

**METER ERROR REPORT****FINAL**

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

SITE NAME	Kenn	
LDZ	SW	
START DATE (actual)		
LAST GOOD DATE	6 <sup>th</sup> March 2014	
END DATE	12 <sup>th</sup> March 2015	
SIZE OF ERROR (No reconciliation required if under 0.1%)	0.2696% over-registration (3.84 GWh)	
ESTIMATE – Y/N?		
ROOT CAUSE	Failed validation checks for Temperature ADC and transmitter on stream A.	
ANALYSIS	Recalculation of volumes using corrected temperature.	
METER TYPE	USM	
AUTHOR	H Richardson	
CHECKED BY	C Jones	
ACCEPTED BY WWU NETWORK		
RECONCILIATION	Distribution	Transportation

## 2. BACKGROUND

Kenn has a duty/standby Turbine meter stream using a gas chromatograph for CV determination and PTZ correction.

During the annual validation for stream A, the CP4e (ADC Temperature Check) and the CP12 (Temperature Transmitter Check) tests failed on 11<sup>th</sup> and 12<sup>th</sup> March 2015 respectively. Both errors were corrected on the day they were discovered.

## 3. ERROR QUANTIFICATION AND IMPACT

The temperature measurements were corrected for 'As Found' errors shown in Table 1 and Table 2 for Stream A when the recorded measurement was in the appropriate range.

Temperature (°C)	CP12 Error (% span)	CP4e Error (% span)	Combined Error (% span)
-10	-0.57505	n/a	-0.57505
2.5	-0.66255	n/a	-0.66255
15	-0.9844	n/a	-0.9844
27.5	-1.0813	n/a	-1.0813
40	-1.0938	n/a	-1.0938

Table 1 – Temperature Errors, Stream A (06/03/2014 – 12/03/2014 and 11/03/2015 – 12/03/2015)

Temperature (°C)	CP12 Error (% span)	CP4e Error (% span)	Combined Error (% span)
-10	-0.57505	-0.015	-0.59005
2.5	-0.66255	-0.0463	-0.70885
15	-0.9844	-0.075	-1.0594
27.5	-1.0813	-0.115	-1.1963
40	-1.0938	-0.1213	-1.2151

Table 2 – Temperature Errors, Stream A (12/03/2014 – 11/03/2015)

The density, flow rate and daily volumes were recalculated from the corrected temperature readings. The error was calculated on a daily basis as the difference between volume totals using measured and corrected inputs.

The overall error is an over-registration of 0.2696%. The error is equivalent to 3.84 GWh.

#### 4. CAUSES

Temperature ADC and transmitter checks failed during routine validation for both streams.

#### 5. RECOMMENDATIONS AND LEARNING

Failures of this type will occur occasionally, if the same checks fail regularly then it suggests a fundamental problem with the equipment being tested and repairs or replacements should be made.

The start of the error cannot be identified therefore the total error to be reconciled should be halved in accordance with the Offtake Arrangements Document. Appendix A shows the daily correction factors, which have already been halved.

Where there is missing data and calculated volumes do not match Gemini records a correction has been applied equal to the mean correction factor for the previous and subsequent day where possible.

#### REFERENCES

Kenn\_Data.xlsx – calculation spreadsheet

Kenn\_Summary.xlsx – results spreadsheet

#### VERSION HISTORY

<i>Version</i>	<i>Changes</i>	<i>Author</i>	<i>Date</i>
<i>0</i>	<i>Original</i>	<i>H Richardson</i>	<i>25/11/15</i>
<i>Rev 1</i>	<i>Amended typing error with incorrect registration error</i>	<i>H Richardson</i>	<i>02/12/15</i>

#### DISTRIBUTION

*Wales and West Utilities*

**APPENDIX A – Daily Correction Factors**

The table below gives the daily correction factors which should be used to reconcile the error.

\* Where there is missing data and calculated volumes do not match Gemini records a correction has been applied equal to the mean correction factor for the previous and subsequent day where possible.

