boundary - Downwind</b> |              |                | Personnel: EP                                       |                         |                |
|  |              |                | Date of Sampling: 02/12/2015                        |                         |                |
|  |              |                | Sampling Comments                                   |                         |                |
|  |              |                | <b>Downwind : Ammonia 226-10-16</b>                 |                         |                |
| Ref Moisture   | -            | Wet            |   |                         |                |
| Ref Temp   | K            | 273            |   |                         |                |
| Ref Pressure   | kPa          | 101.325        |   |                         |                |
| Ref Oxygen   | %            | 0              |   |                         |                |
|  | Start        | End            |   |                         |                |
| <b>Sample Times</b>  | <b>10:40</b> | <b>14:40</b>   |   |                         |                |
| <b>Barometric</b>  | <b>kPa</b>   | <b>101.3</b>   |   |                         |                |
|  |              |                |   |                         |                |
|  |              |                | Measured Volume                                     | m <sup>3</sup>          | 0.096          |
|  |              |                | Volume at STP                                       | m <sup>3</sup>          | 0.092          |
|  |              |                |   |                         |                |
| Ambient Temperature  | °C           | 12             |   |                         |                |
| Meter Correction Yd  | -            | 1              |   |                         |                |
| Meter Temp Average   | °C           | 12             |   |                         |                |
| Meter Volume (Start)   | litres       | 0              |   |                         |                |
| Meter Volume (End)   | litres       | 96             |   |                         |                |
| Pitot Coefficient  | -            |                |   |                         |                |
| Measured Oxygen  | %            |                | Moisture Content                                    | %                       | 0.0            |
| <b>Sample Laboratory Data</b>  |              |                | <b>Mass Concentration (at reference conditions)</b> |                         |                |
| <b>Ammonia</b>   | <b>mg</b>    | <b>0.00020</b> | <b>Ammonia</b>                                      | <b>mg/m<sup>3</sup></b> | <b>0.00217</b> |
|  |              |                |   |                         |                |
| <b>Blank Laboratory Data</b>   |              |                | <b>Mass Concentration (at reference conditions)</b> |                         |                |
| 5685501358   | mg           | 0.00020        | Ammonia   | mg/m <sup>3</sup>       | <b>0.00217</b> |
|  |              |                |   |                         |                |

|  |              |              |   |                   |        |
|--|--------------|--------------|---|-------------------|--------|
| <b>Project Ref: FTBS 35216</b><br><b>Site Ref: Queensferry</b><br><b>Sampling Point Ref: Boundary - Downwind</b> |              |              | Personnel: EP                                       |                   |        |
|  |              |              | Date of Sampling:                                   |                   |        |
|  |              |              | Sampling Comments                                   |                   |        |
|  |              |              | <b>Downwind : Phenols 226-95</b>                    |                   |        |
| Ref Moisture   | -            | Wet          |   |                   |        |
| Ref Temp   | K            | 273          |   |                   |        |
| Ref Pressure   | kPa          | 101.325      |   |                   |        |
| Ref Oxygen   | %            | 0            |   |                   |        |
|  | Start        | End          |   |                   |        |
| <b>Sample Times</b>  | <b>09:55</b> | <b>13:55</b> |   |                   |        |
| <b>Barometric</b>  | <b>kPa</b>   | <b>101.3</b> |   |                   |        |
|  |              |              |   |                   |        |
|  |              |              |   |                   |        |
| Ambient Temperature  | °C           | 12           | Measured Volume                                     | m <sup>3</sup>    | 0.096  |
| Meter Correction Yd  | -            | 1            | Volume at STP                                       | m <sup>3</sup>    | 0.092  |
| Meter Temp Average   | °C           | 12           |   |                   |        |
| Meter Volume (Start)   | litres       | 0            |   |                   |        |
| Meter Volume (End)   | litres       | 96           |   |                   |        |
| Pitot Coefficient  | -            |              |   |                   |        |
| Measured Oxygen  | %            |              | Moisture Content                                    | %                 | 0.0    |
| <b>Sample Laboratory Data</b>  |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |        |
| Phenol   | mg           | 0.003        | Phenol  | mg/m <sup>3</sup> | 0.0272 |
|  |              |              |   |                   |        |
| <b>Blank Laboratory Data</b>   |              |              | <b>Mass Concentration (at reference conditions)</b> |                   |        |
| 20006896   |              | 0.005        | Phenol  | mg/m <sup>3</sup> | 0.054  |
|  |              |              |   |                   |        |

reported at limit of detection

## **APPENDIX 7: Certificates of Analysis**



Test Certificate

Date 05/11/2015

|             |   |                 |                   |
|-------------|---|-----------------|-------------------|
| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 32216        |
|             |   | Certificate No. | WK16-6799         |
|             |   | Issue No.       | 1                 |
| Contact     | Chris Davies  | Date Received   | 13/10/2015        |
| Description | 6 filters & 6 washes for TPM  | Technique       | Gravimetric Stack |

| Sample No.               | 854498    | 122027   | Method |
|--------------------------|-----------|----------|--------|
| Total particulate matter | 1.32 mg   |          | D8(U)  |
| Sample No.               | 854499    | 20009178 | Method |
| Total particulate matter | <0.5 mg   |          | D8(U)  |
| Sample No.               | 854500    | 122028   | Method |
| Total particulate matter | 73.98 mg  |          | D8(U)  |
| Sample No.               | 854501    | 20009179 | Method |
| Total particulate matter | 8.51 mg   |          | D8(U)  |
| Sample No.               | 854502    | 110867   | Method |
| Total particulate matter | 1.50 mg   |          | D8(U)  |
| Sample No.               | 854503    | 20009183 | Method |
| Total particulate matter | <0.5 mg   |          | D8(U)  |
| Sample No.               | 854504    | 122029   | Method |
| Total particulate matter | 109.74 mg |          | D8(U)  |
| Sample No.               | 854505    | 20009184 | Method |
| Total particulate matter | 23.18 mg  |          | D8(U)  |

