GL Noble Denton

Aberdeen SMER Methodology

16th July 2012

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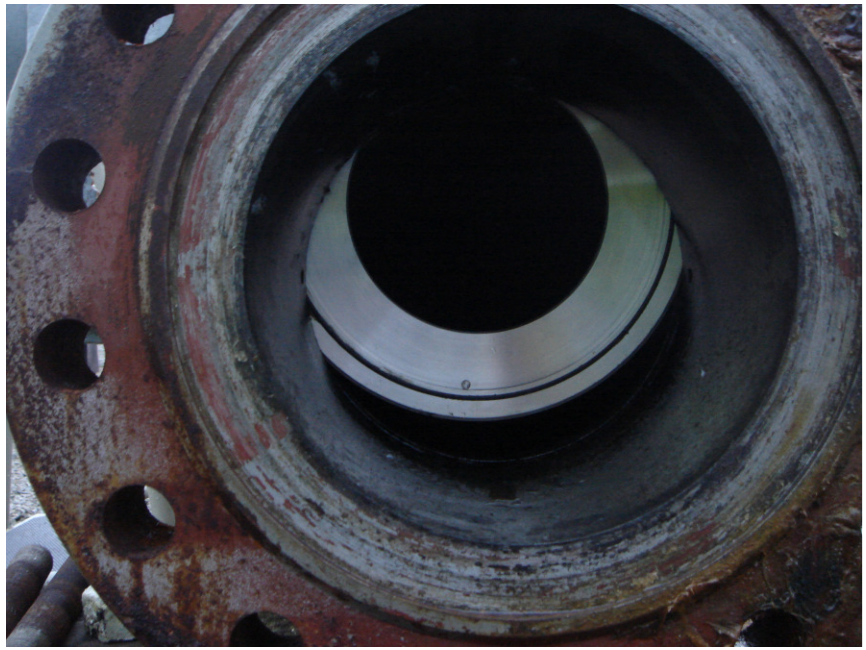
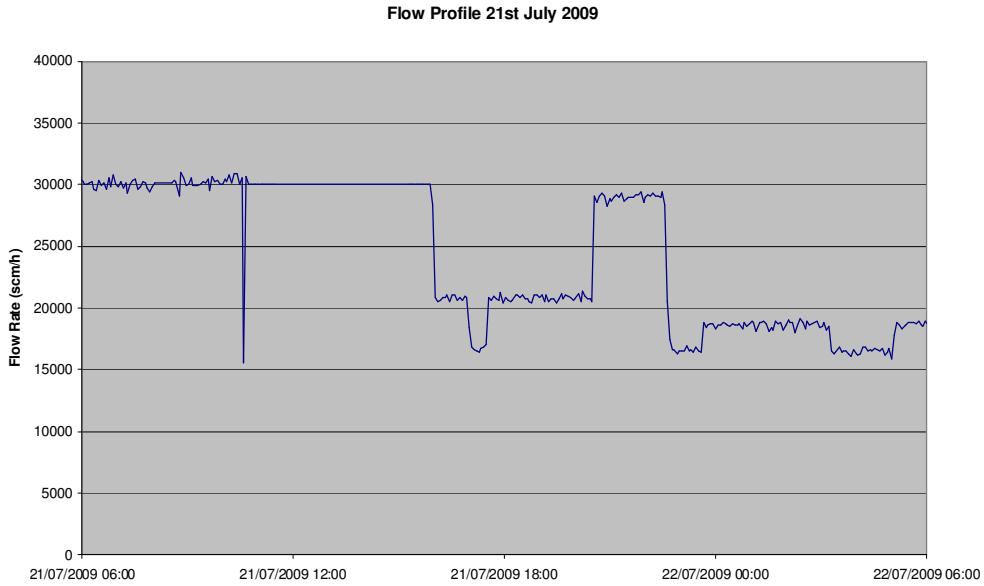
Background

- 21st July 2009 – Problem was introduced at orifice plate change
- 27th July 2010 – Orifice plate was changed but error persisted
- 7th August 2010 – Fault initiated at Aberdeen AGI
  - Comparison of hourly volume (21 kscm) to line pack (32 kscm)
- 10th August 2010 – Fault corrected
  - Incorrect counter reading (99950) was identified on orifice plate carrier
  - Orifice plate set to counter reading of 00000