Gas Day	Daily Correction Factor
06/03/2014	0.999070
07/03/2014	0.998792
08/03/2014	0.998806
09/03/2014	0.998806
10/03/2014	0.998843
11/03/2014	0.998838
12/03/2014	0.998789*
13/03/2014	0.998741
14/03/2014	0.998719*
15/03/2014	0.998696
16/03/2014	0.998697
17/03/2014	0.998705
18/03/2014	0.998692
19/03/2014	0.998689
20/03/2014	0.998723
21/03/2014	0.998722
22/03/2014	0.998732
23/03/2014	0.998732
24/03/2014	0.998721
25/03/2014	0.998734
26/03/2014	0.998724
27/03/2014	0.998734
28/03/2014	0.998721
29/03/2014	0.998715*
30/03/2014	0.998709
31/03/2014	0.998777
01/04/2014	0.998751
02/04/2014	0.998723
03/04/2014	0.998751
04/04/2014	0.998748
05/04/2014	0.998753
06/04/2014	0.998749
07/04/2014	0.998741
08/04/2014	0.998706
09/04/2014	0.998741
10/04/2014	0.998747

Gas Day	Daily Correction Factor
11/04/2014	0.998752
12/04/2014	0.998729
13/04/2014	0.998718
14/04/2014	0.998711
15/04/2014	0.998727
16/04/2014	0.998730
17/04/2014	0.998729
18/04/2014	0.998760
19/04/2014	0.998751
20/04/2014	0.998751
21/04/2014	0.998706
22/04/2014	0.998736
23/04/2014	0.998708
24/04/2014	0.998723
25/04/2014	0.998732
26/04/2014	0.998728
27/04/2014	0.998752
28/04/2014	0.998758
29/04/2014	0.998727
30/04/2014	0.998732
01/05/2014	0.998722
02/05/2014	0.998736
03/05/2014	0.998728
04/05/2014	0.998705
05/05/2014	0.998692
06/05/2014	0.998693
07/05/2014	0.998700
08/05/2014	0.998725
09/05/2014	0.998693
10/05/2014	0.998690
11/05/2014	0.998685
12/05/2014	0.998719
13/05/2014	0.998697
14/05/2014	0.998692
15/05/2014	0.998705
16/05/2014	0.998685

Gas Day	Daily Correction Factor
17/05/2014	0.998682
18/05/2014	0.998661
19/05/2014	0.998641
20/05/2014	0.998667
21/05/2014	0.998655
22/05/2014	0.998665
23/05/2014	0.998658
24/05/2014	0.998644
25/05/2014	0.998644
26/05/2014	0.998662
27/05/2014	0.998692
28/05/2014	0.998693
29/05/2014	0.998677
30/05/2014	0.998677
31/05/2014	0.998661
01/06/2014	0.998647
02/06/2014	0.998687
03/06/2014	0.998683
04/06/2014	0.998681
05/06/2014	0.998672
06/06/2014	0.998681
07/06/2014	0.998671
08/06/2014	0.998665
09/06/2014	0.999535
10/06/2014	0.999005
11/06/2014	0.998670
12/06/2014	0.998648
13/06/2014	0.998638
14/06/2014	0.998636
15/06/2014	0.998625
16/06/2014	0.998656
17/06/2014	0.998654
18/06/2014	0.998660
19/06/2014	0.998627
20/06/2014	0.998651
21/06/2014	0.998639
22/06/2014	0.998627*
23/06/2014	0.998614
24/06/2014	0.998640
25/06/2014	0.998664
26/06/2014	0.998662
27/06/2014	0.998670
28/06/2014	0.998632
29/06/2014	0.998623
30/06/2014	0.998636