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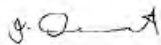


Test Certificate

Date 06/11/2016

|                          |                        |          |                 |           |
|--------------------------|------------------------|----------|-----------------|-----------|
| Client                   | RPS Milton Keynes HSED |          | Certificate No. | WK15-6799 |
|                          |                        |          | Issue No.       | 1         |
| Sample No.               | 864606                 | 122404   | Method          |           |
| Total particulate matter |                        | 15.90 mg | D8(U)           |           |
| Sample No.               | 864607                 | 20009216 | Method          |           |
| Total particulate matter |                        | <0.5 mg  | D8(U)           |           |

Tested By Joanne Dewhurst Date 21/10/2015

Approved By  Date 21/10/2015  
Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

Method Symbols (U) Analysis is UKAS Accredited  
(N) Analysis is not UKAS Accredited

Concentration values (mg/m<sup>3</sup> and ppm) are calculated on the basis of information provided by the customer.  
Results stated as m) are referring to the sample volume.

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Test Certificate

Date 05/11/2015

|             |   |                 |            |
|-------------|---|-----------------|------------|
| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216 |
|             |   | Certificate No. | WK15-5801  |
|             |   | Issue No.       | 1          |
| Contact     | Chris Davies  | Date Received   | 13/10/2015 |
| Description | 5 tubes for amine screen  | Technique       | IC         |

|            |        |          |        |
|------------|--------|----------|--------|
| Sample No. | 854477 | 20009188 | Method |
|------------|--------|----------|--------|

|                |       |
|----------------|-------|
| Amine Suite    | A1(U) |
| Diethylamine   | <1 µg |
| Dimethylamine  | <1 µg |
| Ethanolamine   | <1 µg |
| Methylamine    | <1 µg |
| Trimethylamine | <1 µg |

|            |        |          |        |
|------------|--------|----------|--------|
| Sample No. | 854478 | 20009189 | Method |
|------------|--------|----------|--------|

|                |       |
|----------------|-------|
| Amine Suite    | A1(U) |
| Diethylamine   | <1 µg |
| Dimethylamine  | <1 µg |
| Ethanolamine   | <1 µg |
| Methylamine    | <1 µg |
| Trimethylamine | <1 µg |

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Test Certificate

Date 06/11/2016

|        |                        |                 |           |
|--------|------------------------|-----------------|-----------|
| Client | RPS Milton Keynes HSED | Certificate No. | WK15-5801 |
|        |                        | Issue No.       | 1         |

|            |        |          |        |
|------------|--------|----------|--------|
| Sample No. | 854479 | 20009191 | Method |
|------------|--------|----------|--------|

|             |       |
|-------------|-------|
| Amine Suite | A1(U) |
|-------------|-------|

Diethylamine

<1 µg

Dimethylamine

<1 µg

Ethanolamine

<1 µg

Methylamine

<1 µg

Trimethylamine

<1 µg

|            |        |          |        |
|------------|--------|----------|--------|
| Sample No. | 854480 | 20009192 | Method |
|------------|--------|----------|--------|

|             |       |
|-------------|-------|
| Amine Suite | A1(U) |
|-------------|-------|

Diethylamine

<1 µg

Dimethylamine

<1 µg

Ethanolamine

<1 µg

Methylamine

<1 µg

Trimethylamine

<1 µg

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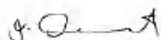


Test Certificate

Date 05/11/2015

|                |                        |          |                 |           |
|----------------|------------------------|----------|-----------------|-----------|
| Client         | RPS Milton Keynes HSED |          | Certificate No. | WK15-5801 |
|                |                        |          | Issue No.       | 1         |
| Sample No.     | 854481                 | 20009194 | Method          |           |
| Amine Suite    |                        |          | A1(U)           |           |
| Diethylamine   |                        |          |                 |           |
| <1 µg          |                        |          |                 |           |
| Dimethylamine  |                        |          |                 |           |
| <1 µg          |                        |          |                 |           |
| Ethanolamine   |                        |          |                 |           |
| <1 µg          |                        |          |                 |           |
| Methylamine    |                        |          |                 |           |
| <1 µg          |                        |          |                 |           |
| Trimethylamine |                        |          |                 |           |
| <1 µg          |                        |          |                 |           |

Tested By Nicholas Lynch Date 20/10/2015

Approved By  Date 21/10/2015  
Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

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(N) Analysis is not UKAS Accredited

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Analysis carried out on samples 'as received'

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Test Certificate

Date 05/11/2015

Client RPS Milton Keynes HSED  
Noble House  
Capital Drive  
Linford Wood  
Milton Keynes  
MK14 6QP

