Optimize Pipeline Hydraulics with Multiphase Flow Modeling

Below are questions asked by attendees during the webinar on February 22, 2012, followed by answers provided by our presenters.

- **Will you also be discussing scaling, paraffin/wax solids deposition in pipe flow?**
  The existing capability addresses wax or paraffin deposition, not yet scaling. We have developed the thermodynamic framework and data for scaling, but it is not yet available inside the pipeline. These data and methods are in the Electrolyte NRTL model of Aspen Properties®.

- **How does the Aspen HYSYS® model choke flow in a multiphase blowdown/relief situation?**
  In Hydraulics, the multiphase choking calculation is based on a paper by Henry and Fauske (1971).

- **We need accurate prediction of slug sizes and slug velocities to design pipe supports. How is this information obtained from the model?**
  You can obtain this information from the Slug page of the Flow assurance tab.

- **Wellhead production is a mixture of oil+gas +water+suspended solids (silica) in varying proportions. Most multiphase flow problems do not consider solids. They may not influence the flow regime but cause significant erosion. Is there a way to tackle this?**
  We do not currently support this, but methods exist and we will look into incorporating these in a future version.

- **Would this apply to two-phase flow from a geothermal well?**
  We believe the methods we have will equally apply to flow from a geothermal well.

- **Are the tools being discussed in the webinar suitable to evaluate typical piping hydraulics within a refinery/plant?**
  Yes, they are.

- **What is the minimum pipe length you should model using this software for a refinery / plant piping network?**
  There isn't a specific limitation, and for single phase flow any length can be used. But, for multiphase flow, most correlations apply to a pipe that has settled in a certain regime and for short pieces of pipe this will not have occurred.

- **I would like to calculate any water hammer issue and capability of Aspen HYSYS to transfer those data in piping Stress software.**
  Aspen HYSYS is currently not recommended for water hammer calculations.

- **How do you model a wellhead?**
  In Aspen HYSYS V7.3 you will find a wellhead curve unit operation.

- **What is the most reliable correlation in PIPESYS to predict the liquid hold-up of a gas/cond. pipeline? I have compared the results of Beggs and Brill with OLGAS, and there were huge differences, especially at low gas flowrates.**
  It is indeed the correlation that is important. Whether you apply that correlation in PIPESYS or in the Aspen HYSYS pipe segment doesn't really make a difference. Between Beggs & Brill and OLGAS, the general consensus is that OLGAS will be more reliable. We believe that the NEW Tulsa correlations will provide accuracy on par with the OLGAS correlation.

- **I compared the results of pipe segment in Aspen HYSYS for a wet gas pipeline of about 18 miles long with actual field data, and found that it over predicts the pressure drop. Other than varying the roughness, what other changes can I make to close the gap?**
  The first item to look at is the correlation used. If you used the default Beggs & Brill correlation, I would not be surprised if there is a significant over prediction. Use the HTFS or the NEW Tulsa methods for a much better match.

- **Aspen HYSYS PIPE module was not recommended for choke flow or flow near sonic velocity. Does the recommendation still apply for the latest HYSYS version?**
  It is best to use Aspen Hydraulics for choked flow conditions.

- **Valve module was not recommended for sizing but CV calculation was implemented? Please explain.**
  The size valve functionality was put in place to provide dynamic modelers a reasonable valve size if the real valve size is not available. It was not intended as a valve sizing tool.

- **Does this discussion apply to Cryogenic applications?**
  Yes.

- **Will the software handle multiphase flows with condensation of vapor phase and vaporization of liquid phase due to either rise in temperature or due to flashing under pressure drop?**
  Yes, it will.

- **Could a result in flow regime change along the pipe?**
  It could. The pipe segment uses multiple increments along the length of the pipe and in that way it can change method if the conditions change significantly along the length of the pipe.

- **In Aspen HYSYS Steady-state, how does HYSYS count for the inlet/outlet nozzle elevations and static head contributions from the major equipment/Unit Operations?**
  In Steady-state it is up to the user to make sure that the profile includes all elevation changes. If that is done, the steady state model will properly account for static head.

- **Are these tools also available in Aspen Hydraulics?**
  Most of the tools discussed in the webinar are available in Aspen Hydraulics.

- **Is Woelflin not available?**
  Woelflin is available. That is the method referred to as "HYSYS" as that is the method that has always been available inside Aspen HYSYS.

- **Is that a single or multiphase network?**
  Both.

- **Was the velocity displayed on the screen with slug flow the slug velocity or the superficial gas velocity? If it is the slug velocity, what method is used to calculate it?**
  It is the velocity of the slug. We have an article that describes the theoretical basis for the slug tool.

- **Is there any difference in Dynamics tab of Aspen HYSYS 7.3 with 7.2? To do pigging frequency or pigging slug analysis?**
  There is not any difference. In Dynamics you can do pigging analysis.

- **If you are modeling say a 50-mile pipeline is there an easy way to put in the elevation profile? Some sort of a copy and paste from Excel or something?**
  No problem with copy and paste. You will have to hit the ADD button the appropriate number of times to create the "space" for your paste, but otherwise pasting from Excel will work fine.

