From: Havstad, Mark A.
To: Dykhuizen, Ronald C; Miller, Wayne O.; Morrow, Charles W
Sent: 7/27/2010 3:00:22 PM
Subject: RE: flow variation calibration of total flow

Wasn't it sec. chu who said "you go to the well with the model and data you have, not the model and the data you wish you had?"

Wasn't it sec. chu who said "there are known unknowns and there are unknown unknowns and there are …..

You and morro could might more shamelessly use models to guess at stuff that otherwise is unguessable

But then that would mean ….

On my farm there are tractors and turkeys and other stuff.

There are no models. Either the tractor runs or it does not. Turkeys go to market and costs exceed revenues

Or they do not.

This may or may not make sense to you all

I do not intend to waste more of your time today

From: Dykhuizen, Ronald C [mailto:rcdykhu@sandia.gov]
Sent: Tuesday, July 27, 2010 7:35 AM
To: Havstad, Mark A.
Subject: RE: flow variation calibration of total flow

Thanks. Maybe if I looked harder at your email I could have figured it out. I like that if we had any real data. The models typically assume that the friction is proportional to rho*V*V, but the proportional constant is changing due to changes in the Reynolds number. So the model results would not be exactly represented by K*Q^2 since rho changes and the proportional constant changes.

What you suggest is something to think about. I am open to any suggestions.

However:

1. We do not know the parameters that K is dependent upon

a. Is K a function of delta P, or is it a function of the liquid volume fraction

b. Is K a function of the change in the liquid volume fraction across the device

2. The model results are equally suspect as the K formulation, so I do not think we can use

model results to find any derivatives.

Ron

From: Havstad, Mark A. [mailto:havstad1@llnl.gov]
Sent: Tuesday, July 27, 2010 8:09 AM
To: Dykhuizen, Ronald C
Subject: RE: flow variation calibration of total flow

Sorry I was thinking this stuff I was doing for something else was useful here

My points would be these

1) The method assumes K with delP1 is the same as K with delP2. Use taylor series to investigate size of this error.

2) One could use pressure drop vs. flow calculations from one of the other methods to estimate possible deviation from Q squared assumption

From: Dykhuizen, Ronald C [mailto:rcdykhu@sandia.gov]
Sent: Tuesday, July 27, 2010 7:01 AM
To: Havstad, Mark A.
Subject: RE: flow variation calibration of total flow

Sorry, I am lost. Do you mean "sum" instead of integral? Where are these pressures coming from? Method 1 is only through the Kill valve and only involves 2300 and 2600 psi measurements (plus ambient). I have no idea what your point is.

Ron

From: Havstad, Mark A. [mailto:havstad1@llnl.gov]
Sent: Tuesday, July 27, 2010 6:50 AM
To: Dykhuizen, Ronald C
Subject: RE: flow variation calibration of total flow

I am looking at

delP1 = K1 x Q^2

delP2 = K2(Q^2+d+g)

K2 = K1+ dK1/Dp x deltaP + dK1/deltaRo x deltaRo+.....

Or

K is actually an integral over length involving diams and p's and ro's

Kg/sec P_hi P_lo delP/(Q^2)

134.2

8168

2974

0.288401

114.4

6919

2651

0.326116

111

6920

2826

0.332278

89.3

8173

4953

0.403788

75.2

6924

4197

0.482225

42.6

6926

4902

1.115299

22.7

6927

5128

3.491238

4.4

6927

5171

90.70248

From: Dykhuizen, Ronald C [mailto:rcdykhu@sandia.gov]
Sent: Monday, July 26, 2010 2:38 PM
To: Havstad, Mark A.
Subject: RE: flow variation calibration of total flow

This is method 1. You have now seen it. Let me know of any improvements.

My major problem with method 1 is quantifying the error. It is simple to put an error on pressure and rerun the calculation. However, that assumes that the model is accurate.

I do not know what accuracy to assign to accepting the model equations: DP=K*Q^2 ; should I modify it to DP=K*Q^1.9? I doubt it. Any help would be appreciated.

I see that your results in the choke line analysis peaks a bit higher than Charlie and Curt? Is that due to inconsistent use of K and area in your model, or is all that fixed now?