Order No. FTBS 35216  
Certificate No. WK18-5798  
Issue No. 1

Contact Chris Davies  
Description 8 solutions for NHS

Date Received 13/10/2016  
Technique IC Stack

| Parameter | Analysis Method | Accreditation | Method LOD | Uncertainty |
|-----------|-----------------|---------------|------------|-------------|
| Ammonia   | A6              | UKAS          | 0.1 µg/ml  | 8.00%       |

|            |             |          |        |
|------------|-------------|----------|--------|
| Sample No. | 854490      | 20009180 | Method |
| Ammonia    | <0.10 µg/ml | 135 ml   | A6(U)  |
| Sample No. | 854491      | 20009181 | Method |
| Ammonia    | 188 µg/ml   | 248 ml   | A6(U)  |
| Sample No. | 854492      | 20009182 | Method |
| Ammonia    | 0.40 µg/ml  | 122 ml   | A6(U)  |
| Sample No. | 854493      | 20009186 | Method |
| Ammonia    | <0.10 µg/ml | 130 ml   | A6(U)  |
| Sample No. | 854494      | 20008186 | Method |
| Ammonia    | 232 µg/ml   | 234 ml   | A6(U)  |
| Sample No. | 854495      | 20008187 | Method |
| Ammonia    | 0.88 µg/ml  | 112 ml   | A6(U)  |
| Sample No. | 854496      | 20009199 | Method |
| Ammonia    | 148 µg/ml   | 206 ml   | A6(U)  |

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Test Certificate

Date 05/11/2015

|            |                        |          |                 |           |
|------------|------------------------|----------|-----------------|-----------|
| Client     | RPS Milton Keynes HSED |          | Certificate No. | WK15-5798 |
|            |                        |          | Issue No.       | 1         |
| Sample No. | 854497                 | 20009200 | Method          |           |
| Ammonia    | 0.61 µg/ml             | 107 ml   | A6(U)           |           |

Tested By Nicholas Lynch Date 19/10/2015

Approved By  Date 21/10/2015

Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

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Date 05/11/2015

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| Client | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216 |
|        |   | Certificate No. | WK15-5800  |
|        |   | Issue No.       | 1          |

|             |                           |               |            |
|-------------|---------------------------|---------------|------------|
| Contact     | Chris Davies              | Date Received | 13/10/2015 |
| Description | 5 tubes for phenol screen | Technique     | GC-FID     |

|            |        |          |        |
|------------|--------|----------|--------|
| Sample No. | 854472 | 20009196 | Method |
|------------|--------|----------|--------|

|               |       |
|---------------|-------|
| Phenol screen | P1(U) |
| m,p- Cresol   |       |
| <5 µg         |       |
| m,p-Xylenol   |       |
| <5 µg         |       |
| o-Cresol      |       |
| <5 µg         |       |
| o-Xylenol     |       |
| <5 µg         |       |
| Phenol        |       |
| <5 µg         |       |

|            |        |          |        |
|------------|--------|----------|--------|
| Sample No. | 854473 | 20009197 | Method |
|------------|--------|----------|--------|

|               |       |
|---------------|-------|
| Phenol screen | P1(U) |
| m,p- Cresol   |       |
| <5 µg         |       |
| m,p-Xylenol   |       |
| <5 µg         |       |
| o-Cresol      |       |
| <5 µg         |       |
| o-Xylenol     |       |
| <5 µg         |       |
| Phenol        |       |
| 106 µg        |       |

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|--|------------------------|----------|-----------------|-----------|
| Client                                 | RPS Milton Keynes HSED |          | Certificate No. | WK15-6800 |
|  |                        |          | Issue No.       | 1         |
| Sample No.                             | 854474                 | 20009211 | Method          |           |
| Phenol screen                          |                        |          | P1(U)           |           |
| m,p- Cresol                            |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| m,p-Xylenol                            |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| o-Cresol                               |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| o-Xylenol                              |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| Phenol                                 |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| Sample No.                             | 854475                 | 20009212 | Method          |           |
| Phenol screen                          |                        |          | P1(U)           |           |
| m,p- Cresol                            |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| m,p-Xylenol                            |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| o-Cresol                               |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| o-Xylenol                              |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| Phenol                                 |                        |          |                 |           |
| <input type="text" value=" 37 µg"/>    |                        |          |                 |           |
| Sample No.                             | 854476                 | 20009214 | Method          |           |
| Phenol screen                          |                        |          | P1(U)           |           |
| m,p- Cresol                            |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| m,p-Xylenol                            |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| o-Cresol                               |                        |          |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |          |                 |           |
| Phenol                                 |                        |          |                 |           |
| <input type="text" value=" 32 µg"/>    |                        |          |                 |           |

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|--------|------------------------|-----------------|-----------|
| Client | RPS Milton Keynes HSED | Certificate No. | WK15-5800 |
|        |                        | Issue No.       | 1         |

|           |              |      |            |
|-----------|--------------|------|------------|
| Tested By | Jane Damerum | Date | 22/10/2015 |
|-----------|--------------|------|------------|

|             |   |      |            |
|-------------|---|------|------------|
| Approved By |  | Date | 22/10/2015 |
|             | Joanne Dewhurst<br>Operational Manager  |      |            |

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Test Certificate

Date 21/10/2015

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| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216 |
|             |   | Certificate No. | WK15-5792  |
|             |   | Issue No.       | 1          |
| Contact     | Richard Harvey  | Date Received   | 13/10/2015 |
| Description | 4 tubes for amine screen  | Technique       | IC         |

|            |        |            |        |
|------------|--------|------------|--------|
| Sample No. | 854460 | 5897109940 | Method |
|------------|--------|------------|--------|

|                |       |
|----------------|-------|
| Amine Suite    | A1(U) |
| Diethylamine   | <1 µg |
| Dimethylamine  | <1 µg |
| Ethanolamine   | <1 µg |
| Methylamine    | <1 µg |
| Trimethylamine | <1 µg |

|            |        |            |        |
|------------|--------|------------|--------|
| Sample No. | 854461 | 5897109942 | Method |
|------------|--------|------------|--------|

|                |       |
|----------------|-------|
| Amine Suite    | A1(U) |
| Diethylamine   | <1 µg |
| Dimethylamine  | <1 µg |
| Ethanolamine   | <1 µg |
| Methylamine    | <1 µg |
| Trimethylamine | <1 µg |

