From: Griffiths, Stewart
To: Ratzel, Arthur C; Tatro, Marjorie
CC: Griffiths, Stewart
Sent: 9/28/2010 4:51:22 PM
Subject: FW: summary of your model

Art and Margie,

Here is an e-mail exchange with Ron from this morning. I am getting tired of this and find his behavior overtly antagonistic rather than helpful. His arguments are largely misguided, I think, and the language he is using is inappropriate. He accused me yesterday of using an "implicit fudge factor" by stopping work on the model once I had an answer that looked credible. Say what? Here he accuses "errors" in the model.

You folks will need to decide what (if anything) to do with my analysis. The truth is I don't much care as my only intention was to help out in whatever way I could. For my part, I will push on to get this finished as a Sand report. I will gladly respond to any concerns/question you two have, but am pretty much done arguing with Ron.

Thanks,
Stewart

------ Forwarded Message
From: Stewart Griffiths <skgriff@sandia.gov>
Date: Tue, 28 Sep 2010 10:27:16 -0600
To: "Dykhuizen, Ronald C" <rcdykhu@sandia.gov>
Cc: Stewart Griffiths <skgriff@sandia.gov>
Subject: Re: summary of your model

Ron,

Thanks for your time in our discussion yesterday afternoon and for your comments here. While I do appreciate this, I feel that you do not yet really understand my model and, at this point, are leveling strong criticisms of the model that have little basis in fact. Further, I do not believe there are any "errors" in this model as you state, but rather "assumptions" or "approximations" like those in any model. I remain convinced that these assumptions are justified over the range of conditions of interest and that this is demonstrated satisfactorily in my report, which I suggest you read.

In reply to your comments:

(1) I do assume that the static head between the BOP and bottom of the well does not change significantly over the 86-day history or during the few hours of the shut in process. You argued yesterday that the static head would change significantly during shut-in such that the reservoir pressure I use is therefore wrong. I certainly agree that changes in flow rate do affect the static head but do not feel that these changes are large enough over the conditions of interest to significantly affect my results. This holds even during shut-in as evidenced by the fact that flow rates computed using pressure differences between the reservoir and BOP and those computed using the difference between the capping-stack and ambient sea agree very well with one another throughout the shut-in process. This would not be possible if the static head changed significantly as the choke was closed because large changes in static head would strongly affect flow between the reservoir and BOP but not that between the capping-stack and sea.

(2) The BOP pressure offset is not an adjustable parameter. Once I assume that the static head is unchanging, the offset in the BOP pressure is already determined by the measured capping-stack pressure just at shut-in. From my report: "Also note that the BOP pressures after day 82 were offset by -620 psi due to field repairs to the gauge that resulted in a loss of the reference pressure. This was clearly evident in the data as the appearance a sudden offset of +612 psi in the pressures between the 11th and 13th of July when the repairs were made. The value of -620 psi for the offset used here is based on reconciling the BOP gauge with that in the capping stack (PT_3K_2) at the end of the shut-in process, thus also

eliminating any differences in static head."

(3) In fact I do not use a PI of 50. The PI is 47.2, which was determined in the process of matching flow rates along discrete legs of the flow path using the measured BOP, capping-stack, and ambient pressures.

I have already considered the possibility of using a realistic EOS in my model, but at this point feel it is not worth the effort as (I estimate) it will reduce uncertainty by just 3%. And, I agree with you the labs calculations showing "The increasing flow rate at the beginning of the transient [as choke is closed] is very troubling." This could be real, but I suspect this is an artifact of using an equilibrium EOS whereas frozen composition might be more appropriate. My results, based on the assumption of constant density, do not show this anomalous behavior.

Stewart

On 9/28/10 8:00 AM, "Dykhuizen, Ronald C" <rcdykhu@sandia.gov> wrote:

Federal Record

I would like to summarize my comments since I had to leave in a hurry yesterday.

I do not think your analysis provides an independent calculation of the flow rate at any time in the accident response due to errors in the model. Let me itemize them:

1. The model assumes a constant elevation head when the elevation head is changing. You essentially calculate the elevation head at the no flow condition, and then apply it at flowing conditions.

2. The model has at least two adjustable parameters. The K in the BOP (and likely elsewhere), and the pressure offset. This allows your model to calculate the flow consistently (the same no matter what pairs of pressure you use) at the beginning time and the end of time (zero flow). Since the formulations use similar functional forms, they do not vary significantly between each other in between these extremes. So the agreement does not convince me that the model is correct.

3. You use PI of 50. There is no basis for that except that it yields an answer similar to other work. There is no data base on what is the correct PI to use. If you attempted this calculation with earlier information, you would be using a significantly lower PI and obtain a lower flow rate. The PI is unknown, and this has prevented anybody from using the part from the reservoir (pressure) to any pressure (BOP, sea water, etc.) to calculate a flow rate. At best, one can use an infinite PI and calculate a maximum flow. Or one can model the flow within the reservoir to estimate an upper limit on PI and calculate a more realistic maximum flow. But the resistance across the damaged concrete plug is unknown, and potentially important.

An interesting point you might consider is that you have demonstrated that the BOP pressure gauge behaves reasonably since it goes up when the capping stack gauge rises. You do not need your model to demonstrate that, you can simply plot them together and see that there is a good correlation. You have adjusted the offset and then called it good. Here is a thought experiment. You can also adjust the sensitivity (1 psi change is really 1.2 psi), and then redo your calculation. I can confidently predict that you will find a sensitivity adjustment other than unity that will make your model agreement better. This is simply because you have another free parameter. However, it does not justify changing the sensitivity.

I think that there is use for your modeling efforts in at least two areas. The model might be used as is, or modified to use a more detailed equation of state. I think your demonstration that the BOP pressure readings are very consistent with a declining reservoir pressure is very informative. This will allow more confidence in the flow integral from time zero. I also am interested in how your shut in flow declines (or rises) with closing of the choke valve. This might give us additional insight in the errors in the capping stack calculation of the flow rate. The increasing flow at the beginning of the transient is very troubling.

Ron

------ End of Forwarded Message