

## Application Bulletin PIPENET® LNG Applications

# SURGE ANALYSIS OF THE FIREWATER SYSTEM ON AN FPSO

### BACKGROUND

PIPENET Transient module is being used for performing surge analysis of the firewater system on the fire protection system on an FPSO which will be deployed in the Caribbean Sea.

The purpose of this document is to show some of the capabilities of PIPENET Transient module for performing surge analysis of the firewater system on this FPSO.

Fire protection systems in applications such as FPSOs and offshore platforms are often susceptible to high pressure surges which can damage pipework. The aim of this Application Bulletin is to calculate the potential pressure surges which can arise due to deluge system and fire pump start up. If the pressure surge is high, then the Application Bulletin will show a method of reducing the pressure surge to acceptable values.

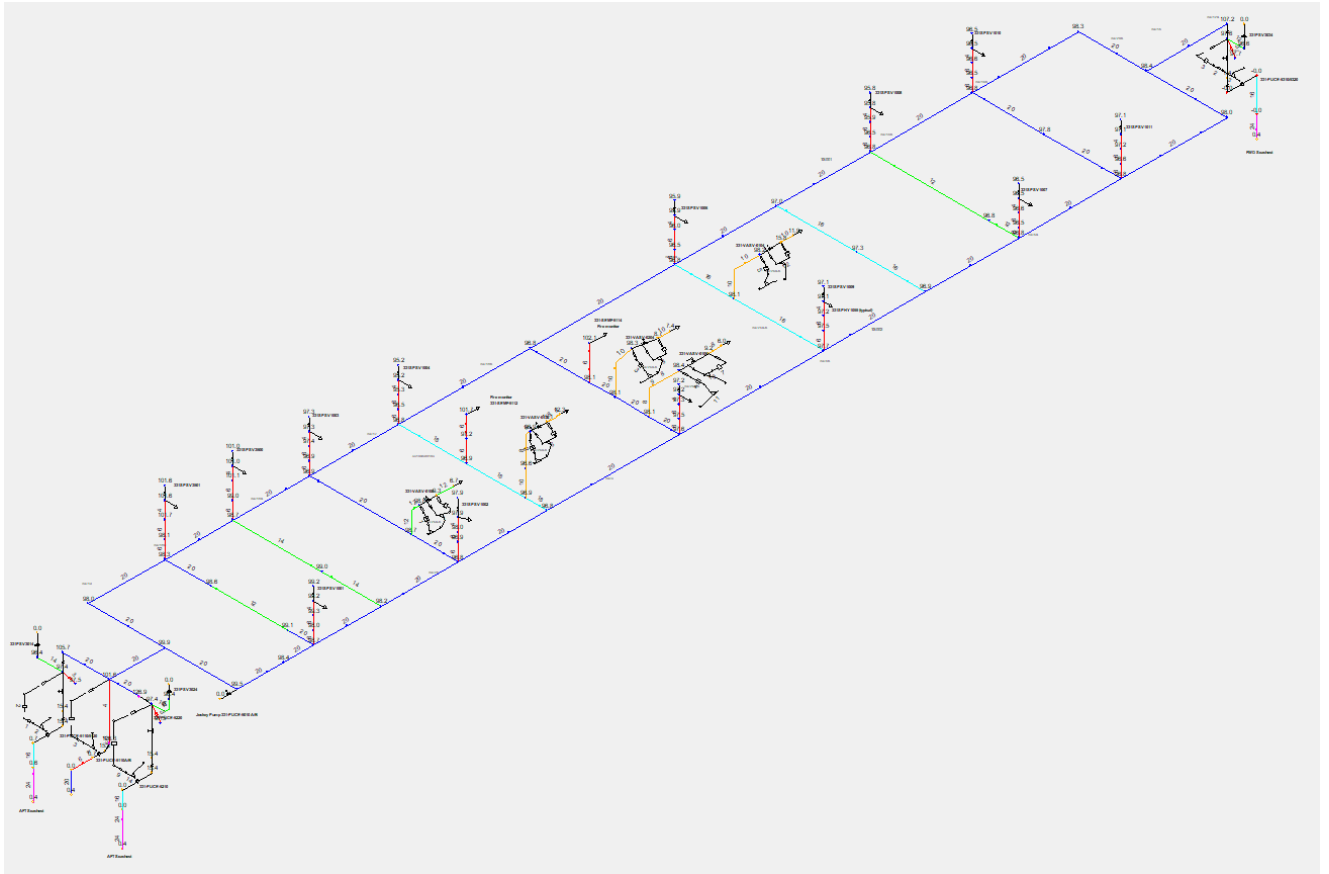
#### 1. The Scenarios

The firewater system has one forward fire pump and three aft fire pumps. In this scenario all three aft fire pumps start but the forward pump is stopped. The deluge valves which operate are of the elastomeric type which is intended to maintain the inlet pressure at the deluge.

Case 1 – The aft pumps start and the deluge systems discharge, without vacuum breakers.

Case 2 - The aft pumps start and the deluge systems discharge, with vacuum breakers. The air inlet valve of the vacuum breaker is set to 50 mm and the air outlet is set to 5 mm.