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| Client                                 | RPS Milton Keynes HSED |            | Certificate No. | WK15-5792 |
|  |                        |            | Issue No.       | 1         |
| Sample No.                             | 854462                 | 5897109936 | Method          |           |
| Amine Suite                            |                        |            | A1(U)           |           |
| Diethylamine                           |                        |            |                 |           |
| <input type="text" value=" &lt;1 µg"/> |                        |            |                 |           |
| Dimethylamine                          |                        |            |                 |           |
| <input type="text" value=" &lt;1 µg"/> |                        |            |                 |           |
| Ethanolamine                           |                        |            |                 |           |
| <input type="text" value=" &lt;1 µg"/> |                        |            |                 |           |
| Methylamine                            |                        |            |                 |           |
| <input type="text" value=" &lt;1 µg"/> |                        |            |                 |           |
| Trimethylamine                         |                        |            |                 |           |
| <input type="text" value=" &lt;1 µg"/> |                        |            |                 |           |

|  |        |            |        |  |
|--|--------|------------|--------|--|
| Sample No.                             | 854463 | 5897109936 | Method |  |
| Amine Suite                            |        |            | A1(U)  |  |
| Diethylamine                           |        |            |        |  |
| <input type="text" value=" &lt;1 µg"/> |        |            |        |  |
| Dimethylamine                          |        |            |        |  |
| <input type="text" value=" &lt;1 µg"/> |        |            |        |  |
| Ethanolamine                           |        |            |        |  |
| <input type="text" value=" &lt;1 µg"/> |        |            |        |  |
| Methylamine                            |        |            |        |  |
| <input type="text" value=" &lt;1 µg"/> |        |            |        |  |
| Trimethylamine                         |        |            |        |  |
| <input type="text" value=" &lt;1 µg"/> |        |            |        |  |

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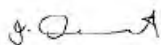


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| Client | RPS Milton Keynes HSED | Certificate No. | WK15-5792 |
|        |                        | Issue No.       | 1         |

|           |                |      |            |
|-----------|----------------|------|------------|
| Tested By | Nicholas Lynch | Date | 20/10/2015 |
|-----------|----------------|------|------------|

|             |   |      |            |
|-------------|---|------|------------|
| Approved By |  | Date | 21/10/2015 |
|             | Joanne Dewhurst<br>Operational Manager  |      |            |

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Date 21/10/2015

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|             |   | Certificate No. | WK15-5793         |
|             |   | Issue No.       | 1                 |
| Contact     | Richard Harvey  | Date Received   | 13/10/2015        |
| Description | 5 filters & 5 washes for TPM  | Technique       | Gravimetric Stack |

| Sample No.               | 126235   | Method |
|--------------------------|----------|--------|
| Total particulate matter | 0.27 mg  | D8(U)  |
| Sample No.               | 30008566 | Method |
| Total particulate matter | <0.5 mg  | D8(U)  |
| Sample No.               | 126247   | Method |
| Total particulate matter | <0.04 mg | D8(U)  |
| Sample No.               | 30008566 | Method |
| Total particulate matter | <0.5 mg  | D8(U)  |
| Sample No.               | 120688   | Method |
| Total particulate matter | <0.04 mg | D8(U)  |
| Sample No.               | 30008567 | Method |
| Total particulate matter | <0.5 mg  | D8(U)  |
| Sample No.               | 121768   | Method |
| Total particulate matter | <0.04 mg | D8(U)  |
| Sample No.               | 30008568 | Method |
| Total particulate matter | <0.5 mg  | D8(U)  |

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|                          |                        |          |                 |           |
|--------------------------|------------------------|----------|-----------------|-----------|
| Client                   | RPS Milton Keynes HSED |          | Certificate No. | WK15-5793 |
|                          |                        |          | Issue No.       | 1         |
| Sample No.               | 854444                 | 121770   | Method          |           |
| Total particulate matter |                        | <0.04 mg | D8(U)           |           |
| Sample No.               | 854445                 | 30008669 | Method          |           |
| Total particulate matter |                        | <0.5 mg  | D8(U)           |           |

Tested By Simon Doodson Date 21/10/2015

Approved By  Date 21/10/2015

Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

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Test Certificate

Date 21/10/2015

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|-------------|---|-----------------|---------------|
| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216    |
|             |   | Certificate No. | WK15-5795     |
|             |   | Issue No.       | 1             |
| Contact     | Richard Harvey  | Date Received   | 13/10/2015    |
| Description | 5 solutions for formaldehyde  | Technique       | Wet Chemistry |

| Sample No.   | 854446     | 30008573 | Method  |
|--------------|------------|----------|---------|
| Formaldehyde | <0.1 µg/ml | 270 ml   | M103(U) |
| Sample No.   | 854447     | 30008574 | Method  |
| Formaldehyde | <0.1 µg/ml | 256 ml   | M103(U) |
| Sample No.   | 854448     | 30008575 | Method  |
| Formaldehyde | 0.2 µg/ml  | 186 ml   | M103(U) |
| Sample No.   | 854449     | 30008577 | Method  |
| Formaldehyde | 0.1 µg/ml  | 375 ml   | M103(U) |
| Sample No.   | 854450     | 30008579 | Method  |
| Formaldehyde | 0.1 µg/ml  | 381 ml   | M103(U) |