Gas Day	Daily Correction Factor
01/07/2014	0.998655
02/07/2014	0.998643
03/07/2014	0.998639
04/07/2014	0.998652
05/07/2014	0.998632
06/07/2014	0.998624
07/07/2014	0.998648
08/07/2014	0.998666
09/07/2014	0.998647
10/07/2014	0.998652
11/07/2014	0.998658
12/07/2014	0.998635
13/07/2014	0.998615
14/07/2014	0.998624
15/07/2014	0.998630
16/07/2014	0.998627
17/07/2014	0.998620*
18/07/2014	0.998620*
19/07/2014	0.998620*
20/07/2014	0.998620*
21/07/2014	0.998620*
22/07/2014	0.998620*
23/07/2014	0.998620*
24/07/2014	0.998610
25/07/2014	0.998610
26/07/2014	0.998589
27/07/2014	0.998564
28/07/2014	0.998567
29/07/2014	0.998560
30/07/2014	0.998559
31/07/2014	0.998572
01/08/2014	0.998558
02/08/2014	0.998549
03/08/2014	0.998540
04/08/2014	0.998546
05/08/2014	0.998570
06/08/2014	0.998567
07/08/2014	0.998568
08/08/2014	0.998578
09/08/2014	0.998564
10/08/2014	0.998566
11/08/2014	0.998568
12/08/2014	0.998571
13/08/2014	0.998563
14/08/2014	0.998575

Gas Day	Daily Correction Factor
15/08/2014	0.998580
16/08/2014	0.998555
17/08/2014	0.998566
18/08/2014	0.998589
19/08/2014	0.998586
20/08/2014	0.998588
21/08/2014	0.998585
22/08/2014	0.998599
23/08/2014	0.998591
24/08/2014	0.998588
25/08/2014	0.998594
26/08/2014	0.998603
27/08/2014	0.998609
28/08/2014	0.998609
29/08/2014	0.998592
30/08/2014	0.998589
31/08/2014	0.998592
01/09/2014	0.998590*
02/09/2014	1.000000
03/09/2014	1.000000
04/09/2014	1.000000
05/09/2014	1.000000
06/09/2014	1.000000
07/09/2014	1.000000
08/09/2014	1.000000
09/09/2014	1.000000
10/09/2014	1.000000
11/09/2014	1.000000
12/09/2014	1.000000
13/09/2014	1.000000
14/09/2014	1.000000
15/09/2014	1.000000
16/09/2014	1.000000
17/09/2014	1.000000
18/09/2014	0.998576
19/09/2014	0.998558
20/09/2014	1.000000
21/09/2014	1.000000
22/09/2014	1.000000
23/09/2014	1.000000
24/09/2014	1.000000
25/09/2014	1.000000
26/09/2014	1.000000
27/09/2014	1.000000
28/09/2014	1.000000

Gas Day	Daily Correction Factor
29/09/2014	1.000000
30/09/2014	1.000000
01/10/2014	1.000000
02/10/2014	1.000000
03/10/2014	1.000000
04/10/2014	1.000000
05/10/2014	1.000000
06/10/2014	1.000000
07/10/2014	1.000000
08/10/2014	1.000000
09/10/2014	1.000000
10/10/2014	1.000000
11/10/2014	1.000000
12/10/2014	1.000000
13/10/2014	0.998663
14/10/2014	0.998661
15/10/2014	0.998619
16/10/2014	0.998635
17/10/2014	0.998619
18/10/2014	0.998560
19/10/2014	0.998605
20/10/2014	0.998625
21/10/2014	0.998651
22/10/2014	0.998662
23/10/2014	0.998607
24/10/2014	0.998611
25/10/2014	0.998620*
26/10/2014	0.998629
27/10/2014	0.998644
28/10/2014	0.998628
29/10/2014	0.998635
30/10/2014	0.998632
31/10/2014	0.998594
01/11/2014	0.998619
02/11/2014	0.998630
03/11/2014	0.998621
04/11/2014	0.998638
05/11/2014	0.998644
06/11/2014	0.998642
07/11/2014	0.998634
08/11/2014	0.998636
09/11/2014	0.998636
10/11/2014	0.998647
11/11/2014	0.998612
12/11/2014	0.998630

