GL Noble Denton

Report Number: 14453 *26 September 2013*

Summary Report for Aberdeen SMER SC006

Not Restricted

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Amendment details

Issue	Description of Amendment	Originator/Author
1.0	Original	B Kirkman

Report approval

Issue	Checked by	Approved by	Date
1.0	K Vugler (Kelton)	K Vugler (Kelton)	26 September 2013

Previous issues of this document shall be destroyed or marked SUPERSEDED

Report Number: 14453
Issue: 1.0

Project Code: 1/18274

Distribution

Name	Company
Steve Howells	Scotia Gas Networks 2 Leesons Hill Orpington Kent BR5 2TN

Executive Summary

Site name	Aberdeen Offtake
DNO	Scotland Gas Networks
LDZ	Scotland
Error start date	21st July 2009 (16:03)
Error corrected date	10th August 2010 (13:10)
Size of error (over or under read)	1,603 GWh under-registration
Error description	Following an orifice plate change the new plate was not lowered fully into the pipe. This resulted in a reduction in differential pressure and hence an under-registration of flow.
Meter type	Orifice Plate
SMER Unique Reference No	SC006
Compiled by	Ben Kirkman (GL Noble Denton) & Keith Vugler (Kelton)

Contents

1 Introduction

Following the notification that a Significant Measurement Error had occurred at Aberdeen Offtake, two Independent Technical Experts (ITEs) were appointed to produce individual Significant Measurement Error Reports (SMERs) in accordance with the Measurement Error Notification Guidelines[1].

The final individual SMER[2&3] from each ITE has been published on the Joint Office website after consideration of all Technical Measurement Issues that were raised.

A meeting was convened between the ITEs to review and discuss the findings from their individual SMERs along with a comparison of their individual SMERs.

This summary report identifies the material differences in the individual SMERs, considers the most appropriate use of data based on these differences and provides a single revised methodology and conclusion supported by both ITEs. References are made to the final individual SMERs by Kirkman [2] and Vugler [3] as appropriate.

2 Comparison of ITE Reports

The final individual SMERs produced by the ITEs are largely supportive of each other. The description of the error and presentation of evidence for the 99985 and 99950 counter readings is similar in both reports.

The interpretation of the test results showed some minor differences that have a small impact on the overall error. This was due to differences in the periods of flow data that were identified as being stable for a particular counter reading. The periods chosen were typically only one or two readings different (10 or 20 seconds in a few minutes) and the impact on the averaged flow was small. The ITEs reconsidered all the periods and agreed on the data to be used.

Some instability was encountered during the testing. The method of correction for instability (and hence the reference flow used) was different between the final individual SMERs (Refer to [2] section 2.5.1 and [3] section 5.4). After consideration of both methods it was decided that the most appropriate method was to compare the results for each counter reading against the relevant timeframe of a linear interpolation. The application of the revised methodology is detailed in section 4.1.1.

The methodologies differed slightly in their consideration of validity of results. One report excluded the 99950 counter reading results from tests 1, 9 and 11 based on comparison with the CFD analysis (Refer to [3] section 7.6). The other report excluded the 99950 counter reading results from tests 1, 6, 9 and 11 based on higher uncertainties at low differential pressures (DPs) and statistical analysis of standard deviations (Refer to [2] section 3). It was decided that whilst the 99950 counter reading result from test 6 was calculated using low DPs, it could be considered valid based on the agreement with the CFD analysis as it did not significantly affect the standard deviations. The application of the revised methodology is detailed in section 5.

The methodologies also differed in their treatment of the errors. One report stated that the error results were independent of process conditions (Refer to [2] figures 50 and 53), whilst the other identified that the errors varied with flow rate at the 99985 counter reading only (Refer to [3] section 9.2). The difference in approach was considered relevant and valid for the results presented in each final individual SMER. The results differed due to the method of correction for instability. It was decided that following revision of the results a statistical significance analysis would be carried out to determine whether or not the errors varied with flow rate. The application of the revised methodology is detailed in section 5.

3 Error Description

Refer to [2] section 1 and [3] section 3.

4 Methodology

A common methodology was used in the carrier checks, site testing and CFD analysis. The treatment of the results from the carrier checks and CFD analysis was also identical (Refer to [2] and [3]).

4.1.1 Calculation of Reference Flow

Over the duration of each test the flow rate was seen to drift slightly due to changes in downstream pressure. The downstream demand was around 2 Mscm/d, therefore the changes in downstream pressure were brought about by an imbalance between the supplied flow rate and the demand. This was most prevalent at the highest flow rates (i.e. where the difference between supply and demand was at it's the greatest). The flow rate drift was assumed to be linear over the duration of each test. An average of flow rates from a stable period at the 00000 counter reading was taken at the start and end of each test. A linear interpolation was carried out between these flow rates to produce the reference flow rate. The results for each counter reading were referenced to the corresponding period of reference flow rate as illustrated in Figure 1.