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|---|---|-----------|------------|
| Client  | RPS Milton Keynes HSED  |           |            |
|   | Certificate No.   | WK15-5795 |            |
|   | Issue No.   | 1         |            |
| Tested By   | Lora McKerracher  | Date      | 20/10/2015 |
| Approved By   |  | Date      | 21/10/2015 |
|   | Joanne Dewhurst<br>Operational Manager  |           |            |
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Test Certificate

Date 22/10/2015

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|             |   | Certificate No. | WK15-5794  |
|             |   | Issue No.       | 1          |
| Contact     | Richard Harvey  | Date Received   | 13/10/2015 |
| Description | 4 tubes for phenol  | Technique       | GC-FID     |

| Sample No. | 854486 | 5911200322 | Method |
|------------|--------|------------|--------|
| Phenol     | <5 µg  |            | P1(U)  |
| Sample No. | 854487 | 5911200321 | Method |
| Phenol     | <5 µg  |            | P1(U)  |
| Sample No. | 854488 | 5911200320 | Method |
| Phenol     | <5 µg  |            | P1(U)  |
| Sample No. | 854489 | 5911200325 | Method |
| Phenol     | <5 µg  |            | P1(U)  |

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| Client | RPS Milton Keynes HSED | Certificate No. | WK15-5794 |
|        |                        | Issue No.       | 1         |

|           |              |      |            |
|-----------|--------------|------|------------|
| Tested By | Jane Damerum | Date | 22/10/2015 |
|-----------|--------------|------|------------|

|             |   |      |            |
|-------------|---|------|------------|
| Approved By |  | Date | 22/10/2015 |
|             | Joanne Dewhurst<br>Operational Manager  |      |            |

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Date 21/10/2015

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| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216 |
|             |   | Certificate No. | WK15-5771  |
|             |   | Issue No.       | 1          |
| Contact     | Edwin Powell  | Date Received   | 13/10/2015 |
| Description | 4 tubes for amines screen   | Technique       | IC         |

|            |        |              |        |
|------------|--------|--------------|--------|
| Sample No. | 854311 | 5897109914 F | Method |
|------------|--------|--------------|--------|

|                |       |
|----------------|-------|
| Amine Suite    | A1(U) |
| Diethylamine   | <1 µg |
| Dimethylamine  | <1 µg |
| Ethanolamine   | <1 µg |
| Methylamine    | <1 µg |
| Trimethylamine | <1 µg |

|            |        |            |        |
|------------|--------|------------|--------|
| Sample No. | 854312 | 5897109917 | Method |
|------------|--------|------------|--------|

|                |       |
|----------------|-------|
| Amine Suite    | A1(U) |
| Diethylamine   | <1 µg |
| Dimethylamine  | <1 µg |
| Ethanolamine   | <1 µg |
| Methylamine    | <1 µg |
| Trimethylamine | <1 µg |

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Date 21/10/2016

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|--------|------------------------|-----------------|-----------|
| Client | RPS Milton Keynes HSED | Certificate No. | WK15-6771 |
|        |                        | Issue No.       | 1         |

|            |        |              |        |
|------------|--------|--------------|--------|
| Sample No. | 854313 | 5897109916 F | Method |
|------------|--------|--------------|--------|

|             |       |
|-------------|-------|
| Amine Suite | A1(U) |
|-------------|-------|

Diethylamine

<1 µg

Dimethylamine

<1 µg

Ethanolamine

<1 µg

Methylamine

<1 µg

Trimethylamine

<1 µg

|            |        |            |        |
|------------|--------|------------|--------|
| Sample No. | 854314 | 5897109937 | Method |
|------------|--------|------------|--------|

|             |       |
|-------------|-------|
| Amine Suite | A1(U) |
|-------------|-------|

Diethylamine

<1 µg

Dimethylamine

<1 µg

Ethanolamine

<1 µg

Methylamine

<1 µg

Trimethylamine

<1 µg

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|---|---|-----------|------------|
| Client  | RPS Milton Keynes HSED  |           |            |
|   | Certificate No.   | WK15-5771 |            |
|   | Issue No.   | 1         |            |
| Tested By   | Nicholas Lynch  | Date      | 20/10/2015 |
| Approved By   |  | Date      | 21/10/2015 |
|   | Joanne Dewhurst<br>Operational Manager  |           |            |
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| Method Symbols  | (U) Analysis is UKAS Accredited<br>(N) Analysis is not UKAS Accredited            |           |            |
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Test Certificate

Date 21/10/2015

|             |   |                 |                   |
|-------------|---|-----------------|-------------------|
| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216        |
|             |   | Certificate No. | WK15-5768         |
|             |   | Issue No.       | 1                 |
| Contact     | Edwin Powell  | Date Received   | 13/10/2015        |
| Description | 6 filters & 6 washes for TPM  | Technique       | Gravimetric Stack |

| Sample No.               | 126242   | Method |
|--------------------------|----------|--------|
| Total particulate matter | 0.21 mg  | D8(U)  |
| Sample No.               | 30008741 | Method |
| Total particulate matter | <0.5 mg  | D8(U)  |
| Sample No.               | 126239   | Method |
| Total particulate matter | 57.78 mg | D8(U)  |
| Sample No.               | 30008742 | Method |
| Total particulate matter | <0.5 mg  | D8(U)  |
| Sample No.               | 126247   | Method |
| Total particulate matter | 0.26 mg  | D8(U)  |
| Sample No.               | 30008724 | Method |
| Total particulate matter | <0.5 mg  | D8(U)  |
| Sample No.               | 126236   | Method |
| Total particulate matter | 22.57 mg | D8(U)  |
| Sample No.               | 30008725 | Method |
| Total particulate matter | 0.54 mg  | D8(U)  |

