Application Bulletin – Process Industry
PIPENET® Transient Module Case Study

Dry Pipes and Nozzles

BACKGROUND

Two new features have been introduced into the PIPENET Transient module:

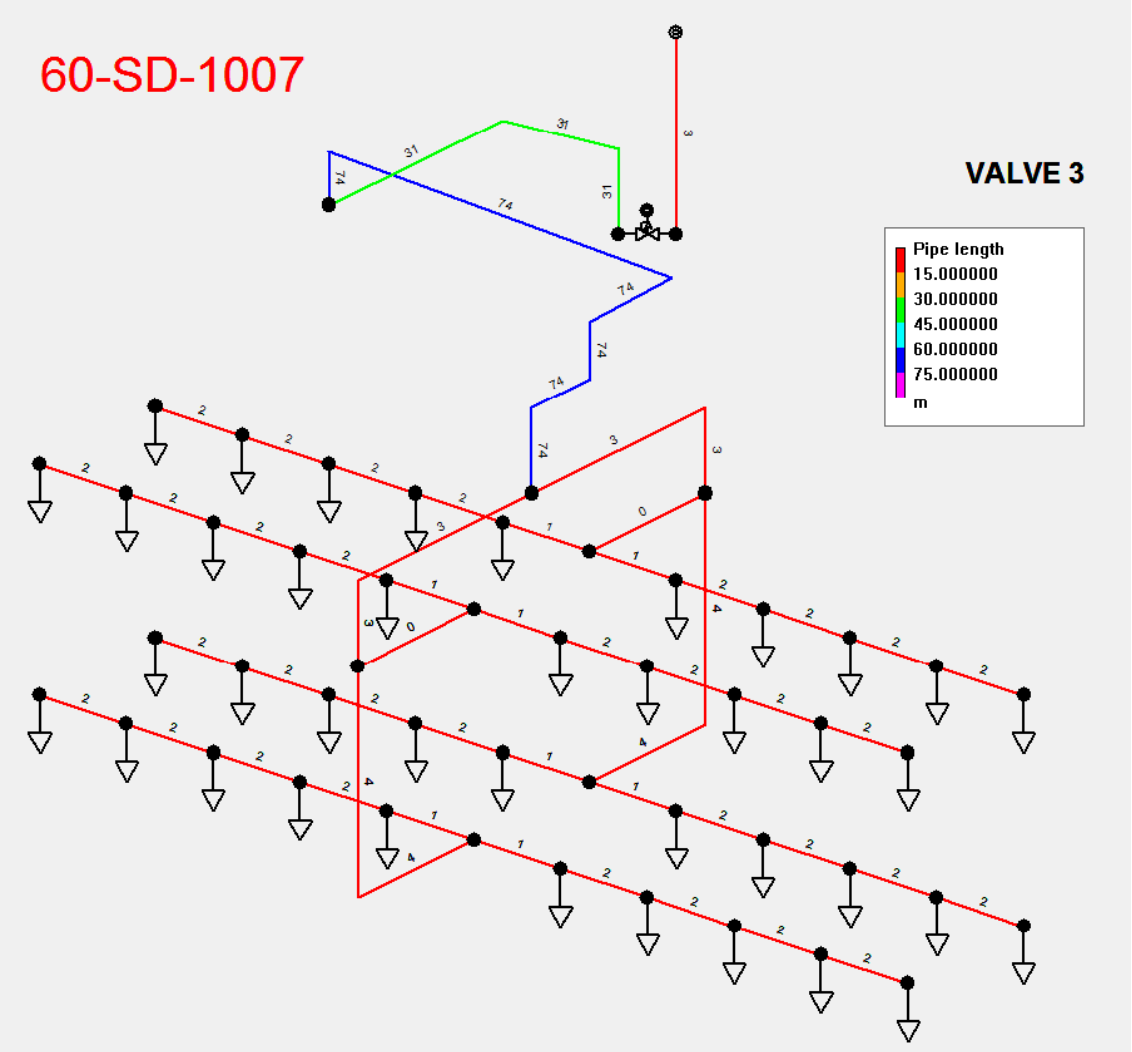
- You can now set the **initial state of a pipe** as being **"wet"** (full of fluid) or **"dry"** (containing no fluid). The default is ñwetò However an alternative setting of ñdryòcan be specified, to model pipes which are initially dry but which fill up with fluid during the course of the simulation.