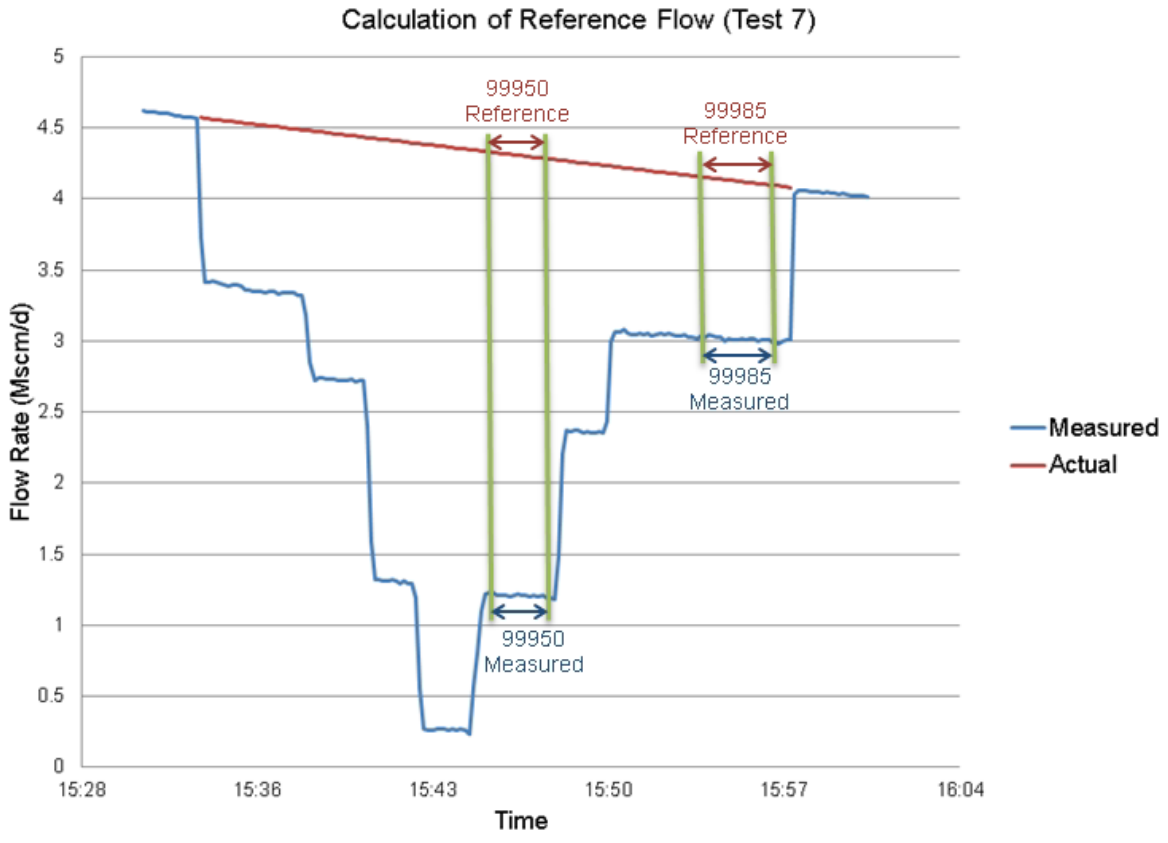

Figure 1 - Calculation of Reference Flow

Note: Test 7 is shown as this had the largest instability.

5 Error Quantification

Errors for the 99985 and 99950 counter readings from the on-site testing were recalculated based on the revised methodology. The results from the CFD analysis were used to produce equivalent error values for the various counter readings. The changes to the experimental results impacted on the CFD results because they were referenced to the experimental results.

Test	Error at 99985 (%)		Error at 99950 (%)	
	Experimental	CFD	Experimental	CFD
1	26.671%	25.051%	75.302%	70.448%
2	26.822%	26.389%	71.119%	70.896%
3	26.143%	26.985%	71.571%	71.305%
4	25.816%	25.839%	72.038%	70.645%
6	26.098%	25.130%	70.437%	69.994%
7	26.895%	27.660%	71.918%	71.559%
8	26.277%	25.851%	71.057%	70.776%
9	25.389%	24.642%	65.445%	69.672%
10	26.995%	26.087%	71.542%	70.950%
11	24.706%	24.474%	65.129%	69.491%

Table 1 - Flow Rate Errors at Counter Readings (Insertion)

Counter Reading	Experimental Error (%)		CFD Error (%)		Difference in Mean (% relative)
	Mean	Std. Dev.	Mean	Std. Dev.	
99985	26.181 %	0.728 %	25.811 %	1.022 %	-1.4 %
99950	70.556 %	3.068 %	70.574 %	0.678 %	0.0 %

Table 2 - Mean Flow Rate Error at Counter Readings (Insertion)

The correlation between all tests was good, as illustrated in Figure 2 and Figure 3. The combined results from the on-site testing and CFD analysis are shown in Figure 4 and summarised in Table 2. The mean values demonstrate good agreement between the on-site tests and the CFD analysis.

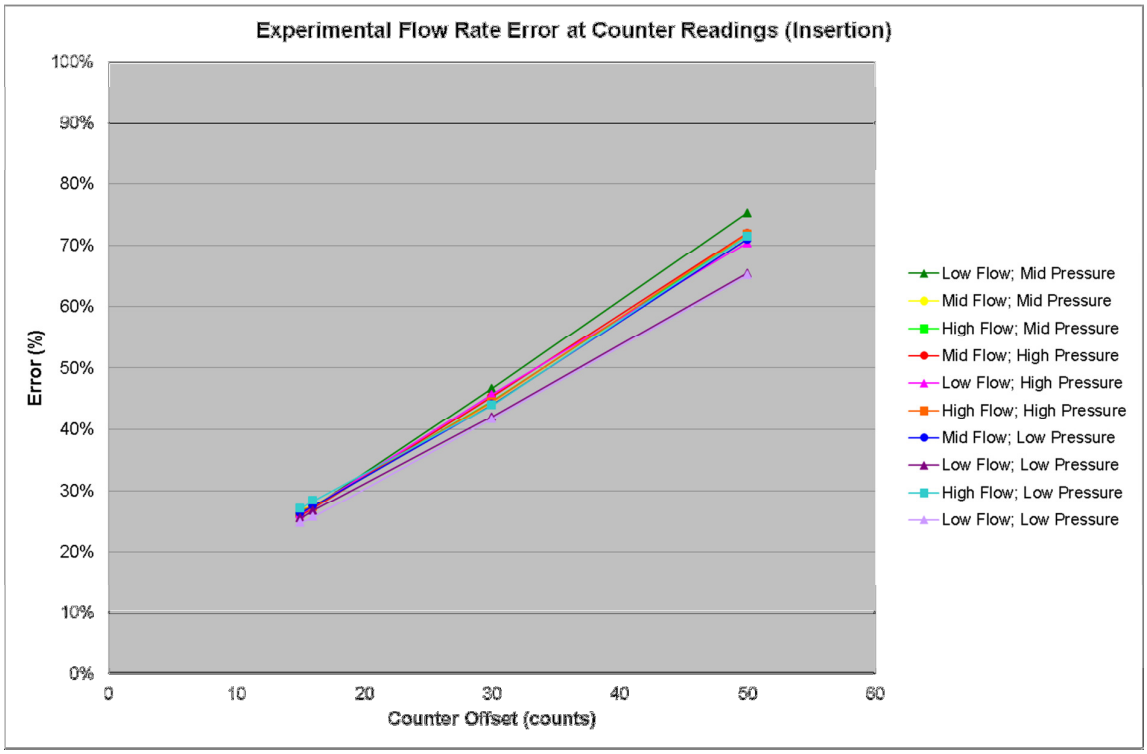

Figure 2 - Experimental Flow Rate Error at Counter Readings (Insertion)

