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**Client : SCOTIA GAS NETWORKS**

**Project Title : MEASUREMENT ERROR REPORT**

**Document Title : MER SE005 FARNINGHAM B OFFTAKE**

**Document Ref. : NK3191G – 001**

**Client Ref. : PO 1615056585**

REV	ISSUE DATE	DESCRIPTION	PREP. BY	APP. BY
1	25/11/15	Issue for Comment	BK	KV
2	02/12/15	Final	BK	KV

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## 1.0 EXECUTIVE SUMMARY

<b>Site Name</b>	<b>Farningham B Offtake</b>
<b>DNO</b>	Scotia Gas Networks
<b>LDZ</b>	South East
<b>Error Start Date</b>	26 <sup>th</sup> June 2015
<b>(Or) Last Good Date</b>	
<b>Error Corrected Date</b>	25 <sup>th</sup> September 2015
<b>Size of Error (over or under read)</b>	1.25 % over-registration (693,931 scm; approx. 7.7 GWh)
<b>Error Description</b>	Incorrect K-factor used in flow computer
<b>Methodology</b>	Correction of volumes using correct K-factor
<b>Meter Type</b>	Ultrasonic
<b>MER Unique Reference Number</b>	SE005

## 2.0 ERROR DESCRIPTION

Farningham B Offtake has two ultrasonic meter streams with a gas chromatograph for determination of density and CV. The flow computer uses interpolation between pairs of frequency and K-factor points to correct for errors found during the calibration of the ultrasonic meter. On 26<sup>th</sup> June 2015 one of the Stream 1 K-factor entries in the flow computer was changed from 719.352 pulses/m<sup>3</sup> to an incorrect value of 619.352 pulses/m<sup>3</sup>. The flow computer interpolation points are shown in Table 1 with both the correct and incorrect Stream 1 K-factor values.

<b>Frequency (Hz)</b>	<b>Correct K-factor (pls/m<sup>3</sup>)</b>	<b>Incorrect K-factor (pls/m<sup>3</sup>)</b>
150.4	719.352	<b>619.352</b>
299.8	719.712	719.712
754.4	719.424	719.424
1198.0	718.776	718.776
2198.2	718.776	718.776
3009.4	718.344	718.344

**Table 1 – Flow computer interpolation points**

## 3.0 METHODOLOGY

The flows recorded with a frequency below 299.8 Hz were in error during the period. Correct K-factors were recalculated for these points using interpolation. The flow rates, recorded on a 4-minutely basis, were integrated to give a daily volume. Two sets of calculations were made, one using the recorded flow rates and another using corrected flow rates, the error being the difference between the two.

### 3.1 Gemini Discrepancies

The daily volumes calculated from the recorded data were compared to the Gemini billed volumes to establish significant discrepancies between the results. There were discrepancies between 29<sup>th</sup> June and 2<sup>nd</sup> July 2015; on 1<sup>st</sup>, 15<sup>th</sup> and 24<sup>th</sup> August 2015; and on 24<sup>th</sup> September 2015.

**29<sup>th</sup> June 2015:** There is a break in the HPMIS data capture between ~0800 and ~0830 each day where the gas chromatograph runs through a daily auto-calibration sequence. The flow started at some point during this calibration period and was not captured until 0827 leading to the discrepancy of ~10% between HPMIS recalculated volume and Gemini volume on this day. It is not possible to reconstitute this period accurately however it will not have a significant impact on the reported measurement error.

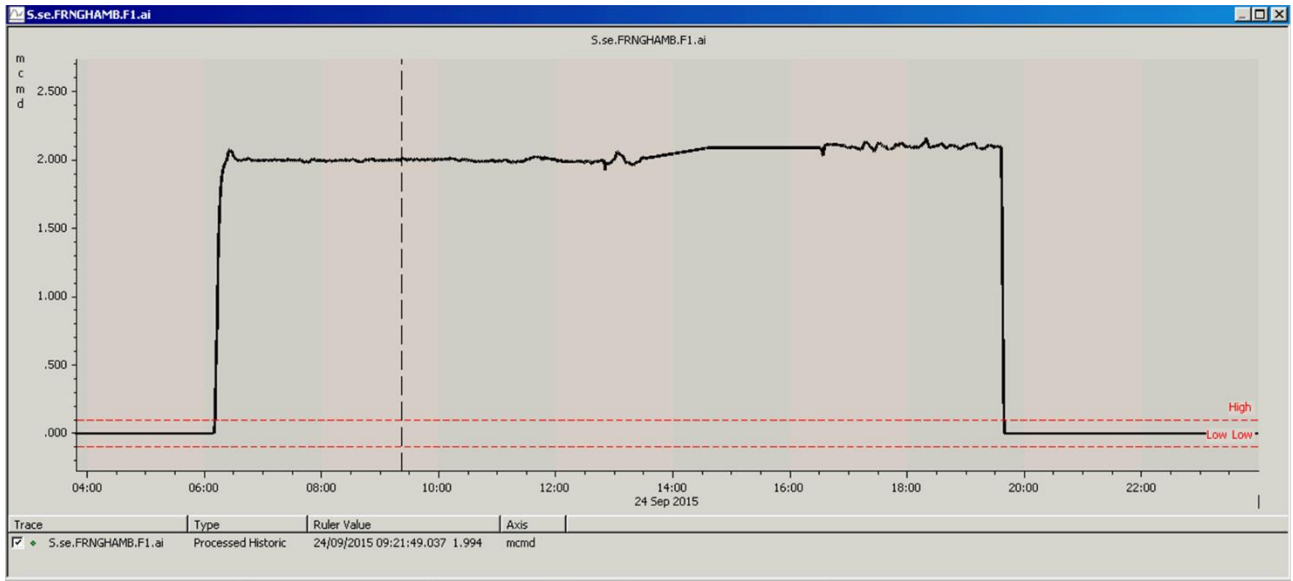
**30<sup>th</sup> June to 2<sup>nd</sup> July 2015:** No flow was indicated in the HPMIS data on these days leading to a 100% discrepancy between HPMIS recalculated volume and Gemini volume. Stream 1 was closed and Stream 2 was open on these days and the flows appear to be calculated and registered correctly through telemetry, however the frequency and K-factor values were not captured in the HPMIS data. The Stream 2 K-factors were correct throughout and therefore no error occurred on these days.