- PIPENET Transient now allows the direct modelling of **nozzle components** within the network. The Spray and Standard sub-options of Transient both offer this capability, with the specification methods differing in detail.

Taken together, these new facilities significantly increase the range and accuracy of the network scenarios that PIPENET Transient can analyse, as we shall see in the example below. They have been implemented in response to an increasing need from our customers, and are key to accurately predicting the priming time of deluge systems.

INITIAL ANALYSIS SCENARIO

Working collaboratively with an international full service contractor who already uses PIPENET, we were able to test our analysis capabilities on a real network. Here is a schematic of the deluge system under study, in which pipes have been annotated with their lengths:

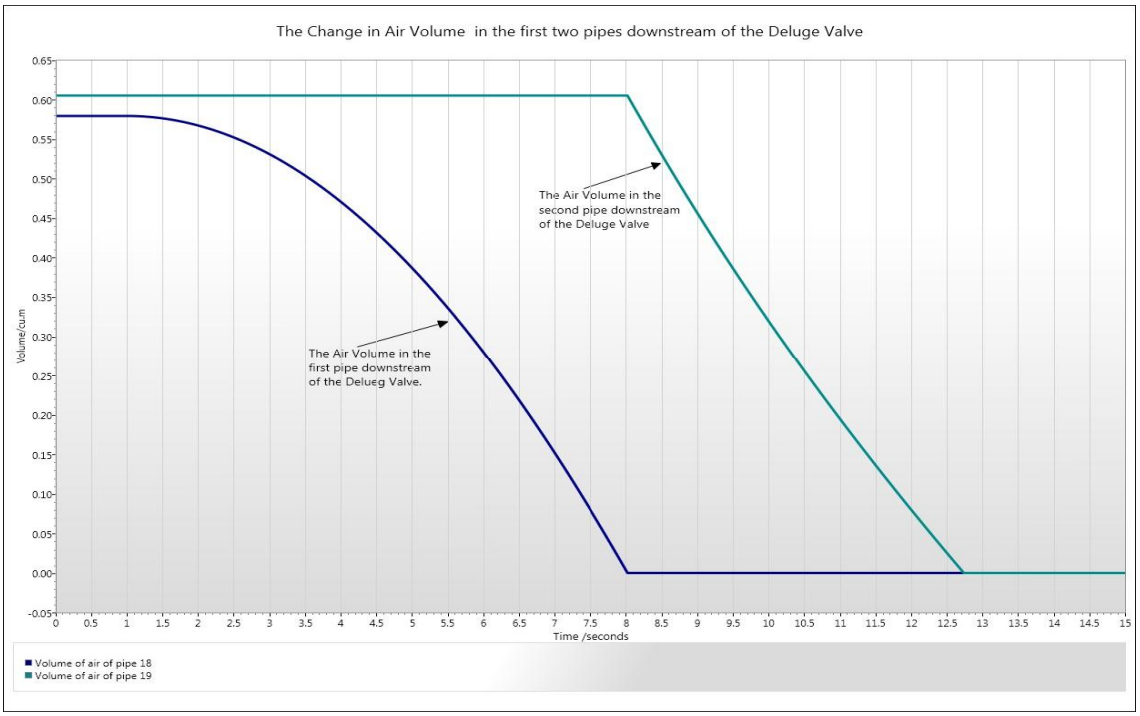


All of the pipes downstream of the deluge valve are dry (empty) at the start of the simulation, when the deluge valve is opened. Using an early version of PIPENET 1.6, we performed an analysis of what happens when the deluge valve is opened.