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Test Certificate

Date 21/10/2015

|                          |                        |          |                 |           |
|--------------------------|------------------------|----------|-----------------|-----------|
| Client                   | RPS Milton Keynes HSED |          | Certificate No. | WK15-5768 |
|                          |                        |          | Issue No.       | 1         |
| Sample No.               | 854291                 | 126261   | Method          |           |
| Total particulate matter | 30.28 mg               |          | D9(U)           |           |
| Sample No.               | 854292                 | 30008726 | Method          |           |
| Total particulate matter | 0.54 mg                |          | D9(U)           |           |
| Sample No.               | 854293                 | 126999   | Method          |           |
| Total particulate matter | 26.31 mg               |          | D9(U)           |           |
| Sample No.               | 854294                 | 30008727 | Method          |           |
| Total particulate matter | <0.5 mg                |          | D9(U)           |           |

Tested By Simon Doodson Date 21/10/2015

Approved By  Date 21/10/2015

Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

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(N) Analysis is not UKAS Accredited

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Test Certificate

Date 21/10/2015

Client RPS Milton Keynes HSED  
Noble House  
Capital Drive  
Linford Wood  
Milton Keynes  
MK14 6QP

Order No. FTBS 35216  
Certificate No. WK18-5769  
Issue No. 1

Contact Edwin Powell  
Description 8 solutions for NH3

Date Received 13/10/2016  
Technique IC Stack

| Parameter | Analysis Method | Accreditation | Method LOD | Uncertainty |
|-----------|-----------------|---------------|------------|-------------|
| Ammonia   | A6              | UKAS          | 0.1 µg/ml  | 8.00%       |

|            |             |          |        |
|------------|-------------|----------|--------|
| Sample No. | 854295      | 30008738 | Method |
| Ammonia    | 0.19 µg/ml  | 81 ml    | A6(U)  |
| Sample No. | 854296      | 30008739 | Method |
| Ammonia    | 11.6 µg/ml  | 57 ml    | A6(U)  |
| Sample No. | 854297      | 30008740 | Method |
| Ammonia    | 3.93 µg/ml  | 30 ml    | A6(U)  |
| Sample No. | 854298      | 30008728 | Method |
| Ammonia    | <0.10 µg/ml | 91 ml    | A6(U)  |
| Sample No. | 854299      | 30008729 | Method |
| Ammonia    | 15.9 µg/ml  | 62 ml    | A6(U)  |
| Sample No. | 854300      | 30008730 | Method |
| Ammonia    | 0.37 µg/ml  | 36 ml    | A6(U)  |
| Sample No. | 854301      | 30008734 | Method |
| Ammonia    | 19.8 µg/ml  | 87 ml    | A6(U)  |

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Test Certificate

Date 21/10/2015

|            |                        |          |                 |           |
|------------|------------------------|----------|-----------------|-----------|
| Client     | RPS Milton Keynes HSED |          | Certificate No. | WK18-5769 |
|            |                        |          | Issue No.       | 1         |
| Sample No. | 854316                 | 30008736 | Method          |           |
| Ammonia    | 31.8 µg/ml             | 82 ml    | A6(U)           |           |

Tested By Nicholas Lynch Date 19/10/2015

Approved By  Date 21/10/2015

Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

Method Symbols (U) Analysis is UKAS Accredited  
(N) Analysis is not UKAS Accredited

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Test Certificate

Date 21/10/2015

|             |   |                 |               |
|-------------|---|-----------------|---------------|
| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216    |
|             |   | Certificate No. | WK15-5772     |
|             |   | Issue No.       | 1             |
| Contact     | Edwin Powell  | Date Received   | 13/10/2015    |
| Description | 5 water samples for formaldehyde  | Technique       | Wet Chemistry |

| Sample No.   | 854318     | 30008731 | Method  |
|--------------|------------|----------|---------|
| Formaldehyde | <0.1 µg/ml | 280 ml   | M103(U) |
| Sample No.   | 854319     | 30008732 | Method  |
| Formaldehyde | 12.7 µg/ml | 330 ml   | M103(U) |
| Sample No.   | 854320     | 30008733 | Method  |
| Formaldehyde | 1.2 µg/ml  | 183 ml   | M103(U) |
| Sample No.   | 854321     | 30008735 | Method  |
| Formaldehyde | 10.8 µg/ml | 499 ml   | M103(U) |
| Sample No.   | 854322     | 30008737 | Method  |
| Formaldehyde | 10.8 µg/ml | 479 ml   | M103(U) |

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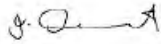


Test Certificate

Date 21/10/2015

|        |                        |                 |           |
|--------|------------------------|-----------------|-----------|
| Client | RPS Milton Keynes HSED | Certificate No. | WK15-5772 |
|        |                        | Issue No.       | 1         |

|           |                  |      |            |
|-----------|------------------|------|------------|
| Tested By | Lora McKerracher | Date | 20/10/2015 |
|-----------|------------------|------|------------|

|             |   |      |            |
|-------------|---|------|------------|
| Approved By |  | Date | 21/10/2015 |
|             | Joanne Dewhurst<br>Operational Manager  |      |            |

For and on authority of RPS Laboratories Ltd.

