

**From:** Ratzel, Arthur C  
**Sent:** Tuesday, August 03, 2010 10:52:24 PM  
**To:** Dykhuizen, Ronald C  
**CC:** Tatro, Marjorie; Ratzel, Arthur C; Charles, Barry G. (LANL)  
**Subject:** write-up

Thanks Ron - this write-up helped me as well. Our discussions on Thursday night led me to represent your story hopefully reasonably well on Friday - some of the key assumptions were initially a little challenging for me, e.g., how you established the magnitudes of the laminar and turbulent portions of the "realistic" form of the friction model, but our discussions and my follow-on review convinced me you were well in the ball-park, bracketing all laminar or all turbulent cases. Actually, this is an extremely clever approach in my view since it took the direct use of the geometry again out of the calculations.

My reading is that the increase of 4.5% is, frankly the same number (10-15% would have been a different situation obviously!). The key to your number is the starting point of 53K kppd which you predicted via the lift side differential pressure/differential flow analyses. Since we also ran those numbers using pipe flow simulations, 53K was really a point between a range of values that both you and Wayne computed. Additionally, you both had an uncertainty that spanned +/- several K kppd. So for me the important point is that we recognized the need to adjust to an increased flow for the times prior to when the cap was installed. Moreover, when I compared your more detailed "Reservoir-to-well" results and those of Navstad's, the range on the flow exiting the BOP were also around 4-5% greater than when the flow was through the capping stack, depending upon which model you trusted more. 4% seemed as good as 5%, and certainly better than 10%.

It does raise the issue I believe all of the analyst team, including yourself, raised - the uncertainty in the starting numbers themselves. We all still have concerns over some of our assumptions that we need to continue to review - the work reported clearly represents a "nominal" best estimate.

Margie - we can talk more about this if needed but I believe our numbers put in the summary table near the end of the DOE Flow Analysis report show the bands - nominals were wanted and

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