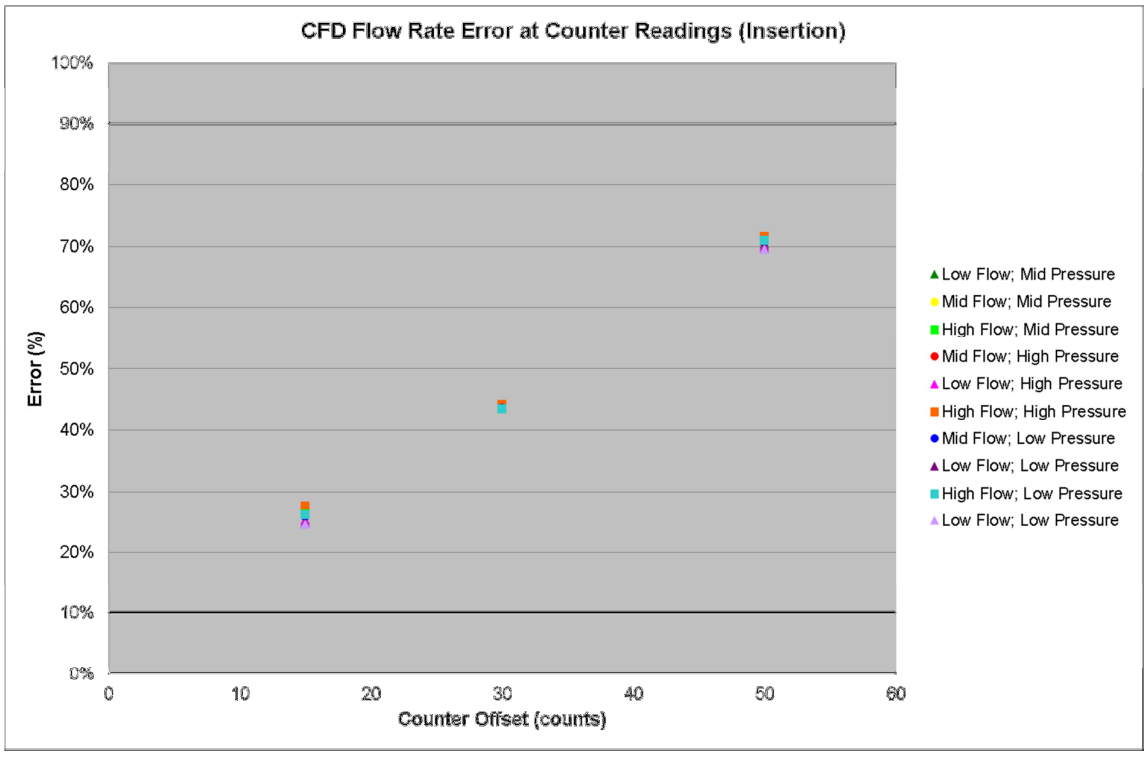

Figure 3 - CFD Flow Rate Error at Counter Readings (Insertion)

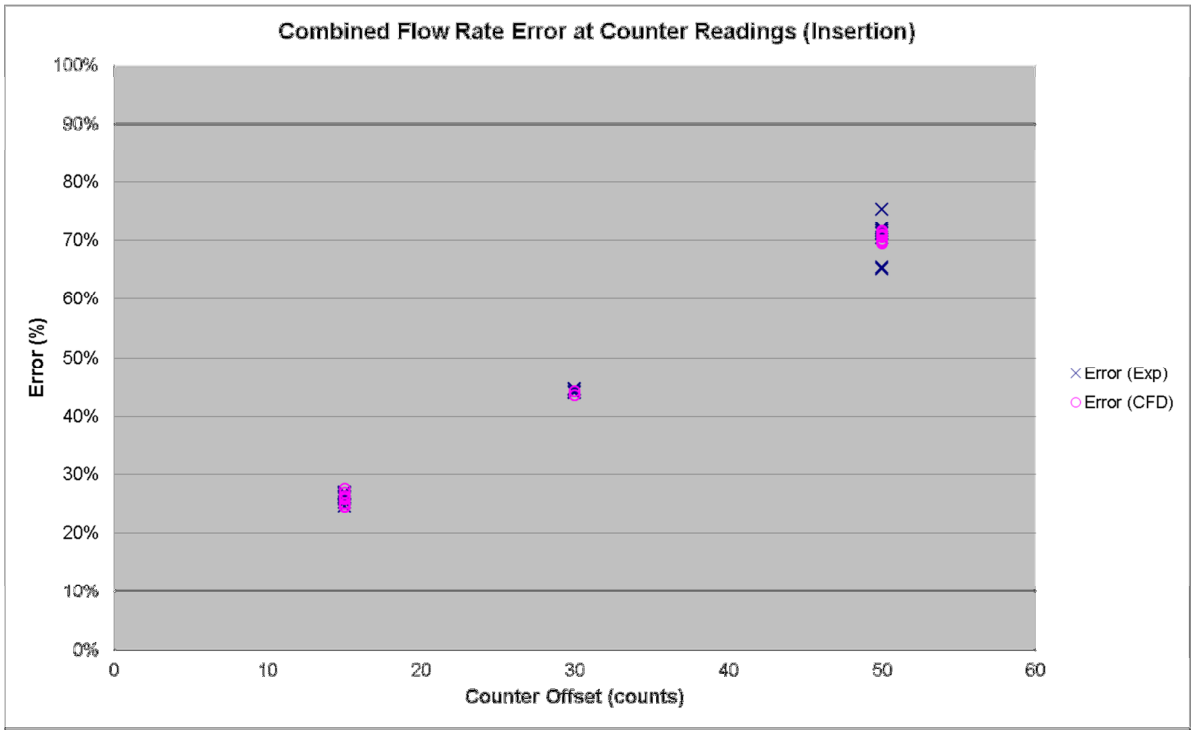

Figure 4 - Combined Flow Rate Error at Counter Readings (Insertion)

The standard deviation is higher at a counter reading of 99950, the largest deviations being at lower flow rates. The 99950 counter reading results for tests 1, 9 and 11 also showed large differences between the experimental results and CFD analysis with relative errors of -42%, 23% and 23% respectively. This can be attributed to the high uncertainty levels in the DP measurement at low DPs. For this reason the 99950 counter reading results for tests 1, 9 and 11 were excluded from the analysis.

