

METER ERROR REPORT**FINAL**

Reconcile?	Y
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Safety Issue?	N
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Thesis Report No.	
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1. EXECUTIVE SUMMARY

SITE NAME	Blackrod
LDZ	NW
START DATE (actual)	11/08/2004 14:12
LAST GOOD DATE	11/08/2004
END DATE	04/08/2005
SIZE OF ERROR (No reconciliation required if under 0.1%)	0.275% (2219685 scm) under-registration
ESTIMATE – Y/N?	N
ROOT CAUSE	The orifice plate bore diameter was incorrectly measured. The incorrect bore was entered into the flow computer configuration without taking the drain hole into account
ANALYSIS	Detailed within this report
METER TYPE	Orifice plate meter
AUTHOR	Piers Eldridge
CHECKED BY	Andrew Finch

2. BACKGROUND

Gas is supplied to part of the North West network at Blackrod FWACV offtake. Blackrod is a dual stream orifice plate meter site using a gas chromatograph for RD and CV determination and PTZ correction.

The error was discovered whilst analysing the data for another MER for Blackrod where the orifice plate bore diameter was incorrectly measured. The orifice plate certificates for all the plates installed at Blackrod were examined and the incorrect measurement in certificate number 4125 was discovered.

3. ERROR QUANTIFICATION AND IMPACT

The orifice plate certificates for plate number 226 and configuration tracking data files were compared. It was determined that the incorrect bore diameter was entered into the flow computer configuration for the second metering stream on 11th August 2004 and was changed when another plate was installed on 4th August 2005.

Table 1 contains relevant measurements from the orifice plate certificates from plate number 226.

Year	Cert number	serial number	Measured bore	Drain hole bore	Effective bore	OMNI config
2003	3112	226	366.5015	Not declared	366.5015	Not available
2004	4125	226	364.508	10.047	364.6598102	364.5075
2006	OP50199	226	366.499	10.049	366.6505429	366.499

Table 1 Relevant measurements from the orifice plate certificates from plate serial number 226.

During the same validation, the bore diameter entered in the flow computer for meter stream 1 was not corrected for the drain hole. The incorrect effective bore was in the flow computer configuration until another plate was installed on 4th August 2005.

Table 2 shows how the plate installed in both streams changed together with the changes in the flow computer configuration.

		08/07/2003	10/08/2004	11/08/2004	04/08/2005
MTA	Plate bore in the OMNI config	366.491	366.8525	366.8525	366.4845
	Plate serial number	225-1	225	225	225-1
	Calibration certificate number	OP2123	OP4124	OP4124	OP50164
	Measured bore from the certificate	366.491	366.8525	366.8525	366.4845
	Measured drain hole bore	0	10.03	10.03	0
MTB	Plate bore in the OMNI config	366.5885	366.5885	364.5075	366.578
	Plate serial number	226-1	226-1	226	226-1
	Calibration certificate number			OP3858	OP4820
	Measured bore from the certificate	366.589	366.589	364.508	366.578
	Measured drain hole bore	0	0	10.047	0

Table 2. A summary showing the changes in to both streams

Table 3 shows the thickness and bore measurements taken from certificates 3112, 4125 and OP50199 and the standard deviations of the measurements are shown. The one suspect measurement is highlighted. The standard deviation of the other 5 bore diameter measurements is 0.0027. Therefore it is likely that the highlighted measurement is the only one in error. Close inspection of the raw data behind the certificate is also consistent.

The error was calculated from 1st April 2005 to 4th August 2005 because it has been stated in mod 152V of UNC the backstop date for retrospective billing is 1st April 2005.

Flow rates for each 4 minute snapshot were recalculated using the values entered into the flow computer and again using a recalculated effective bore. The effective bore for the second meter stream was calculated using the average for the 5 good bore diameter measurements and the 2 drain hole measurements from certificates 4125 and OP50199. The effective bore was calculated to be 366.6525mm.

The effective bore for the plate in the first meter stream was calculated to be 367.0033mm.