Ron

From: Havstad, Mark A. [mailto:havstad1@llnl.gov]
Sent: Friday, July 23, 2010 8:49 PM
To: Dykhuizen, Ronald C
Subject: FW: flow variation calibration of total flow

Ron

Hunter asked me to look at this fluid 101/301 thing

I was ignoring it

Can you send me everything on it?

Sorry

mark

From: hunsaker61@comcast.net [mailto:hunsaker61@comcast.net]
Sent: Tuesday, July 20, 2010 8:12 PM
To: Ronald C Dykhuizen
Cc: Anne K Chavez; Chief.SMU@noaa.gov; steven.aoki@nnsa.doe.gov; Michael J. Burns (LANL); Chinn, Diane J.; schu@hq.doe.gov; gcooper@berkeley.edu; Bryan.Domangue@mms.gov; rlg2@us.ibm.com; richard_l._garwin@ostp.eop.gov; Ray M. Guffee (LANL); lars.herbst@mms.gov; hickman@usgs.gov; John_P._Holdren@ostp.eop.gov; pahsieh@usgs.gov; Tom Hunter; arun.majumdar@hq.doe.gov; mcnutt@usgs.gov; Ray_merewether@seektech.com; mooney@usgs.gov; kathryn_moran@ostp.eop.gov; rod.oconnor@hq.doe.gov; craig.pohler2@mms.gov; tony.rediger@hq.doe.gov; Michael.Saucier@mms.gov; william.shedd@mms.gov; slocum@mit.edu; slocum42@gmail.com; Rick Stulen; Troy.Trosclair@mms.gov; sam.walker@noaa.gov; Curtt N. Ammerman (LANL); Christina B. Behr-Andres (LANL); Stephen J. Black (LANL); Douglas A Blankenship; Amy D Bowen; Bowers, Joel M.; Nathan K. Bultman (LANL); kevin.s.cook@uscg.mil; Paul S. Dunn (LANL); Stewart Griffiths; Basil Hassan; Havstad, Mark A.; Kathleen T Hurst; Drew E. Kornreich (LANL); Miller, Wayne O.; Charles W Morrow; Donald Q. O'Sullivan (LANL); missy.owens@hq.doe.gov; Perfect, Scott A.; Arthur C Ratzel; William S. Jr. Rees (LANL); James Rae Jr. Sims (LANL); Marjorie Tatro; Sheldon R Tieszen; Wapman, Derek; Warner, Bruce
Subject: Re: flow variation calibration of total flow

Ron

I agree with all your uncertainties. Also there is the simple concern that the pressure and flow at the ship during the change have inaccuracies

I stated that it needed to be corrected for the new pressure change across the stack to get back to the pre cap flow.

This analysis is of course for the case when only the kill valve was open and the collection of the Q and HP were taken to zero. I used the average of the two gages and one is now believed to agree with the ambient calibration. Perhaps wayne and you analysts could get the most accurate reading of the pressure change and the flow to the Q and HP which are the only two variables.

You have already analyzed the pre and post riser once and are an expert at it. My question for you is : is the basic approach sound and did I do the algebra correctly. If so I would agrue that it is the most accurate of all estimates since the physical flow circuit is eliminated by division and the deviation from the same state is small at these pressure changes. would welcome your thoughts.

I entitled the first description as Fluids 101 if you agree with the approach, can I raise it to Fluids 301

tom

----- Original Message -----
From: "Ronald C Dykhuizen" <rcdykhu@sandia.gov>
To: "Anne K Chavez" <akchave@sandia.gov>, "Chief.SMU@noaa.gov" <Chief.SMU@noaa.gov>,