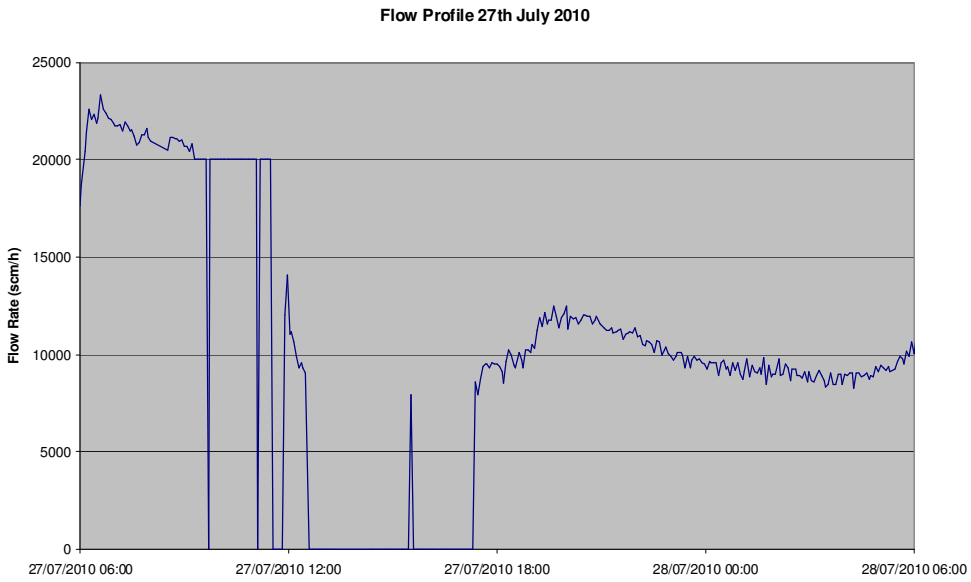
Background

- 21st July 2009 – Problem was introduced at orifice plate change
  - ~30 kscm/h site flow prior to plate change
  - Fixed flow (30 kscm/h) recorded for duration of plate change
  - ~21 kscm/h site flow following plate change



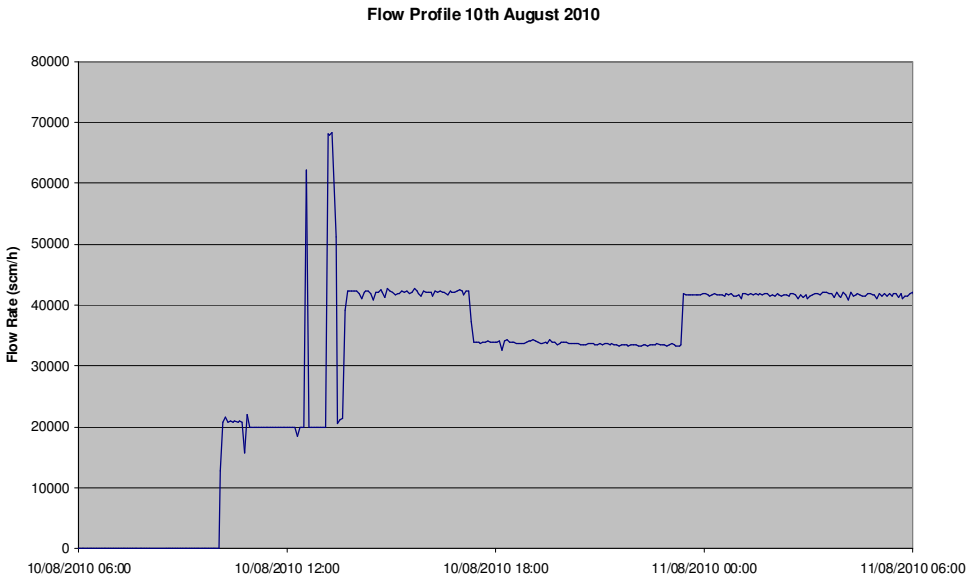
Background

- 27th July 2010 – Orifice plate was changed
  - Transient flow rate before and after plate change
  - No direct comparison available