INITIAL ANALYSIS RESULTS

Measuring air and fluid volumes as the network fills

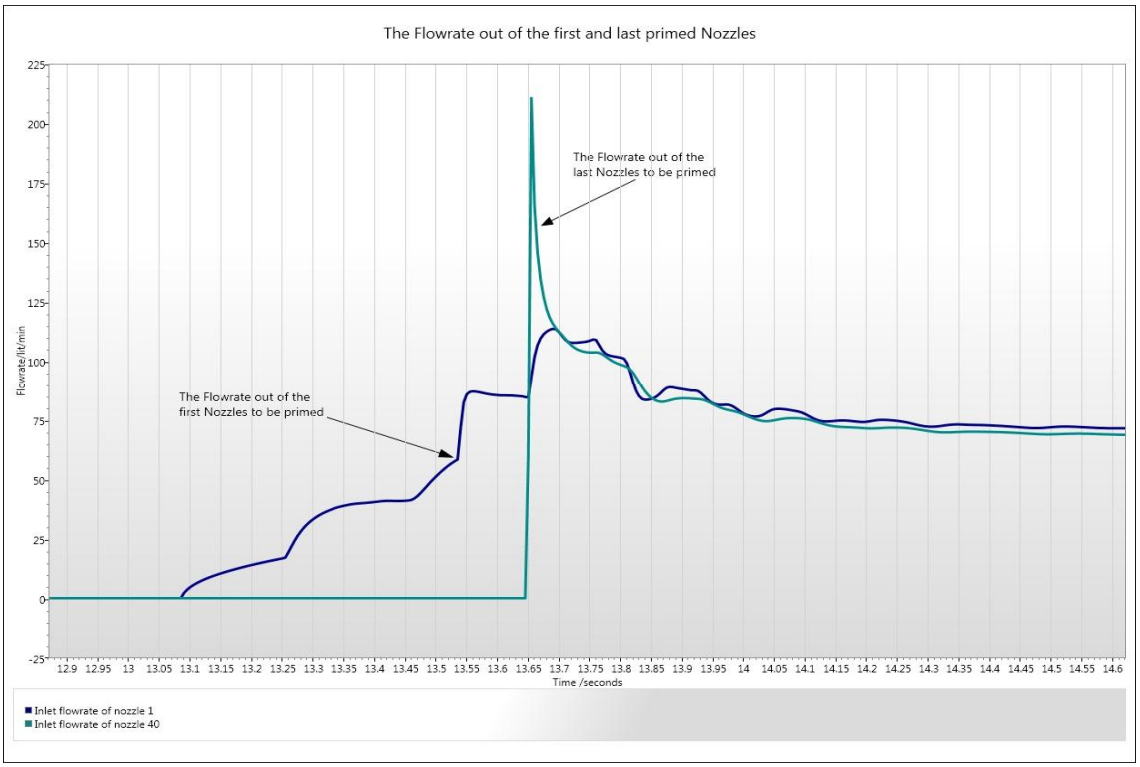
We can graph the volume of air and fluid in the network, and superimpose the results as desired. For example, below is a graph comparing the volume of air in the first and second pipes after the deluge valve. The first pipe is the blue line ï as one would expect, the air is expelled from the first pipe before the second pipe (green line) begins to fill up.



Nozzle priming sequence and flow-rate

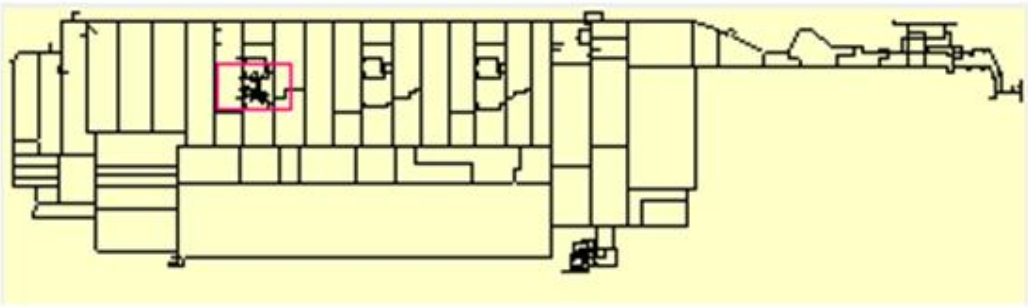
By inspecting the tables and graphs, we can quickly determine for each nozzle how the volume of fluid expelled varies over time. As a by-product this will also tell us the priming sequence, i.e. the order in which the nozzles start to expel fluid.