The combined results are repeated in Table 3 and Figure 5 with these results removed. The reduction in the standard deviation demonstrates that the two data sets are more reliable and support each other particularly well with these results removed.

Counter Reading	Experimental Error (%)		CFD Error (%)		Difference in Mean (% relative)
	Mean	Std. Dev.	Mean	Std. Dev.	
99950	71.383 %	0.554 %	70.875 %	0.499 %	-0.7 %

Table 3 - Flow Rate Error at 99950 Counter Reading (Insertion; Tests 1, 9 & 11 removed)

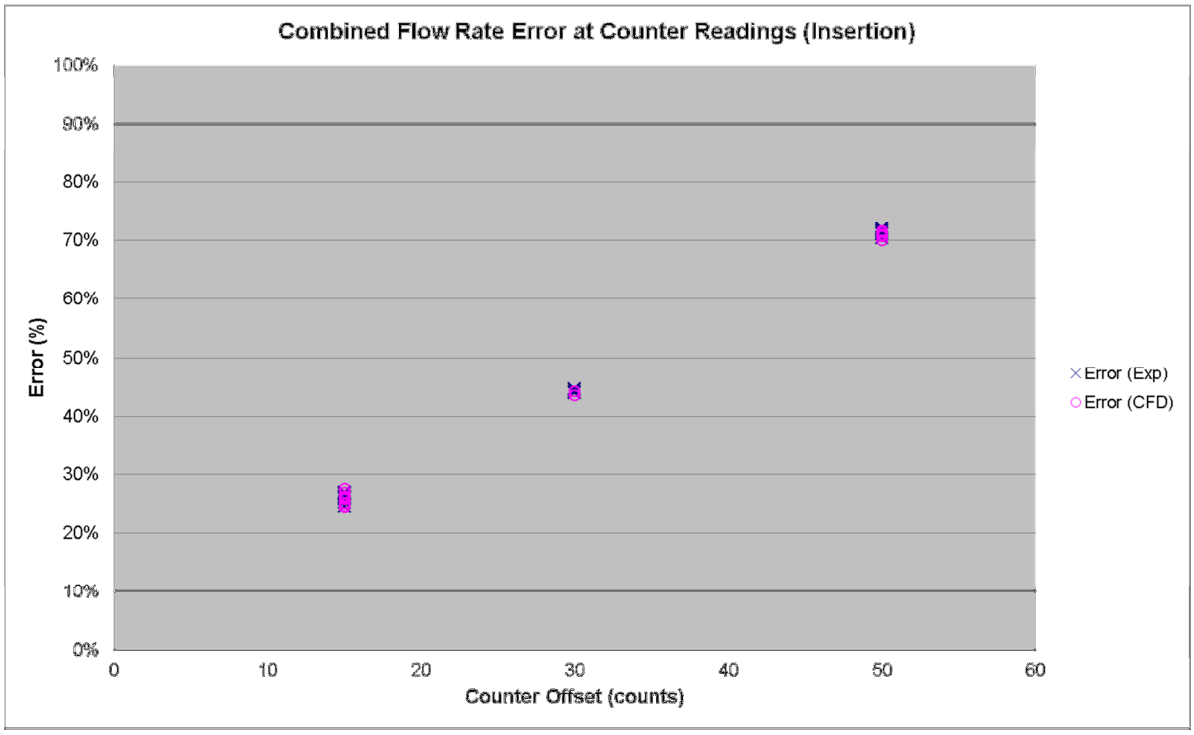

Figure 5 - Combined Flow Rate Error at Counter Readings (Insertion; 99950 Tests 1, 9 & 11 removed)

5.1 Correlation Significance

The revised error results are shown against Reynolds number in figures. The coefficients of determination for the 99985 and 99950 datasets are 0.536 and 0.549 respectively. The correlation of each dataset is significant based on a two-sided T-test with 95% confidence interval. Therefore errors should be determined based on flow rates (i.e. not a single correction factor).