#### 2. The Network

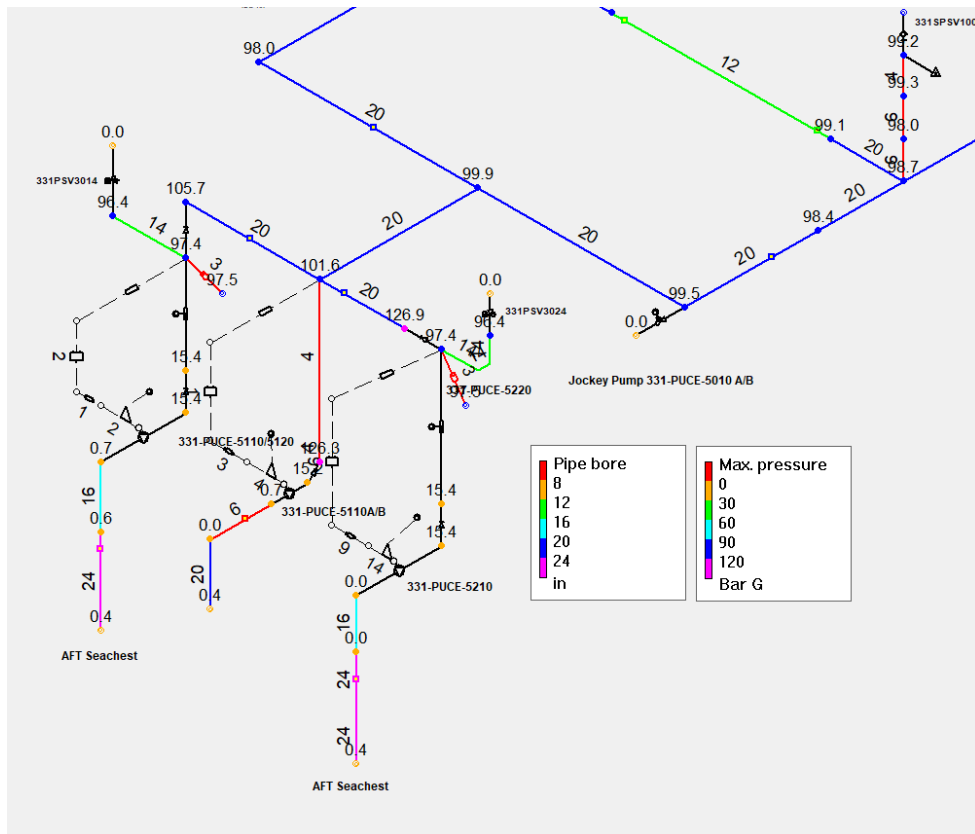


### 3. Salient Features of the System

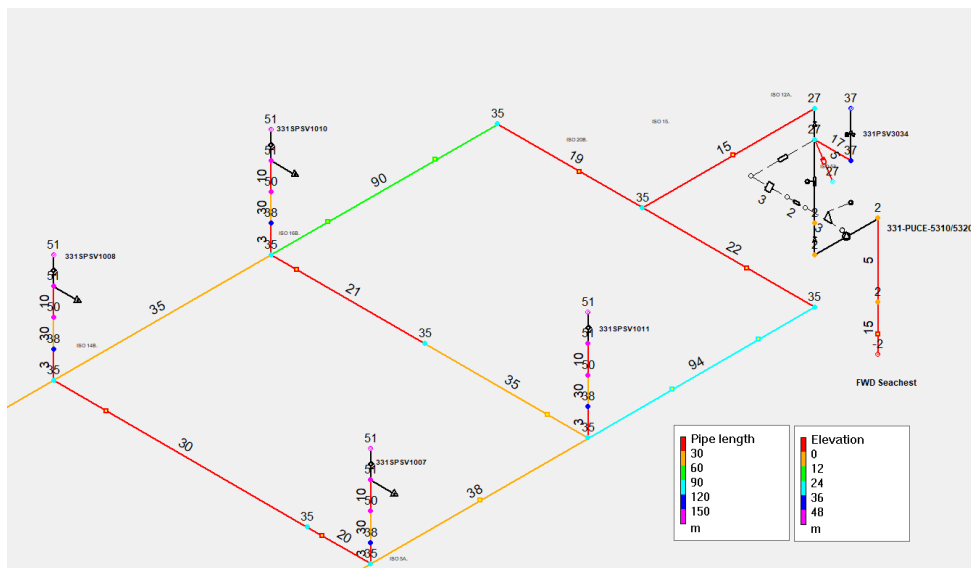
- 3.1. Three aft pumps start at 10 secs and run up. A control system is intended to maintain the pressure

It is assumed that the fire is detected at 10 secs into the simulation. The aft pumps run up in approximately 40 secs starting at 10 secs into the simulation. They have a control system which is intended to maintain their discharge pressure at 12 barg.

Aft pump arrangement:



3.2. Forward pump arrangement: The forward pump is stopped throughout the simulation.



3.3. Deluge Systems:

Operation of the deluge valves: The deluge valves are of the elastomeric type which regulate the downstream pressure at its set point. It is assumed that fire is detected at 10 secs after

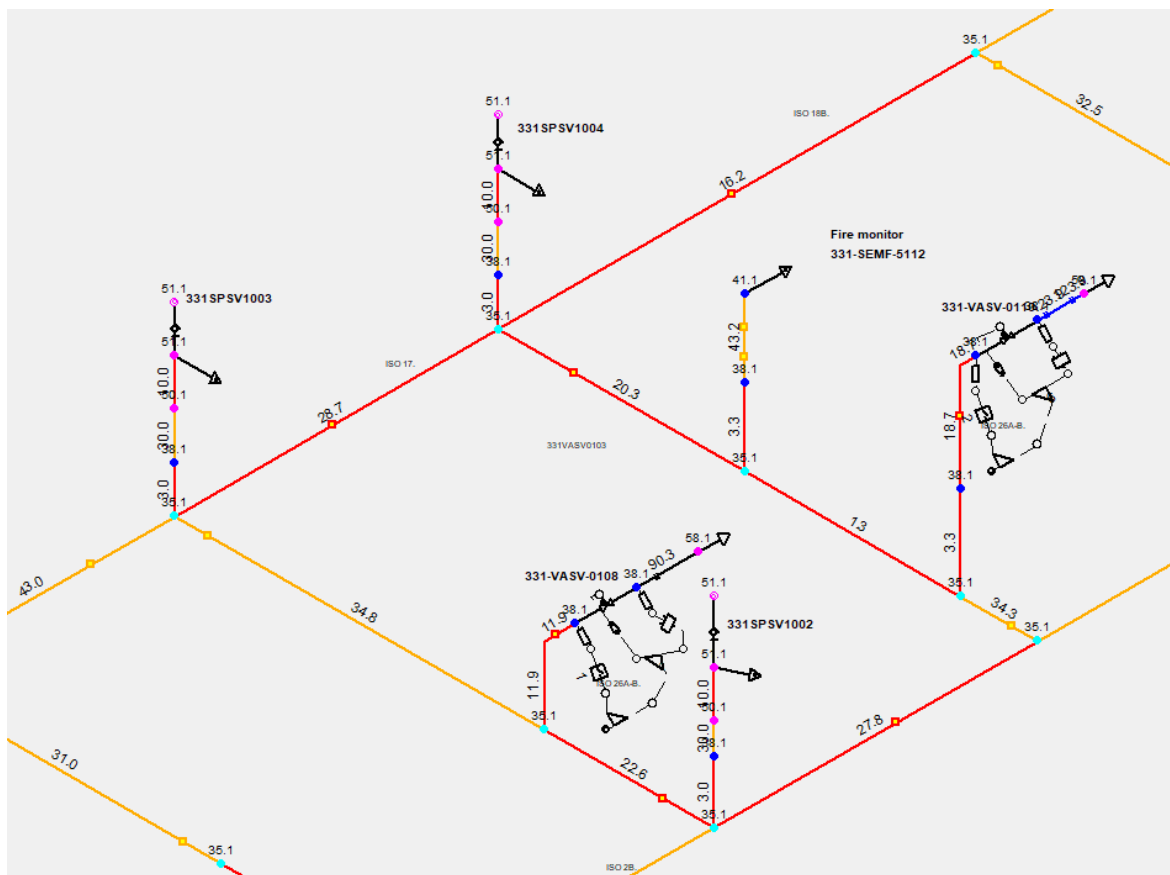
the simulation starts. The deluge valves are pressure activated and so if their inlet pressure is less than 0.3 barg they will remain closed. If the following conditions are satisfied then the deluge valve will begin to regulate the downstream pressure.