- **How accurate is the wax model? Can we input our own actual wax deposition test results in the model?**
  Wax deposition calculations without any calibration data should be treated with a lot of caution. You can input your own wax deposition test results to calibrate the model.

- **There was mention about the tuning of erosional velocity constant... API 14E formula is dimensionally inconsistent. How does Aspen HYSYS handle it, and how does it relate with the current unit set?**
  You always have to assume field units. That is the basis of the correlation.

- **Is there a pipe fitting or another method to model a restriction orifice?**
  There is such a fitting in the pipe segment AND in Aspen Hydraulics.

- **When inputting the ambient temperature in the heat transfer tab, does the ambient temperature go with the ambient medium? If the pipe is buried, the temperature should be the ground temperature, not the air temperature?**
  The ambient temperature is the temperature of the ambient air or water. For a buried pipe, the ambient temperature should be the air temperature. The heat transfer formula accounts for the burial depths of the pipe.

- **How can we do a simulation (dynamic) for heat gain of stagnant pipe, left for a week, say?**
  You first create a dynamic model of a pipe segment. Usually you would start with a flowing pipe, then shut in the pipe (close the inlet and outlet valve) and let the integrator run for the desired amount of time.

- **It is important to deal with choke flow situation especially for PSV compressible gas or two phases fluid. For the old version, technical support didn't recommend using Aspen HYSYS for near sonic velocity situations. Is this improved in V7.3?**
  It is best to use Aspen Hydraulics for those situations.

- **What about slurries?**
  Aspen HYSYS will not properly model the pressure drop of slurries in pipelines.

- **Instead of ignoring a branch in Aspen HYSYS Hydraulics, can you have zero flow in that branch? This would be easier when using Aspen Worksheet solver.**
  Zero flow will not work, but a very small flow will work. We introduced the option to solve on ignore at the explicit request of several customers. You can activate the "ignore" from the worksheet if you prefer.

- **Does the Aspen Hydraulics subflowsheet refer to the PIPESYS capability from Neotec?**
  No, Aspen Hydraulics is 100% AspenTech technology. Links to the other third-party pipeline modeling software such as Neote's PIPESYS pipeline modeling technology are also available in Aspen HYSYS Upstream.

- **For emulsion viscosity, do you have any more accurate or empirical model for Canada oil sands?**
  We provide you with the equations you can use. If you have viscosity data, it should be relatively straightforward to derive the correct coefficients.

- **Has there been any change to the correlations to allow us to relay believable estimates of slug size without massaging the HYSYS results?**
  We do not think that the Aspen HYSYS V7.2 (or V7.3) slug lengths are unbelievable, but it could be that the time to accumulate the necessary liquid is very long. In such cases it is advisable to check the calculations with a dynamics mode.

- **How can you get an estimation of drain quantity from pipeline scraping process?**
  In the Aspen HYSYS pipe segment and in Aspen Hydraulics, you will get an estimate of the liquid holdup in the pipe that accounts for the liquid slip effect for some correlations. You can use that holdup to make this estimate. The easiest would be to copy/paste the table to Excel and make the calculation in Excel.

- **Can we model pigging?**
  Yes, but only using Aspen Hydraulics in dynamics.

- **Are there any guidelines for the size of the pipe segments in order to get realistic and stable results?**
  HYSYS will issue a warning if the length of an increment is too short to provide accurate results.

- **Is the simulation capable of predicting/analyzing short runs for cryogenic fluids - two-phase bubble-point liquid-gas streams?**
  Yes; however, if the runs are really short, the results of the multiphase pressure drop may be inaccurate.

- **Can we estimate the Liquid hold-up using Pipe segment? Or do we need to use the slug lengths x cross section area to arrive at the liquid hold-ups?**
  You need to use the slug lengths x cross section area.

- **Is it possible to calculate Froude number?**
  That should be easy with a user variable or a spreadsheet.

- **In Flow Assurance, is it possible to view the effect of more than one variable (such as both hydrate formation & Slug Analysis) all on one graphical profile?**
  No, you would have to copy the table results to Excel. A simple copy/paste should allow you to do this.

- **What information is needed for inhibitor consideration in corrosion tool?**
  You directly enter a corrosion reduction factor (K). This is as per the description in the Norsok standard.

- **In the viscosity correlations is it possible to predict the inversion point if we provide lab analysis data for oil viscosity at 3-4 temperatures?**
  Yes, although I would expect you to need data at varying amounts of water as well as temperature.

- **Do I need a separate license for Aspen Hydraulics?**
  You need an Aspen HYSYS Upstream license.

- **For wax deposition option: What is considered as input for fluid definition? Is cloud point the result taken from the visual test or does it refer to WAT? Is it necessary to make any special fluid definition or indicate any wax forming component so as the tool is able to calculate wax deposition?**
  Aspen HYSYS will automatically select the wax forming components unless you define a wax composition yourself. If you do not provide any extra data, HYSYS will estimate the cloud point, but do not expect much accuracy. You need to enter the cloud point or a wax precipitation curve to get accurate results.

- **Dynamic capability of pipe segment? Slug volume? Slug delivery?**
  The pipe segment in dynamics does NOT model phase slip, so it is not suited to predict slug volumes through dynamics modeling.