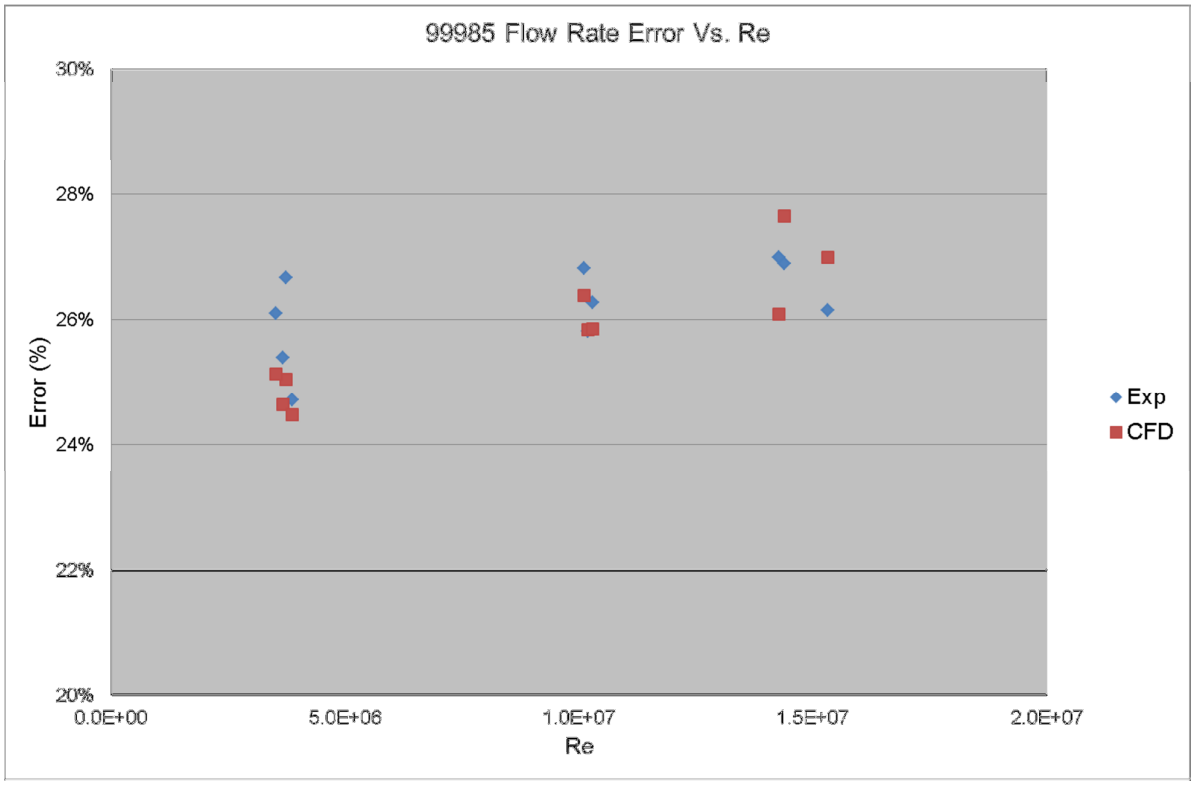

Figure 6 – 99985 Dataset Correlation

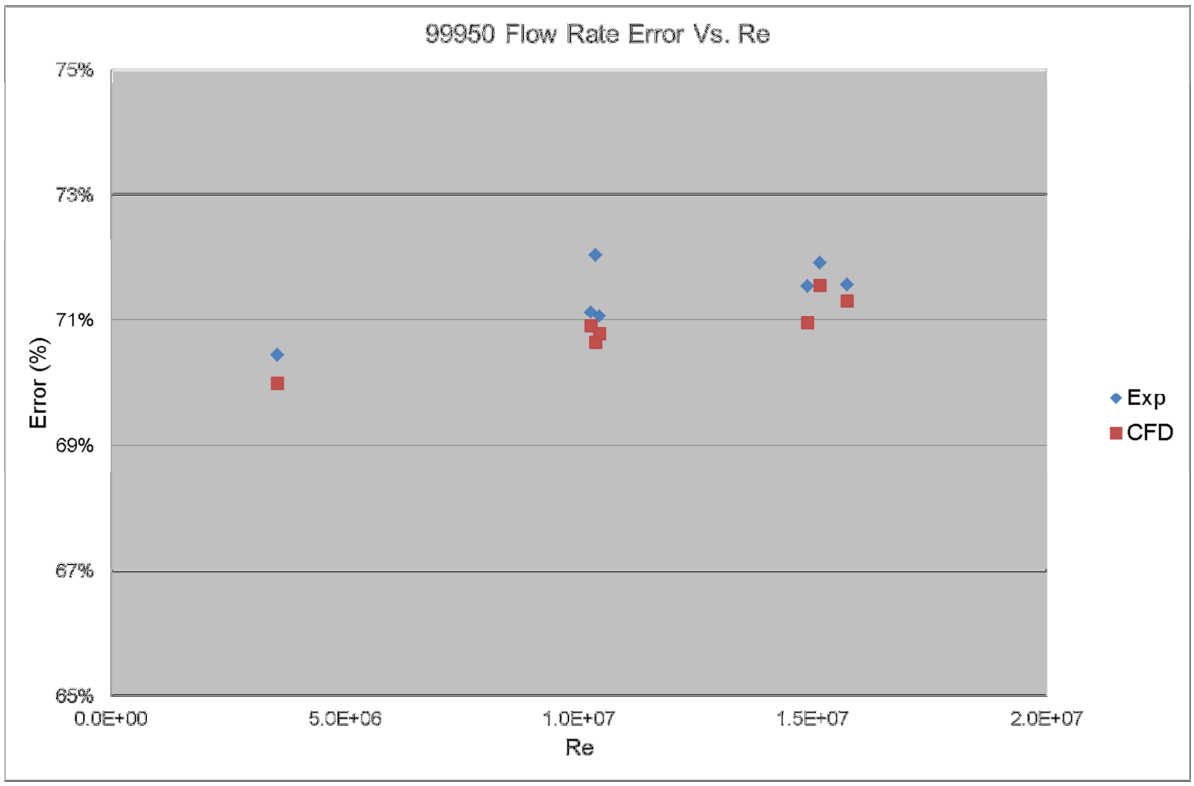

Figure 7 – 99950 Dataset Correlation

5.2 First Error Period (21st July 2009 to 27th July 2010)

For the first error period, a counter reading of 99985 has been used based on the evidence available which includes:

- the (~31%) step change in flow rate when the plate was inserted on 21st July 2009;
- the 99885 values stamped on the carrier information plate;
- the pattern of orifice plate contamination found on the plate when removed on 27th July 2010 when compared to the offset location of the plate from physical measurements.

It has been assumed that the plate arrived at a counter reading of 99985 by insertion (not removal).

The results show that the error is dependent on flow rate and should be applied in bands. The bands are based on the flow rates used during testing (1, 3 and 4.5 Mscm/d), corrected to measured flow rates.

	Test Flow (Mscm/d)	Error (%)	Measured Flow (Mscm/d)	Flow Range (Mscm/d)	# of Days	Correction Factor
Low	1	25.716	0.743	< 1.477	275	1.346188
Medium	3	26.305	2.211	1.477 to 2.755	96	1.356940
High	4.5	26.677	3.300	≥ 2.755	0	1.363833

Table 4 - Correction Factors for First Error Period

5.3 Second Error Period (27th July 2010 to 10th August 2010)

For the second error period, a counter reading of 99950 has been used based on the evidence available which includes:

- the (~69%) step change in flow rate when the plate location was corrected on 10th August 2010;
- the 9995 value stamped on the carrier information plate;
- the 99950 reading stated in the interviews conducted with the mechanical operatives that undertook the work.