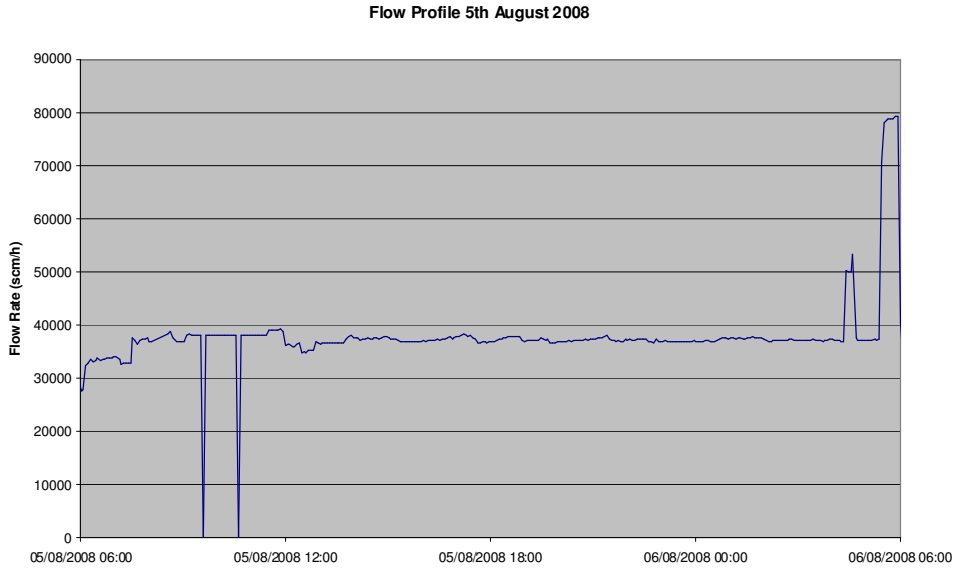
Background

- 10th August 2010 – Fault corrected
  - ~20 kscm/h site flow prior to correction
  - Fixed flow (20 kscm/h) recorded for duration of correction
  - ~42 kscm/h site flow following correction



Background

- 5th August 2008 – Correct orifice plate change
  - ~38 kscm/h site flow prior to plate change
  - Fixed flow (38 kscm/h) recorded for duration of plate change
  - ~38 kscm/h site flow following plate change



Background

- Counter reading at 99950 for July 2010 to August 2010
- Step changes suggest different counter reading for July 2009 to July 2010
- Most plausible counter reading for this period is 99985
  - Instruction plate on carrier includes 99885
  - Non-punched text is barely legible
  - 99885 relates to position in top chamber