Method Symbols (U) Analysis is UKAS Accredited  
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Test Certificate

Date 22/10/2015

|        |   |                 |            |
|--------|---|-----------------|------------|
| Client | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216 |
|        |   | Certificate No. | WK15-5773  |
|        |   | Issue No.       | 1          |

|             |                                    |               |            |
|-------------|------------------------------------|---------------|------------|
| Contact     | Edwin Powell                       | Date Received | 13/10/2015 |
| Description | 6 x 226-96 tubes for phenol screen | Technique     | GC-FID     |

|            |        |              |        |
|------------|--------|--------------|--------|
| Sample No. | 854306 | 5911200342 F | Method |
|------------|--------|--------------|--------|

Phenol screen P1(U)

|             |       |
|-------------|-------|
| m,p- Cresol | <5 µg |
| m,p-Xylenol | <5 µg |
| o-Cresol    | <5 µg |
| o-Xylenol   | <5 µg |
| Phenol      | <5 µg |

|            |        |            |        |
|------------|--------|------------|--------|
| Sample No. | 854306 | 5911200340 | Method |
|------------|--------|------------|--------|

Phenol screen P1(U)

|             |       |
|-------------|-------|
| m,p- Cresol | <5 µg |
| m,p-Xylenol | <5 µg |
| o-Cresol    | <5 µg |
| o-Xylenol   | <5 µg |
| Phenol      | <5 µg |

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Test Certificate

Date 22/10/2016

|  |                        |              |                 |           |
|--|------------------------|--------------|-----------------|-----------|
| Client                                 | RPS Milton Keynes HSED |              | Certificate No. | WK15-5773 |
|  |                        |              | Issue No.       | 1         |
| Sample No.                             | 864307                 | 5911200341 F | Method          |           |
| Phenol screen                          |                        |              | P1(U)           |           |
| m,p- Cresol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| m,p-Xylenol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Cresol                               |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Xylenol                              |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| Phenol                                 |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| Sample No.                             | 864308                 | 5911200344 F | Method          |           |
| Phenol screen                          |                        |              | P1(U)           |           |
| m,p- Cresol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| m,p-Xylenol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Cresol                               |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Xylenol                              |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| Phenol                                 |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |

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Test Certificate

Date 22/10/2016

|  |                        |              |                 |           |
|--|------------------------|--------------|-----------------|-----------|
| Client                                 | RPS Milton Keynes HSED |              | Certificate No. | WK16-5773 |
|  |                        |              | Issue No.       | 1         |
| Sample No.                             | 854309                 | 5911200347 F | Method          |           |
| Phenol screen                          |                        |              | P1(U)           |           |
| m,p- Cresol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| m,p-Xylenol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Cresol                               |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Xylenol                              |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| Phenol                                 |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| Sample No.                             | 854310                 | 5911200339 F | Method          |           |
| Phenol screen                          |                        |              | P1(U)           |           |
| m,p- Cresol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| m,p-Xylenol                            |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Cresol                               |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| o-Xylenol                              |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |
| Phenol                                 |                        |              |                 |           |
| <input type="text" value=" &lt;5 µg"/> |                        |              |                 |           |

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Test Certificate

Date 22/10/2015

|        |                        |                 |           |
|--------|------------------------|-----------------|-----------|
| Client | RPS Milton Keynes HSED | Certificate No. | WK15-5773 |
|        |                        | Issue No.       | 1         |

|           |              |      |            |
|-----------|--------------|------|------------|
| Tested By | Jane Damerum | Date | 22/10/2015 |
|-----------|--------------|------|------------|

|             |   |      |            |
|-------------|---|------|------------|
| Approved By |  | Date | 22/10/2015 |
|             | Joanne Dewhurst<br>Operational Manager  |      |            |

For and on authority of RPS Laboratories Ltd.

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Test Certificate

Date 21/10/2015

|        |   |                 |            |
|--------|---|-----------------|------------|
| Client | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216 |
|        |   | Certificate No. | WK15-5767  |
|        |   | Issue No.       | 1          |

|             |                                    |               |            |
|-------------|------------------------------------|---------------|------------|
| Contact     | Edwin Powell                       | Date Received | 13/10/2015 |
| Description | 3 solutions for HCL & formaldehyde | Technique     | IC Stack   |

| Sample No.        | 854302     | 30008743 | Method  |
|-------------------|------------|----------|---------|
| Hydrochloric acid | 0.09 µg/ml | 63 ml    | C27(U)  |
| Formaldehyde      | <0.1 µg/ml |          | M103(U) |
| Sample No.        | 854303     | 30008744 | Method  |
| Hydrochloric acid | 0.09 µg/ml | 48 ml    | C27(U)  |
| Formaldehyde      | 0.1 µg/ml  |          | M103(U) |
| Sample No.        | 854304     | 30008745 | Method  |
| Hydrochloric acid | 0.09 µg/ml | 24 ml    | C27(U)  |
| Formaldehyde      | <0.1 µg/ml |          | M103(U) |

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Test Certificate

Date 21/10/2015

|   |   |           |            |
|---|---|-----------|------------|
| Client  | RPS Milton Keynes HSED  |           |            |
|   | Certificate No.   | WK15-5767 |            |
|   | Issue No.   | 1         |            |
| Tested By   | Nicholas Lynch  | Date      | 19/10/2015 |
|   | Lora McKerracher  | Date      | 20/10/2015 |
| Approved By   |  | Date      | 21/10/2015 |
|   | Joanne Dewhurst<br>Operational Manager  |           |            |
| For and on authority of RPS Laboratories Ltd.   |   |           |            |
| Method Symbols  | (U) Analysis is UKAS Accredited<br>(N) Analysis is not UKAS Accredited            |           |            |
| Concentration values (mg/m <sup>3</sup> and ppm) are calculated on the basis of information provided by the customer.<br>Results stated as ml are referring to the sample volume. |   |           |            |
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Test Certificate