Gas Day	Daily Correction Factor
13/11/2014	0.998650
14/11/2014	0.998653
15/11/2014	0.998660
16/11/2014	0.998650
17/11/2014	0.998654
18/11/2014	0.998627
19/11/2014	0.998639
20/11/2014	0.998648
21/11/2014	0.998654
22/11/2014	0.998598
23/11/2014	0.998638
24/11/2014	0.998669
25/11/2014	0.998643
26/11/2014	0.998667
27/11/2014	0.998670
28/11/2014	0.998647
29/11/2014	0.998652
30/11/2014	0.998666
01/12/2014	0.998698
02/12/2014	0.998665
03/12/2014	0.998695
04/12/2014	0.998686
05/12/2014	0.998655
06/12/2014	0.998712
07/12/2014	0.998687
08/12/2014	0.998686
09/12/2014	0.998681
10/12/2014	0.998653
11/12/2014	0.998683
12/12/2014	0.998677
13/12/2014	0.998690
14/12/2014	0.998664
15/12/2014	0.998647
16/12/2014	0.998684
17/12/2014	0.998640
18/12/2014	0.998655
19/12/2014	0.998692
20/12/2014	0.998722
21/12/2014	0.998681
22/12/2014	0.998681
23/12/2014	0.998701
24/12/2014	0.998675
25/12/2014	0.998701
26/12/2014	0.998729
27/12/2014	0.998718

Gas Day	Daily Correction Factor
28/12/2014	0.998687
29/12/2014	0.998705
30/12/2014	0.998636
31/12/2014	0.998655
01/01/2015	0.998653
02/01/2015	0.998676
03/01/2015	0.998684
04/01/2015	0.998684
05/01/2015	0.998695
06/01/2015	0.998678
07/01/2015	0.998679
08/01/2015	0.998676
09/01/2015	0.998668
10/01/2015	0.998679
11/01/2015	0.998730
12/01/2015	0.998707
13/01/2015	0.998700
14/01/2015	0.998695
15/01/2015	0.998712
16/01/2015	0.998714
17/01/2015	0.998743
18/01/2015	0.998700
19/01/2015	0.998731
20/01/2015	0.998690
21/01/2015	0.998697
22/01/2015	0.998697
23/01/2015	0.998716
24/01/2015	0.998734
25/01/2015	0.998736
26/01/2015	0.998729
27/01/2015	0.998747
28/01/2015	0.998758
29/01/2015	0.998708
30/01/2015	0.998750
31/01/2015	0.998767
01/02/2015	0.998751
02/02/2015	0.998720
03/02/2015	0.998760
04/02/2015	0.998745
05/02/2015	0.998755
06/02/2015	0.998768
07/02/2015	0.998758
08/02/2015	0.998721
09/02/2015	0.998746
10/02/2015	0.998739

<b>Gas Day</b>	<b>Daily Correction Factor</b>
11/02/2015	0.998726
12/02/2015	0.998734
13/02/2015	0.998713
14/02/2015	0.998711
15/02/2015	0.998720
16/02/2015	0.998756
17/02/2015	0.996933
18/02/2015	0.997817*
19/02/2015	0.998702
20/02/2015	0.998700
21/02/2015	0.998723
22/02/2015	0.998765
23/02/2015	0.998733
24/02/2015	0.998716
25/02/2015	0.998717
26/02/2015	0.998709
27/02/2015	0.998742
28/02/2015	0.998704
01/03/2015	0.998722
02/03/2015	0.998750
03/03/2015	0.998734
04/03/2015	0.998735
05/03/2015	0.998756
06/03/2015	0.998712
07/03/2015	0.998702
08/03/2015	0.998747
09/03/2015	0.998775
10/03/2015	0.999495
11/03/2015	0.999255
12/03/2015	0.999612