In the graph below we have superimposed the flow-rate graphs for the first (dark blue) and last (light blue) nozzles to be primed. The graphs are qualitatively reasonable ï at the last nozzle, the fluid has no exit path other than through the nozzle and so one might expect a higher initial pressure and flowrate. Even so, the spike at the last nozzle is surprisingly high in this scenario.



Connecting to the rest of the network

Actually the deluge system modelled in our initial analysis is only a small subset of the total network. Below is an overview of what the total network looks like. The deluge system modelled by our initial analysis is shown by the red rectangle:



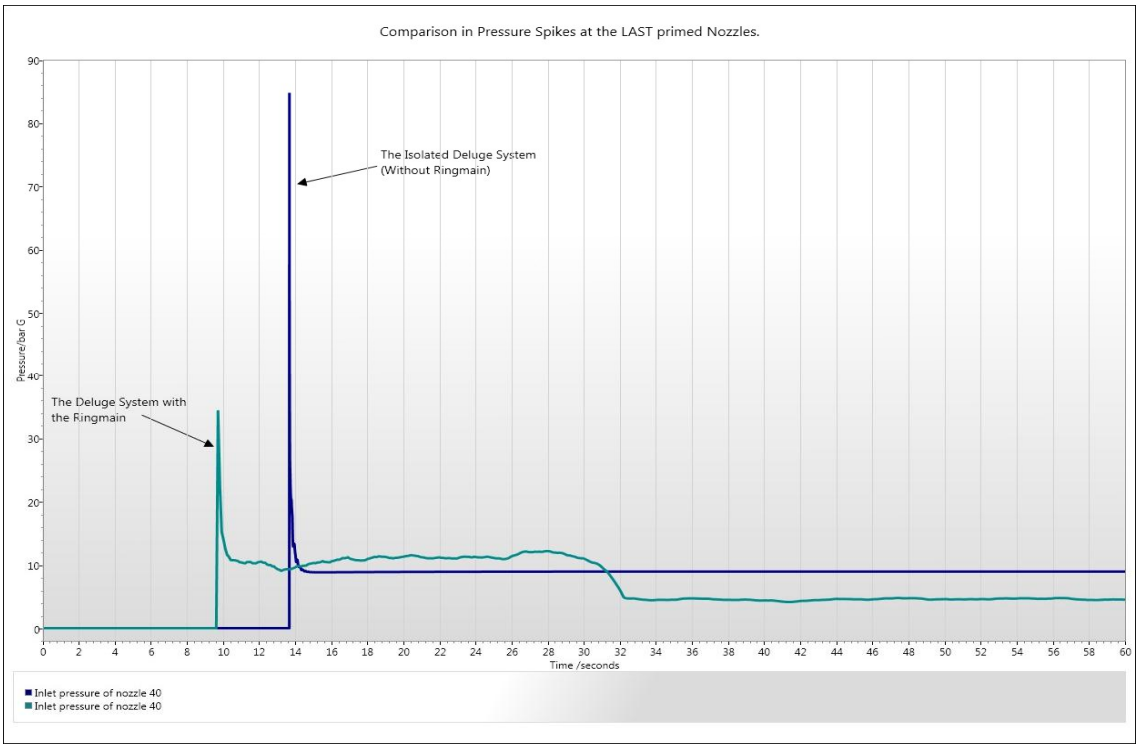
There are some important differences in the behaviour of our deluge sub-system when it is connected to the main system:

- In the initial analysis, we fixed the pressure at the inlet node to be a constant. In the real network, our spray sub-network is connected to a ringmain, as a consequence of which the pressure at the inlet will vary over time.

- The main network incorporates a standby pump which is activated as the same time as the deluge valve opens, to help handle the new demand on the ringmain.

- Pressure peaks within the deluge sub-network will tend to be reduced, as they can dissipate out of the system and into the ringmain.

When we re-run the analysis, we can see in the graph below that the pressure spike at the last nozzle to be primed is considerably reduced to a more reasonable level (the dark blue line is the isolated deluge sub-network, the light blue line is a deluge system connected to the ring main).



CONCLUSIONS

This has been a brief demonstration of two important new PIPENET Transient features.

If you have any questions about this case study, or any other of PIPENETôs capabilities, please email us at Pipenet@sunrise-sys.com.