A correction factor was calculated by dividing the correct flow rate by the incorrect flow rate taking into account the low flow cutoff threshold. The correct flow in each 4 minute snapshot was calculated by multiplying the correction factor by the difference in totaliser readings.

	Thickness	Bore diameter
Measurements from the certificates.	12.664	366.499
	12.671	366.499
	12.654	366.504
	12.636	362.511
	12.659	366.499
	12.661	366.504
	12.645	
	12.641	
	12.68	
	12.657	
	12.649	
	12.644	
	12.669	
	12.681	
	12.678	
	12.642	
	12.671	
	12.685	
	12.66	
	12.643	
12.649		
12.663		
12.648		
12.653		

Std Dev	0.0141	1.63
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Table 3 Thickness and bore measurements taken from certificates 3112, 4125 and OP50199.

The daily correction factors are shown in appendix 1.

There are three days where 92% of the readings were not available during the periods when the site flowed. In these cases a default correction factor was applied. However, on the 18th April 2005 gas was flowing through both streams and on the 29th and 30th April 2005 gas flowed through the stream with the correctly measured plate. Therefore, two default correction factors were calculated using the standard volume and error from the periods when each error occurs. The default correction factors are shown in table 4.

Period	Total volume	Total error	Default correction factor
1st April - 24th April	257128425	1724015	1.006750
26th April - 4th August	543815014	482478	1.000887

Table 4. Default correction factors

The error before the backstop date for retrospective billing can be calculated by applying the default correction factors in table 4 to station dvol when gas flowed through MO2. When the gas flowed through both streams, the default correction factor is applied to dvol/2. Between 11th August 2004 and 8th November 2004 gas flowed through MO1. From 8th November to the backstop date for retrospective billing, gas flowed at a 50% ratio through both streams. The net result over the retrospective billing period is an under-registration of 2219685scm. Further details of the calculations can be found in the accompanying spreadsheets.

4. CAUSES

The flow error was caused by a 4mm error in the upstream measurement in the orifice bore diameter. The upstream measurement was averaged with the downstream measurement to give to official bore diameter published on the certificate. The incorrect bore was entered into the flow computer configuration without taking the drain hole into account. The reason why the upstream bore diameter was not measured correctly is unclear.

5. RECOMMENDATIONS AND LEARNING

Investigate the source of the initial error (be it instrument error, operator error or otherwise) and take steps in order to prevent this from occurring in the future.

Develop and document a uniform procedure for handling drain hole dimensions when configuring the OMNI flow computer.

REFERENCES

Summary2.xls

VERSION HISTORY

<i>Version</i>	<i>Changes</i>	<i>Author</i>	<i>Date</i>
<i>1</i>	<i>First version</i>	<i>Piers Eldridge</i>	<i>22/09/2009</i>
<i>2</i>	<i>Statements to explain why the error was calculated from the backstop date for retrospective bill.</i>	<i>Piers Eldridge</i>	<i>21/10/2009</i>
<i>3</i>	<i>The correction for the drain hole in MTA explained. The correction factor was inverted. Superfluous information about orifice plate certificate number OP70096 has been removed.</i>	<i>Piers Eldridge</i>	<i>14/12/2009</i>
<i>4</i>	<i>The correction factors were recalculated</i>	<i>Piers Eldridge</i>	<i>23/12/2009</i>