It has been assumed that the plate arrived at a counter reading of 99950 by insertion (not removal).

The results from test 1, 9 and 11 for the 99950 counter reading have been excluded to improve the accuracy of the datasets.

The results show that the error is dependent on flow rate and should be applied in bands. The bands are based on the flow rates used during testing (1, 3 and 4.5 Mscm/d), corrected to measured flow rates.

	Test Flow (Mscm/d)	Error (%)	Measured Flow (Mscm/d)	Flow Range (Mscm/d)	# of Days	Correction Factor
Low	1	70.437	0.296	< 0.577	15	3.382663
Medium	3	71.405	0.858	0.577 to 1.066	0	3.497065
High	4.5	71.677	1.275	≥ 1.066	0	3.530691

Table 5 - Correction Factors for Second Error Period

6 Recommendations

It is recommended that the error, an overall under-registration of 1,603 GWh, be reconciled using the daily correction factors in Appendix A. The error was only present for part of the day on 21st July 2009 and 10th August 2010, and the error magnitude changed at 11:52 on 27th July 2010 therefore individual correction factors have been calculated for these days.

7 References

[1] Measurement Error Notification Guidelines for NTS to LDZ and LDZ to LDZ Measurement Installations. Version 4.0, 21st July 2011.

[2] Aberdeen SMER SC006, GL Noble Denton Report 14291, B Kirkman, 19th August 2013

[3] Independent Expert Significant Meter Error (SMER), Kelton Doc. Ref. NK3177 – 001, Rev 2, K Vugler, 20th September 2013

Appendix A Daily Correction Factors

The error was present only for part of the day on 21st July 2009 and 10th August 2010, therefore specific daily correction factors have been calculated. On 27th July 2010 the magnitude of the error changed part of the way through the day, therefore a specific daily correction factor has been calculated. The daily correction factor to be applied from 22nd July 2009 until 26th July 2010 is either 1.346188 or 1.356940 dependent on flow range. The daily correction factor to be applied is constant from 28th July 2010 until 9th August 2010 with a value of 3.382663.

Gas Day	Range	Daily Correction Factor
21-Jul-09	Low	1.167837[1]
22-Jul-09	Low	1.346188
23-Jul-09	Low	1.346188
24-Jul-09	Low	1.346188
25-Jul-09	Low	1.346188
26-Jul-09	Low	1.346188
27-Jul-09	Low	1.346188
28-Jul-09	Low	1.346188
29-Jul-09	Low	1.346188
30-Jul-09	Low	1.346188
31-Jul-09	Low	1.346188
01-Aug-09	Low	1.346188
02-Aug-09	Low	1.346188
03-Aug-09	Low	1.346188
04-Aug-09	Low	1.346188
05-Aug-09	Low	1.346188
06-Aug-09	Low	1.346188
07-Aug-09	Low	1.346188
08-Aug-09	Low	1.346188
09-Aug-09	Low	1.346188
10-Aug-09	Low	1.346188
11-Aug-09	Low	1.346188
12-Aug-09	Low	1.346188
13-Aug-09	Low	1.346188
14-Aug-09	Low	1.346188
15-Aug-09	Low	1.346188
16-Aug-09	Low	1.346188
17-Aug-09	Low	1.346188
18-Aug-09	Low	1.346188
19-Aug-09	Low	1.346188
20-Aug-09	Low	1.346188
21-Aug-09	Low	1.346188
22-Aug-09	Low	1.346188
23-Aug-09	Low	1.346188
24-Aug-09	Low	1.346188
25-Aug-09	Low	1.346188
26-Aug-09	Low	1.346188
27-Aug-09	Low	1.346188
28-Aug-09	Low	1.346188
29-Aug-09	Low	1.346188
30-Aug-09	Low	1.346188
31-Aug-09	Low	1.346188
01-Sep-09	Low	1.346188
02-Sep-09	Low	1.346188
03-Sep-09	Low	1.346188
04-Sep-09	Low	1.346188
05-Sep-09	Low	1.346188
06-Sep-09	Low	1.346188
07-Sep-09	Low	1.346188
08-Sep-09	Low	1.346188
09-Sep-09	Low	1.346188
10-Sep-09	Low	1.346188
11-Sep-09	Low	1.346188
12-Sep-09	Low	1.346188

[1] The error was only present for part of gas day 21st July 2009

Gas Day	Range	Daily Correction Factor
13-Sep-09	Low	1.346188
14-Sep-09	Low	1.346188
15-Sep-09	Low	1.346188
16-Sep-09	Low	1.346188
17-Sep-09	Low	1.346188
18-Sep-09	Low	1.346188
19-Sep-09	Low	1.346188
20-Sep-09	Low	1.346188
21-Sep-09	Low	1.346188
22-Sep-09	Low	1.346188
23-Sep-09	Low	1.346188
24-Sep-09	Low	1.346188
25-Sep-09	Low	1.346188
26-Sep-09	Low	1.346188
27-Sep-09	Low	1.346188
28-Sep-09	Low	1.346188
29-Sep-09	Low	1.346188
30-Sep-09	Low	1.346188
01-Oct-09	Low	1.346188
02-Oct-09	Low	1.346188
03-Oct-09	Low	1.346188
04-Oct-09	Low	1.346188
05-Oct-09	Low	1.346188
06-Oct-09	Low	1.346188
07-Oct-09	Low	1.346188
08-Oct-09	Low	1.346188
09-Oct-09	Low	1.346188
10-Oct-09	Low	1.346188
11-Oct-09	Low	1.346188
12-Oct-09	Low	1.346188
13-Oct-09	Low	1.346188
14-Oct-09	Low	1.346188
15-Oct-09	Low	1.346188
16-Oct-09	Low	1.346188
17-Oct-09	Low	1.346188
18-Oct-09	Low	1.346188

