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