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Appendix 1

Gas Date	Count of snapshots	Correction factor
01/04/2005	336	1.006752427
02/04/2005	343	1.006754155
03/04/2005	344	1.006756366
04/04/2005	343	1.006751978
05/04/2005	343	1.00675303
06/04/2005	343	1.006753197
07/04/2005	343	1.006758671
08/04/2005	343	1.006756561
09/04/2005	343	1.006756534
10/04/2005	343	1.006762059
11/04/2005	337	1.006759543
12/04/2005	343	1.006757452
13/04/2005	343	1.006759885
14/04/2005	344	1.006761146
15/04/2005	343	1.006758922
16/04/2005	344	1.006761906
17/04/2005	342	1.006764371
18/04/2005	233	Default correction factor used
19/04/2005	342	1.006764252
20/04/2005	344	1.006756254
21/04/2005	343	1.006530156
22/04/2005	344	1.00676261
23/04/2005	343	1.006765156
24/04/2005	343	1.006763223
25/04/2005	343	1.002085557
26/04/2005	343	1.000885326
27/04/2005	343	1.000885322
28/04/2005	343	1.000885326
29/04/2005	55	Default correction factor used
30/04/2005	166	Default correction factor used
01/05/2005	336	1.000885319
02/05/2005	344	1.000885321
03/05/2005	342	1.000885322
04/05/2005	341	1.000885326
05/05/2005	343	1.000885327
06/05/2005	343	1.000885327
07/05/2005	343	1.000885338
08/05/2005	343	1.000885333
09/05/2005	343	1.000885344
10/05/2005	342	1.000885329
11/05/2005	343	1.000885326
12/05/2005	343	1.000885319
13/05/2005	343	1.000885334
14/05/2005	342	1.00088532
15/05/2005	343	1.000885331
16/05/2005	344	1.00088533
17/05/2005	343	1.000885338
18/05/2005	342	1.000885331
19/05/2005	343	1.000885327

20/05/2005	343	1.000885329
21/05/2005	342	1.000885345
22/05/2005	343	1.000885333
23/05/2005	343	1.000885346
24/05/2005	339	1.000885333
25/05/2005	343	1.000885328
26/05/2005	342	1.000885321
27/05/2005	343	1.000885323
28/05/2005	343	1.000885323
29/05/2005	344	1.000885324
30/05/2005	343	1.000885325
31/05/2005	343	1.000885323
01/06/2005	336	1.00088533
02/06/2005	343	1.000885335
03/06/2005	344	1.000885323
04/06/2005	344	1.000885361
05/06/2005	343	0
06/06/2005	344	1.000885354
07/06/2005	343	1.000885334
08/06/2005	343	1.000885335
09/06/2005	343	1.000885339
10/06/2005	343	1.000885337
11/06/2005	343	1.000885337
12/06/2005	343	1.000885326
13/06/2005	343	1.000885331
14/06/2005	343	1.000885326
15/06/2005	333	1.00088532
16/06/2005	343	1.00088533
17/06/2005	342	1.000885342
18/06/2005	344	1.000885352
19/06/2005	344	1.000885325
20/06/2005	343	1.000885334
21/06/2005	343	0
22/06/2005	344	1.000885355
23/06/2005	342	1.000885322
24/06/2005	344	1.000885323
25/06/2005	342	0
26/06/2005	343	1.000885323
27/06/2005	343	1.000885319
28/06/2005	343	1.000885535
29/06/2005	342	1.001126759
30/06/2005	343	1.000885321
01/07/2005	336	1.000885322
02/07/2005	343	1.000885322
03/07/2005	343	1.00088532
04/07/2005	343	1.000885323
05/07/2005	343	1.000885326
06/07/2005	343	1.000885328
07/07/2005	343	1.000885333
08/07/2005	343	1.000885341
09/07/2005	343	1.00088533
10/07/2005	343	1.000885331

11/07/2005	344	1.000885332
12/07/2005	343	1.000885329
13/07/2005	344	1.000885325
14/07/2005	323	0
15/07/2005	342	0
16/07/2005	343	1.00088533
17/07/2005	342	1.000885336
18/07/2005	343	1.000885327
19/07/2005	337	1.000885326
20/07/2005	342	1.000885325
21/07/2005	341	1.000885334
22/07/2005	343	1.000885326
23/07/2005	344	1.00088533
24/07/2005	344	1.000885325
25/07/2005	344	1.000885323
26/07/2005	347	1.000885324
27/07/2005	343	1.000885325
28/07/2005	341	1.000939968
29/07/2005	344	1.000927743
30/07/2005	345	1.000885328
31/07/2005	343	1.000885325
01/08/2005	337	1.000885332
02/08/2005	343	1.000885337
03/08/2005	343	1.00088532
04/08/2005	343	1.000885328