Gas Day	Range	Daily Correction Factor
19-Oct-09	Low	1.346188
20-Oct-09	Low	1.346188
21-Oct-09	Low	1.346188
22-Oct-09	Low	1.346188
23-Oct-09	Low	1.346188
24-Oct-09	Low	1.346188
25-Oct-09	Low	1.346188
26-Oct-09	Low	1.346188
27-Oct-09	Low	1.346188
28-Oct-09	Low	1.346188
29-Oct-09	Low	1.346188
30-Oct-09	Low	1.346188
31-Oct-09	Low	1.346188
01-Nov-09	Low	1.346188
02-Nov-09	Low	1.346188
03-Nov-09	Low	1.346188
04-Nov-09	Low	1.346188
05-Nov-09	Low	1.346188
06-Nov-09	Med	1.356940
07-Nov-09	Low	1.346188
08-Nov-09	Low	1.346188
09-Nov-09	Med	1.356940
10-Nov-09	Low	1.346188
11-Nov-09	Low	1.346188
12-Nov-09	Low	1.346188
13-Nov-09	Low	1.346188
14-Nov-09	Low	1.346188
15-Nov-09	Low	1.346188
16-Nov-09	Low	1.346188
17-Nov-09	Low	1.346188
18-Nov-09	Low	1.346188
19-Nov-09	Low	1.346188
20-Nov-09	Low	1.346188
21-Nov-09	Low	1.346188
22-Nov-09	Low	1.346188
23-Nov-09	Low	1.346188

Gas Day	Range	Daily Correction Factor
24-Nov-09	Low	1.346188
25-Nov-09	Med	1.356940
26-Nov-09	Low	1.346188
27-Nov-09	Low	1.346188
28-Nov-09	Low	1.346188
29-Nov-09	Med	1.356940
30-Nov-09	Med	1.356940
01-Dec-09	Med	1.356940
02-Dec-09	Med	1.356940
03-Dec-09	Med	1.356940
04-Dec-09	Low	1.346188
05-Dec-09	Low	1.346188
06-Dec-09	Low	1.346188
07-Dec-09	Med	1.356940
08-Dec-09	Med	1.356940
09-Dec-09	Low	1.346188
10-Dec-09	Med	1.356940
11-Dec-09	Med	1.356940
12-Dec-09	Med	1.356940
13-Dec-09	Med	1.356940
14-Dec-09	Med	1.356940
15-Dec-09	Low	1.346188
16-Dec-09	Low	1.346188
17-Dec-09	Med	1.356940
18-Dec-09	Med	1.356940
19-Dec-09	Med	1.356940
20-Dec-09	Med	1.356940
21-Dec-09	Med	1.356940
22-Dec-09	Med	1.356940
23-Dec-09	Med	1.356940
24-Dec-09	Med	1.356940
25-Dec-09	Low	1.346188
26-Dec-09	Med	1.356940
27-Dec-09	Med	1.356940
28-Dec-09	Med	1.356940
29-Dec-09	Med	1.356940

Gas Day	Range	Daily Correction Factor
30-Dec-09	Med	1.356940
31-Dec-09	Med	1.356940
01-Jan-10	Low	1.346188
02-Jan-10	Med	1.356940
03-Jan-10	Med	1.356940
04-Jan-10	Med	1.356940
05-Jan-10	Med	1.356940
06-Jan-10	Med	1.356940
07-Jan-10	Med	1.356940
08-Jan-10	Med	1.356940
09-Jan-10	Med	1.356940
10-Jan-10	Med	1.356940
11-Jan-10	Med	1.356940
12-Jan-10	Med	1.356940
13-Jan-10	Med	1.356940
14-Jan-10	Med	1.356940
15-Jan-10	Med	1.356940
16-Jan-10	Med	1.356940
17-Jan-10	Med	1.356940
18-Jan-10	Med	1.356940
19-Jan-10	Med	1.356940
20-Jan-10	Med	1.356940
21-Jan-10	Med	1.356940
22-Jan-10	Med	1.356940
23-Jan-10	Med	1.356940
24-Jan-10	Med	1.356940
25-Jan-10	Med	1.356940
26-Jan-10	Med	1.356940
27-Jan-10	Med	1.356940
28-Jan-10	Med	1.356940
29-Jan-10	Med	1.356940
30-Jan-10	Med	1.356940
31-Jan-10	Med	1.356940
01-Feb-10	Med	1.356940
02-Feb-10	Med	1.356940
03-Feb-10	Med	1.356940

Gas Day	Range	Daily Correction Factor
04-Feb-10	Med	1.356940
05-Feb-10	Med	1.356940
06-Feb-10	Low	1.346188
07-Feb-10	Low	1.346188
08-Feb-10	Med	1.356940
09-Feb-10	Med	1.356940
10-Feb-10	Med	1.356940
11-Feb-10	Med	1.356940
12-Feb-10	Med	1.356940
13-Feb-10	Med	1.356940
14-Feb-10	Low	1.346188
15-Feb-10	Med	1.356940
16-Feb-10	Med	1.356940
17-Feb-10	Med	1.356940
18-Feb-10	Med	1.356940
19-Feb-10	Med	1.356940
20-Feb-10	Med	1.356940
21-Feb-10	Med	1.356940
22-Feb-10	Med	1.356940
23-Feb-10	Med	1.356940
24-Feb-10	Med	1.356940
25-Feb-10	Med	1.356940
26-Feb-10	Med	1.356940
27-Feb-10	Med	1.356940
28-Feb-10	Med	1.356940
01-Mar-10	Med	1.356940
02-Mar-10	Med	1.356940
03-Mar-10	Med	1.356940
04-Mar-10	Med	1.356940
05-Mar-10	Med	1.356940
06-Mar-10	Low	1.346188
07-Mar-10	Low	1.346188
08-Mar-10	Med	1.356940
09-Mar-10	Med	1.356940
10-Mar-10	Med	1.356940
11-Mar-10	Low	1.346188