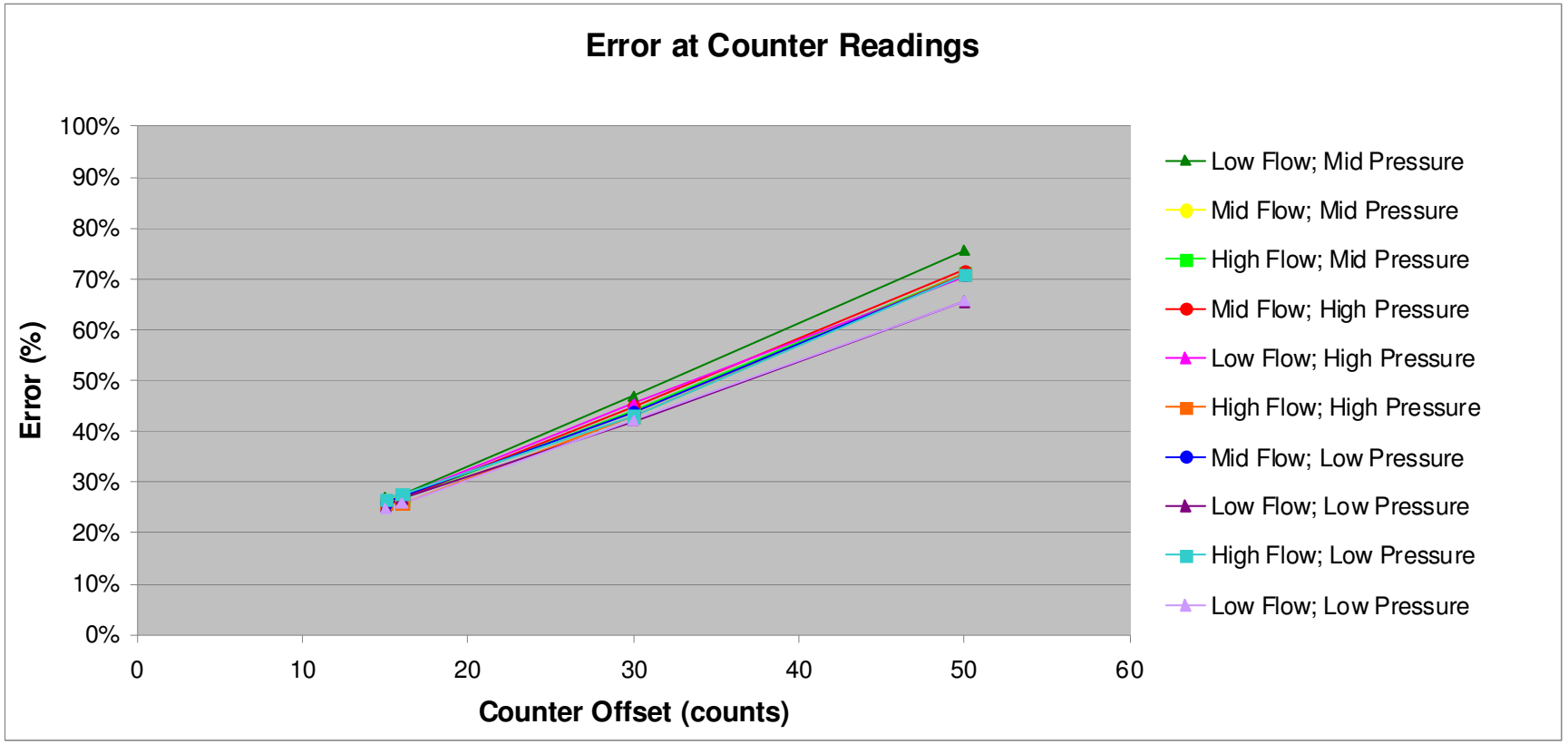
On-site Testing

- Carrier Checks
  - Verified counter reading at correct location of plate
  - Measured position of plate relative to counter readings
  - Gathered some geometrical data from carrier
- Flow Tests
  - Pressure maintained by upstream party
  - Set FCV to fix flow rate
  - Positioned plate at various counter readings (removal and insertion)
  - Logged process data (DP, erroneous flow rate, etc)
  - Repeated for 3 different flow rates at 3 different pressures
  - Some instability in flow rate and pressure (pre- and post-check)

On-site Test Initial Results

- Flow Rate Instability
  - Linear correction applied to results for change in flow rates between start and end of testing
- Flow Test Results
  - Initial calculations indicate that the errors seem to be insensitive to pressure and flow rate at most points
  - Exception is low pressure, low flow rate points (which were successfully reproduced a second time)
  - Uncertainty levels increase rapidly at low differential pressures (low flow rates)

On-site Test Initial Results



CFD Modelling

- Dimensional data provided to independent CFD specialist to create model
- Known good process data provided to validate model

Work completed

- Results produced for (incorrect) counter positions
- Model re-validated (if necessary) against unused flow test points
- Refined results produced for (incorrect) counter positions
- Results compared against on-site test results

Work ongoing

Calculation of Error

- Comparison of on-site testing vs. CFD will determine methodology
- Good correlation – will mean the CFD model can be used to predict errors at all pressure and flow rate combinations
- Poor or no correlation – will mean the CFD model is inaccurate and cannot be used. On-site test data will be used to correct for errors
- Other – If the CFD model agrees at certain points but not others then further on-site testing may be required

Calculation of Error

- Errors will be compared to step changes at orifice plate changes to support the suspected counter readings
- If error is found to be insensitive to pressure and flow rate then a single correction factor can be applied to the billed volumes for each period of the error. Indications from on-site testing are that this is the case.
- Dependency on pressure or flow rate will lead to correction of data on a 4-minutely basis from the RBD data

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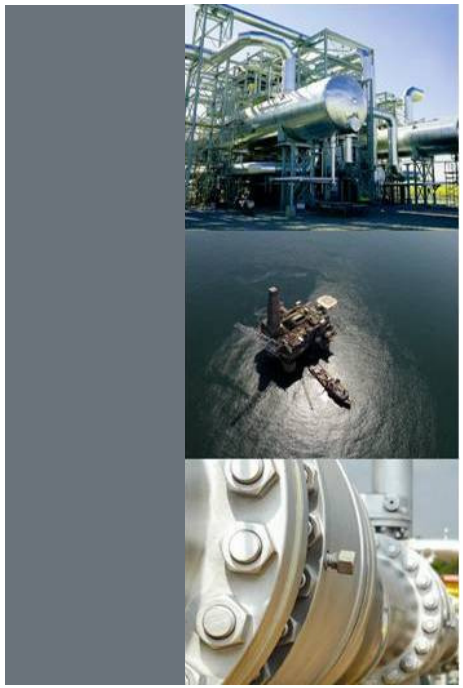

Thank you

Ben.Kirkman@GL-Group.com