Date 21/10/2015

|             |   |                 |            |
|-------------|---|-----------------|------------|
| Client      | RPS Milton Keynes HSED<br>Noble House<br>Capital Drive<br>Linford Wood<br>Milton Keynes<br>MK14 6QP | Order No.       | FTBS 35216 |
|             |   | Certificate No. | WK15-5770  |
|             |   | Issue No.       | 1          |
| Contact     | Edwin Powell  | Date Received   | 13/10/2015 |
| Description | 2 silica gel tubes for formaldehyde   | Technique       | HPLC       |

| Sample No.   | 854316  | 5816303763 F | Method |
|--------------|---------|--------------|--------|
| Formaldehyde | 2.7 µg  |              | A40(U) |
| Sample No.   | 854317  | 5816303765 F | Method |
| Formaldehyde | <0.1 µg |              | A40(U) |

Tested By Nicholas Lynch Date 21/10/2015

Approved By  Date 21/10/2015

Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

Method Symbols (U) Analysis is UKAS Accredited  
(N) Analysis is not UKAS Accredited

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Test Certificate

Date 07/12/2015

Client RPS Milton Keynes HSED  
Noble House  
Capital Drive  
Linford Wood  
Milton Keynes  
MK14 6QP

Order No. FTBS 35216  
Certificate No. WK15-7030  
Issue No. 1

Contact Edwin Powell  
Description 5 solutions for NH3

Date Received 04/12/2016  
Technique IC

| Parameter | Analysis Method | Accreditation | Method LOD | Uncertainty |
|-----------|-----------------|---------------|------------|-------------|
| Ammonia   | A6              | UKAS          | 0.1 µg/ml  | 8.00%       |

|            |            |          |        |
|------------|------------|----------|--------|
| Sample No. | 861101     | 30008872 | Method |
| Ammonia    | <0.1 µg/ml | 84 ml    | A6(U)  |
| Sample No. | 861102     | 30008868 | Method |
| Ammonia    | 2.1 µg/ml  | 85 ml    | A6(U)  |
| Sample No. | 861103     | 30008869 | Method |
| Ammonia    | 0.42 µg/ml | 32 ml    | A6(U)  |
| Sample No. | 861104     | 30008870 | Method |
| Ammonia    | 1.4 µg/ml  | 102 ml   | A6(U)  |
| Sample No. | 861106     | 30008871 | Method |
| Ammonia    | 1.7 µg/ml  | 98 ml    | A6(U)  |

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Test Certificate

Date 07/12/2015

|        |                        |                 |           |
|--------|------------------------|-----------------|-----------|
| Client | RPS Milton Keynes HSED | Certificate No. | WK15-7030 |
|        |                        | Issue No.       | 1         |

|           |                  |      |            |
|-----------|------------------|------|------------|
| Tested By | Lora McKerracher | Date | 04/12/2015 |
|           | Joanne Dewhurst  |      |            |

|             |   |      |            |
|-------------|---|------|------------|
| Approved By |  | Date | 07/12/2015 |
|-------------|---|------|------------|

Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

|                |     |                                 |
|----------------|-----|---------------------------------|
| Method Symbols | (U) | Analysis is UKAS Accredited     |
|                | (N) | Analysis is not UKAS Accredited |

Concentration values (mg/m<sup>3</sup> and ppm) are calculated on the basis of information provided by the customer.  
Results stated as ml are referring to the sample volume

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Test Certificate

Date 07/12/2015

Client RPS Milton Keynes HSED  
Noble House  
Capital Drive  
Linford Wood  
Milton Keynes  
MK14 6QP

Order No. FTBS 35216  
Certificate No. WK15-7031  
Issue No. 1

Contact Edwin Powell  
Description 3 tubes for NH3

Date Received 04/12/2016  
Technique IC

| Parameter | Analysis Method | Accreditation | Method LOD | Uncertainty |
|-----------|-----------------|---------------|------------|-------------|
| Ammonia   | A6              | UKAS          | 0.2 µg     | 5.50%       |

|            |         |            |        |
|------------|---------|------------|--------|
| Sample No. | 861106  | 5685601358 | Method |
| Ammonia    | <0.2 µg |            | A6(U)  |
| Sample No. | 861107  | 5685601362 | Method |
| Ammonia    | <0.2 µg |            | A6(U)  |
| Sample No. | 861108  | 5685601360 | Method |
| Ammonia    | <0.2 µg |            | A6(U)  |

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Test Certificate

Date 07/12/2015

|        |                        |                 |           |
|--------|------------------------|-----------------|-----------|
| Client | RPS Milton Keynes HSED | Certificate No. | WK16-7031 |
|        |                        | Issue No.       | 1         |

|           |                  |      |            |
|-----------|------------------|------|------------|
| Tested By | Lora McKerracher | Date | 04/12/2015 |
|-----------|------------------|------|------------|

|             |   |      |            |
|-------------|---|------|------------|
| Approved By |  | Date | 07/12/2015 |
|-------------|---|------|------------|

Joanne Dewhurst  
Operational Manager

For and on authority of RPS Laboratories Ltd.

|                |     |                                 |
|----------------|-----|---------------------------------|
| Method Symbols | (U) | Analysis is UKAS Accredited     |
|                | (N) | Analysis is not UKAS Accredited |

Concentration values (mg/m<sup>3</sup> and ppm) are calculated on the basis of information provided by the customer.  
Results stated as ml are referring to the sample volume

Analysis carried out on samples 'as received'

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