"steven.aoki@nnsa.doe.gov" <steven.aoki@nnsa.doe.gov>, "Michael J. Burns (LANL)" <burns_michael_j@lanl.gov>, "chinn3@llnl.gov" <chinn3@llnl.gov>, "schu@hq.doe.gov" <schu@hq.doe.gov>, "gcooper@berkeley.edu" <gcooper@berkeley.edu>, "Bryan.Domangue@mms.gov" <Bryan.Domangue@mms.gov>, "rlg2@us.ibm.com" <rlg2@us.ibm.com>, "richard_l._garwin@ostp.eop.gov" <richard_l._garwin@ostp.eop.gov>, "Ray M. Guffee (LANL)" <guffee@lanl.gov>, "lars.herbst@mms.gov" <lars.herbst@mms.gov>, "hickman@usgs.gov" <hickman@usgs.gov>, "John_P._Holdren@ostp.eop.gov" <John_P._Holdren@ostp.eop.gov>, "pahsieh@usgs.gov" <pahsieh@usgs.gov>, "Tom Hunter" <tohunte@sandia.gov>, "hunsaker61@comcast.net" <hunsaker61@comcast.net>, "arun.majumdar@hq.doe.gov" <arun.majumdar@hq.doe.gov>, "mcnutt@usgs.gov" <mcnutt@usgs.gov>, "Ray_merewether@seektech.com" <Ray_merewether@seektech.com>, "mooney@usgs.gov" <mooney@usgs.gov>, "kathryn_moran@ostp.eop.gov" <kathryn_moran@ostp.eop.gov>, "rod.oconnor@hq.doe.gov" <rod.oconnor@hq.doe.gov>, "craig.pohler2@mms.gov" <craig.pohler2@mms.gov>, "tony.rediger@hq.doe.gov" <tony.rediger@hq.doe.gov>, "Michael.Saucier@mms.gov" <Michael.Saucier@mms.gov>, "william.shedd@mms.gov" <william.shedd@mms.gov>, "slocum@mit.edu" <slocum@mit.edu>, "slocum42@gmail.com" <slocum42@gmail.com>, "Rick Stulen" <rhstule@sandia.gov>, "Troy.Trosclair@mms.gov" <Troy.Trosclair@mms.gov>, "sam.walker@noaa.gov" <sam.walker@noaa.gov>, "Curtt N. Ammerman (LANL)" <ammerman@lanl.gov>, "Christina B. Behr-Andres (LANL)" <behr-andres@lanl.gov>, "Stephen J. Black (LANL)" <sblack@lanl.gov>, "Douglas A Blankenship" <dablank@sandia.gov>, "Amy D Bowen" <adbowen@sandia.gov>, "bowers2@llnl.gov" <bowers2@llnl.gov>, "Nathan K. Bultman (LANL)" <nbultman@lanl.gov>, "kevin.s.cook@uscg.mil" <kevin.s.cook@uscg.mil>, "Paul S. Dunn (LANL)" <pdunn@lanl.gov>, "Stewart Griffiths" <skgriff@sandia.gov>, "Basil Hassan" <bhassan@sandia.gov>, "havstad1@llnl.gov" <havstad1@llnl.gov>, "Kathleen T Hurst" <kthurst@sandia.gov>, "Drew E. Kornreich (LANL)" <drewek@lanl.gov>, "miller99@llnl.gov" <miller99@llnl.gov>, "Charles W Morrow" <cwmorro@sandia.gov>, "Donald Q. O'Sullivan (LANL)" <dqosulli@lanl.gov>, "missy.owens@hq.doe.gov" <missy.owens@hq.doe.gov>, "perfect1@llnl.gov" <perfect1@llnl.gov>, "Arthur C Ratzel" <acratze@sandia.gov>, "William S. Jr. Rees (LANL)" <wsr@lanl.gov>, "James Rae Jr. Sims (LANL)" <jsims@lanl.gov>, "Marjorie Tatro" <mltatro@sandia.gov>, "Sheldon R Tieszen" <srtiesz@sandia.gov>, "wapman1@llnl.gov" <wapman1@llnl.gov>, "warner2@llnl.gov" <warner2@llnl.gov>
Sent: Tuesday, July 20, 2010 8:11:46 PM
Subject: flow variation calibration of total flow

At the science team meeting tonight, Secretary Chu mentioned that there was a calculation of the total flow from the leaking BP well that provides a concise estimate of the flow. I have reviewed this calculation. The review is attached. I have not come up with a error estimate for this calculation at this point, but I have itemized a few sources of errors that were not considered. Please review.

Also attached is some work done by S. Griffiths. He tried to fit a linear line (Fit 1) to the BOP pressure gauge for the time period from June 4 to July 4. In this period there were no known changes to the well geometry that might alter the pressure. As you will see Fit 1 on slide 1 shows a decrease of 16 psi per day. That is larger that what we would expect based on 40% of 2000 psi in 85 days (~9psi/day).

ron