**1<sup>st</sup>, 15<sup>th</sup> and 24<sup>th</sup> August 2015:** Very small volumes were recorded on each of these days. The 4-minute resolution of the HPMIS data can lead to discrepancies when flowing for only short periods as in these cases. It is likely that the flow rate was in the low region (below 150 Hz). In this region the error was constant (16.15%) and therefore a daily correction factor of 0.860986 is applicable.

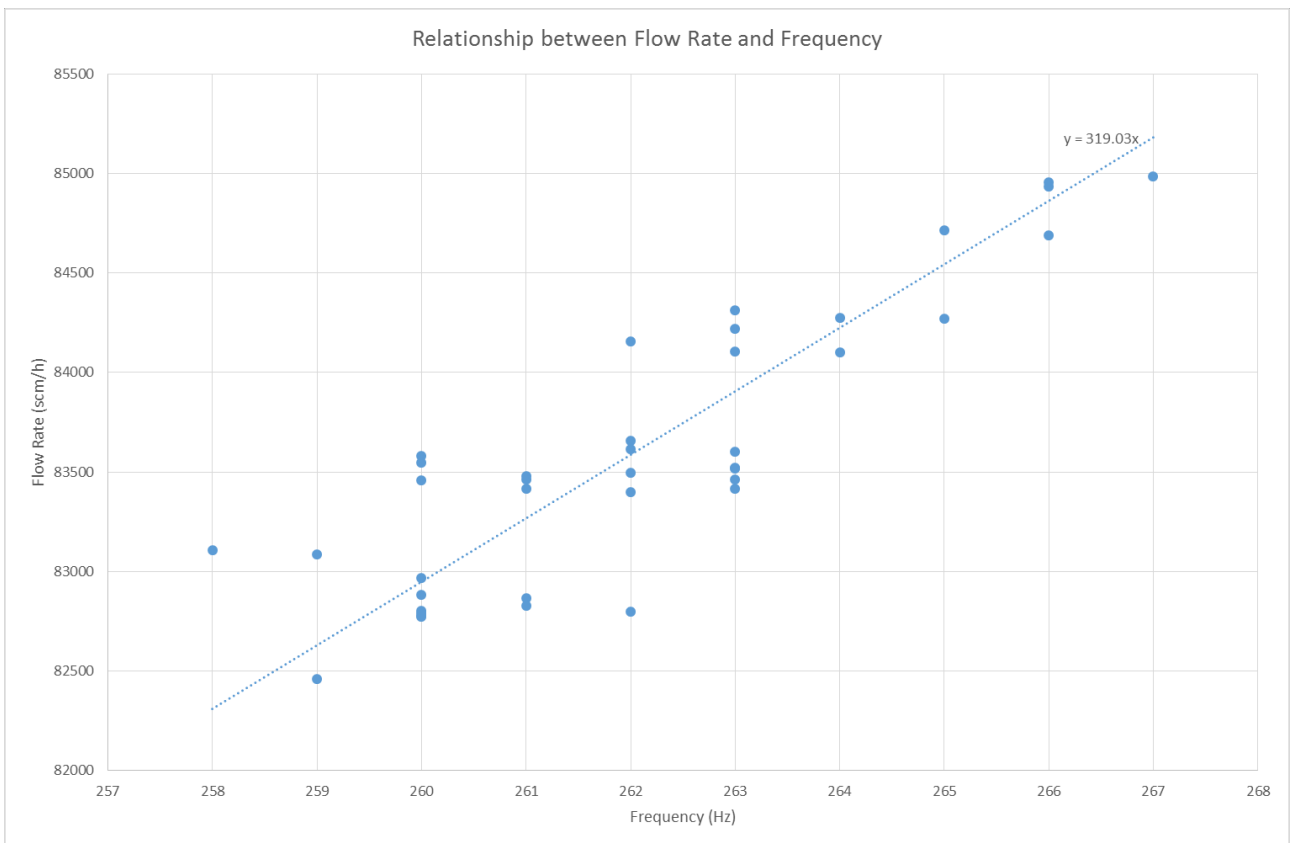
**24<sup>th</sup> September 2015:** No HPMIS data exists for this gas day. The telemetry data (refer to Figure 1) for this day indicates that the site was being controlled to a setpoint of 2 Mscm/d (83,333 scm/h). Using data from the 25<sup>th</sup> September the flow rate was estimated to equate to a frequency of 261 Hz (refer to Figure 2) and error of 4.1932%. The incorrect K-factor was corrected at 1pm at which point the recorded Dvol was 0.564 Mscm.

