From: "Griffiths, Stewart" <skgriff@sandia.gov>
To: "Dykhuizen, "Ronald C" <rcdykhu@sandia.gov>
Cc: "Griffiths, Stewart <skgriff@sandia.gov>
Bcc:
Date: 08/11/10 12:25:13 pm
Subject: Re: well flow rates and total discharge
Attachments:

Thanks Ron.

I do assume that the parameters do not change with conditions, and I do also understand the perils of simple "curve fitting" and using the results outside the range of applicability. But I do not think either of these are the case here.

Sounds like maybe you have interpreted rho* as related to the static head. It is not. This "density" has almost no relevance to shut in conditions, but is instead influenced mostly by flow rates when they are highest. The nearly shut-in conditions with little flow influence mostly the estimated reservoir pressure, and I determine this only without the static head (its not needed for any of the calculations).

As for "curve fitting," the model reproduces all pressures through the shut in very well, I think, and those conditions span all of the conditions relevant to the 87 days except for the varying reservoir pressure. So I don't see any significant issues here with extrapolation outside the applicable range. And, I don't I don't see any issues with aphysical parameters. All of the parameters I get seem to be in good agreement with estimates from other sources over widely differing conditions.

Finally, the +/-80 is not an error estimate. This is simply the range in total flow given +/- 10 psi on the choke gauge measurement. That seems to be what the LANL/LLNL numbers are too – sensitivities really, not errors. The value I get is very small because the delta-p between the reservoir and choke is big.

Thanks again,
Stewart

On 8/11/10 7:55 AM, "Dykhuizen, Ronald C" <rcdykhu@sandia.gov> wrote:

> I do not think you fully understood my question. I suspected that the density was simply a fitting factor. However, your whole approach seems to assume that these fitting factors do not change with the various conditions that you use to determine them. It seemed to me that the density is closely tied to the final shut in condition, for then all of the flow pressure drops are zero, and you are not sensitive to the flow losses. So the only way you can fit the final shut in condition is by choice of the fluid density. It is at this point that the fluid density is known, and it is not 0.465.
>
> I like your approach, and I use it often to interpret experimental measurements. However, if the parameter that I find is non-physical (i.e. a heat transfer problem where a negative emissivity provides the best fit of the data), then one might question the model. The model at that point becomes a curve fitting exercise, and if one has enough free parameters, then you can fit any data set (even if the model is bad). Extrapolation of such a model beyond the range of the data then is very suspect.
>
> Another question from your original slide presentation:
>
> Why do you report such small error (+/- 80) on the flow rates? This appears in 4 places on slide 5. Is that what you determine? I do not know anybody that would justify such a small number.

Ron

From: Griffiths, Stewart
Sent: Tuesday, August 10, 2010 9:45 PM
To: Dykhuizen, Ronald C
Cc: Griffiths, Stewart
Subject: Re: well flow rates and total discharge

Ron,
Thanks much for looking at this and for your questions. They are good ones. I am afraid the answers are not terribly straightforward, so I wrote them up in the attached file. Would very much like to hear your thoughts on all this. Would also like to send this to the others as it provides some detail that is clearly missing in the slides.
Thanks again,
Stewart

On 8/10/10 3:52 PM, "Dykhuizen, Ronald C" <rcdykhu@sandia.gov> wrote:
A lot of interesting work. However, I do have a question.

You do not seem to indicate what you used for an equation of state. Do you use a fluid density of ~0.4 for all conditions, including shut in. When the well is not flowing the pressure is high enough everywhere that the fluid is a liquid. At almost every other time, the pressure is low enough that the fluid is two phase. Only during the two phase conditions would your 0.4 density make sense. When the fluid is liquid, the density is 0.6, which is significantly different. I would assume that this might impact your results.

Ron

From: Griffiths, Stewart
Sent: Tuesday, August 10, 2010 4:03 PM
To: Ammerman, Curtt N. (LANL); Ratzel, Arthur C; Havstad, Mark A.; Dykhuizen, Ronald C; Wayne Miller; Morrow, Charles W
Cc: Griffiths, Stewart
Subject: well flow rates and total discharge

Art and All,

Don't know how much interest remains in flow rates and total discharge, but I have spent some time looking at this over the past week or so at home. What I did was estimate the historical flow rates using measured BOP pressures via a "self-consistent" model. Parameters in the model were chosen to replicate the shut-in process. Instantaneous flow rates were then integrated to give the total discharge.

This worked out much better than expected (given BOP gauge issues), and I think the numbers here are pretty credible. A description of the approach and various results are in the attached slides. Comments, questions, criticisms, etc. are welcomed.

Thanks,
Stewart