Gas Day	Range	Daily Correction Factor
12-Mar-10	Med	1.356940
13-Mar-10	Low	1.346188
14-Mar-10	Low	1.346188
15-Mar-10	Low	1.346188
16-Mar-10	Low	1.346188
17-Mar-10	Low	1.346188
18-Mar-10	Low	1.346188
19-Mar-10	Low	1.346188
20-Mar-10	Low	1.346188
21-Mar-10	Low	1.346188
22-Mar-10	Low	1.346188
23-Mar-10	Low	1.346188
24-Mar-10	Low	1.346188
25-Mar-10	Low	1.346188
26-Mar-10	Low	1.346188
27-Mar-10	Low	1.346188
28-Mar-10	Low	1.346188
29-Mar-10	Low	1.346188
30-Mar-10	Med	1.356940
31-Mar-10	Med	1.356940
01-Apr-10	Med	1.356940
02-Apr-10	Low	1.346188
03-Apr-10	Low	1.346188
04-Apr-10	Low	1.346188
05-Apr-10	Low	1.346188
06-Apr-10	Low	1.346188
07-Apr-10	Low	1.346188
08-Apr-10	Low	1.346188
09-Apr-10	Low	1.346188
10-Apr-10	Low	1.346188
11-Apr-10	Low	1.346188
12-Apr-10	Low	1.346188
13-Apr-10	Low	1.346188
14-Apr-10	Low	1.346188
15-Apr-10	Low	1.346188
16-Apr-10	Low	1.346188

Gas Day	Range	Daily Correction Factor
17-Apr-10	Low	1.346188
18-Apr-10	Low	1.346188
19-Apr-10	Low	1.346188
20-Apr-10	Low	1.346188
21-Apr-10	Low	1.346188
22-Apr-10	Low	1.346188
23-Apr-10	Low	1.346188
24-Apr-10	Low	1.346188
25-Apr-10	Low	1.346188
26-Apr-10	Low	1.346188
27-Apr-10	Low	1.346188
28-Apr-10	Low	1.346188
29-Apr-10	Low	1.346188
30-Apr-10	Low	1.346188
01-May-10	Low	1.346188
02-May-10	Low	1.346188
03-May-10	Low	1.346188
04-May-10	Low	1.346188
05-May-10	Low	1.346188
06-May-10	Low	1.346188
07-May-10	Low	1.346188
08-May-10	Low	1.346188
09-May-10	Low	1.346188
10-May-10	Low	1.346188
11-May-10	Low	1.346188
12-May-10	Low	1.346188
13-May-10	Low	1.346188
14-May-10	Low	1.346188
15-May-10	Low	1.346188
16-May-10	Low	1.346188
17-May-10	Low	1.346188
18-May-10	Low	1.346188
19-May-10	Low	1.346188
20-May-10	Low	1.346188
21-May-10	Low	1.346188
22-May-10	Low	1.346188

Gas Day	Range	Daily Correction Factor
23-May-10	Low	1.346188
24-May-10	Low	1.346188
25-May-10	Low	1.346188
26-May-10	Low	1.346188
27-May-10	Low	1.346188
28-May-10	Low	1.346188
29-May-10	Low	1.346188
30-May-10	Low	1.346188
31-May-10	Low	1.346188
01-Jun-10	Low	1.346188
02-Jun-10	Low	1.346188
03-Jun-10	Low	1.346188
04-Jun-10	Low	1.346188
05-Jun-10	Low	1.346188
06-Jun-10	Low	1.346188
07-Jun-10	Low	1.346188
08-Jun-10	Low	1.346188
09-Jun-10	Low	1.346188
10-Jun-10	Low	1.346188
11-Jun-10	Low	1.346188
12-Jun-10	Low	1.346188
13-Jun-10	Low	1.346188
14-Jun-10	Low	1.346188
15-Jun-10	Low	1.346188
16-Jun-10	Low	1.346188
17-Jun-10	Low	1.346188
18-Jun-10	Low	1.346188
19-Jun-10	Low	1.346188
20-Jun-10	Low	1.346188
21-Jun-10	Low	1.346188
22-Jun-10	Low	1.346188
23-Jun-10	Low	1.346188
24-Jun-10	Low	1.346188
25-Jun-10	Low	1.346188
26-Jun-10	Low	1.346188
27-Jun-10	Low	1.346188

Gas Day	Range	Daily Correction Factor
28-Jun-10	Low	1.346188
29-Jun-10	Low	1.346188
30-Jun-10	Low	1.346188
01-Jul-10	Low	1.346188
02-Jul-10	Low	1.346188
03-Jul-10	Low	1.346188
04-Jul-10	Low	1.346188
05-Jul-10	Low	1.346188
06-Jul-10	Low	1.346188
07-Jul-10	Low	1.346188
08-Jul-10	Low	1.346188
09-Jul-10	Low	1.346188
10-Jul-10	Low	1.346188
11-Jul-10	Low	1.346188
12-Jul-10	Low	1.346188
13-Jul-10	Low	1.346188
14-Jul-10	Low	1.346188
15-Jul-10	Low	1.346188
16-Jul-10	Low	1.346188
17-Jul-10	Low	1.346188
18-Jul-10	Low	1.346188
19-Jul-10	Low	1.346188
20-Jul-10	Low	1.346188
21-Jul-10	Low	1.346188
22-Jul-10	Low	1.346188
23-Jul-10	Low	1.346188
24-Jul-10	Low	1.346188
25-Jul-10	Low	1.346188
26-Jul-10	Low	1.346188
27-Jul-10	Low	2.450775[2]
28-Jul-10	Low	3.382663
29-Jul-10	Low	3.382663
30-Jul-10	Low	3.382663

Gas Day	Range	Daily Correction Factor
31-Jul-10	Low	3.382663
01-Aug-10	Low	3.382663
02-Aug-10	Low	3.382663
03-Aug-10	Low	3.382663
04-Aug-10	Low	3.382663
05-Aug-10	Low	3.382663
06-Aug-10	Low	3.382663
07-Aug-10	Low	3.382663
08-Aug-10	Low	3.382663
09-Aug-10	Low	3.382663
10-Aug-10	Low	1.213305[3]

[2] The magnitude of the error changed on gas day 27th July 2010

[3] The error was only present for part of gas day 10th August 2010