The daily error was calculated as 4.1932% of 0.564 Mscm = 23649.648 scm

The Gemini daily volume was 1.3151 Mscm and therefore the daily correction factor is 0.982017.



**Figure 1 - Telemetry data for 24th September 2015**



**Figure 2 - Relationship between Flow Rate and Frequency (for 25th September 2015)**

#### ***4.0 ERROR QUANTIFICATION***

The error is calculated to be an over-registration of 1.25 % for the period. The error should be corrected using the daily correction factors in Appendix A.

#### ***5.0 REFERENCES***

HPMIS Database

DNCC Telemetry data

Omni Flow Computer Configuration Prints:

OMNI CFGR 9.4. 2015.txt

OMNI CFGR Jul 02 2015 163732.txt

OMNI CFGR 25.9.2015.txt

NMi Calibration Certificate 10500668.1000.1/R1 (for Ultrasonic Meter s/n 10018697)

MER\_SE005\_Data.xlsx – Calculation spreadsheet

**APPENDIX A – DAILY CORRECTION FACTORS**

The days on which discrepancies were found between HPMIS recalculated volumes and Gemini volumes are marked with ‘\*’, see section 3.1 for details.

Gas Date	Daily Correction Factor
26-Jun-15	0.999789
27-Jun-15	1.000000
28-Jun-15	1.000000
29-Jun-15*	0.995262
30-Jun-15*	1.000000
01-Jul-15*	1.000000
02-Jul-15*	1.000000
03-Jul-15	1.000000
04-Jul-15	1.000000
05-Jul-15	1.000000
06-Jul-15	1.000000
07-Jul-15	0.990246
08-Jul-15	1.000000
09-Jul-15	1.000000
10-Jul-15	1.000000
11-Jul-15	1.000000
12-Jul-15	1.000000
13-Jul-15	1.000000
14-Jul-15	1.000000
15-Jul-15	1.000000
16-Jul-15	1.000000
17-Jul-15	1.000000
18-Jul-15	1.000000
19-Jul-15	1.000000
20-Jul-15	1.000000
21-Jul-15	1.000000
22-Jul-15	1.000000
23-Jul-15	1.000000
24-Jul-15	1.000000
25-Jul-15	1.000000
26-Jul-15	1.000000
27-Jul-15	1.000000
28-Jul-15	1.000000
29-Jul-15	1.000000
30-Jul-15	1.000000
31-Jul-15	1.000000
01-Aug-15*	0.860986
02-Aug-15	0.978753

Gas Date	Daily Correction Factor
03-Aug-15	0.967960
04-Aug-15	0.985625
05-Aug-15	0.993083
06-Aug-15	0.954505
07-Aug-15	0.993644
08-Aug-15	0.993158
09-Aug-15	0.991391
10-Aug-15	0.999896
11-Aug-15	0.997511
12-Aug-15	0.997529
13-Aug-15	0.996520
14-Aug-15	0.999389
15-Aug-15*	0.860986
16-Aug-15	1.000000
17-Aug-15	1.000000
18-Aug-15	1.000000
19-Aug-15	1.000000
20-Aug-15	1.000000
21-Aug-15	0.996535
22-Aug-15	0.963880
23-Aug-15	0.974827
24-Aug-15*	0.860986
25-Aug-15	1.000000
26-Aug-15	1.000000
27-Aug-15	1.000000
28-Aug-15	1.000000
29-Aug-15	1.000000
30-Aug-15	0.996827
31-Aug-15	0.999972
01-Sep-15	1.000000
02-Sep-15	1.000000
03-Sep-15	1.000000
04-Sep-15	1.000000
05-Sep-15	1.000000
06-Sep-15	1.000000
07-Sep-15	1.000000
08-Sep-15	1.000000
09-Sep-15	1.000000

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<b>Gas Date</b>	<b>Daily Correction Factor</b>
10-Sep-15	1.000000
11-Sep-15	1.000000
12-Sep-15	1.000000
13-Sep-15	1.000000
14-Sep-15	1.000000
15-Sep-15	1.000000
16-Sep-15	0.996170
17-Sep-15	0.977664
18-Sep-15	0.971484
19-Sep-15	0.958276
20-Sep-15	0.967977
21-Sep-15	0.978694
22-Sep-15	0.998840
23-Sep-15	0.999495
24-Sep-15*	0.982017