- (i) It is 10 secs after the simulation starts.
- (ii) The fire pumps have started and they create a pressure above 0.3 barg at the inlet of the deluge valve.

A total of 5 deluge systems start up at the same time.

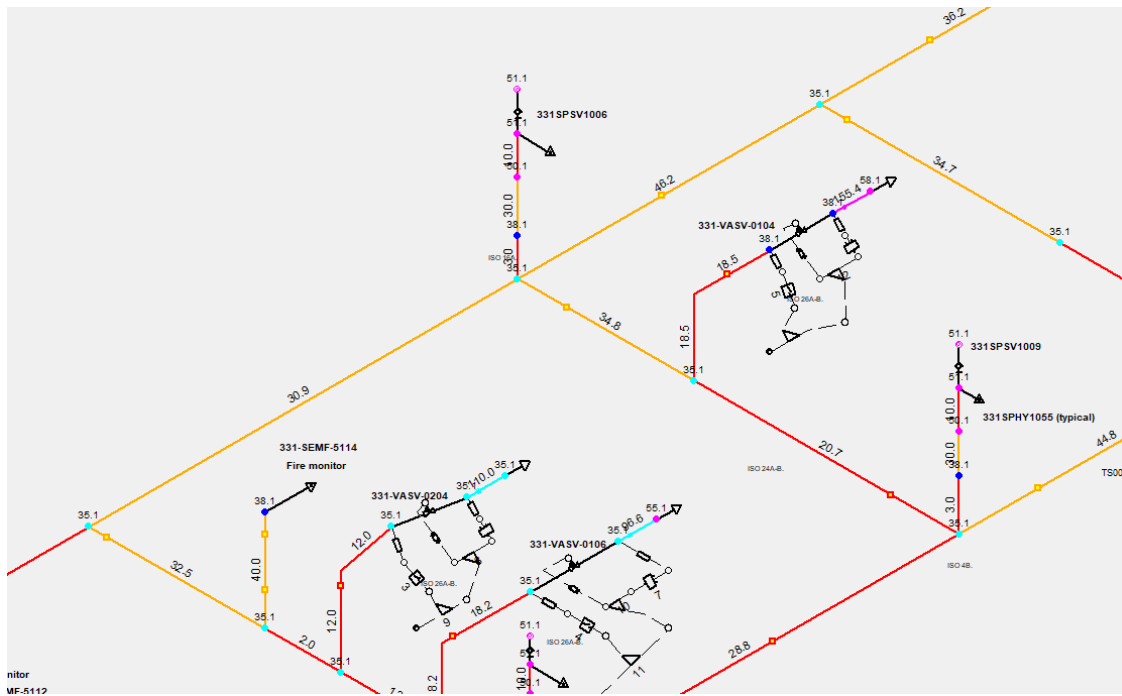
Deluge Systems on aft side:

The two deluge systems which are on the aft side half of the FPSO and which operate are shown below.



Deluge Systems on the forward side

The three deluge systems which are on the forward side half of the FPSO and which operate are shown below.



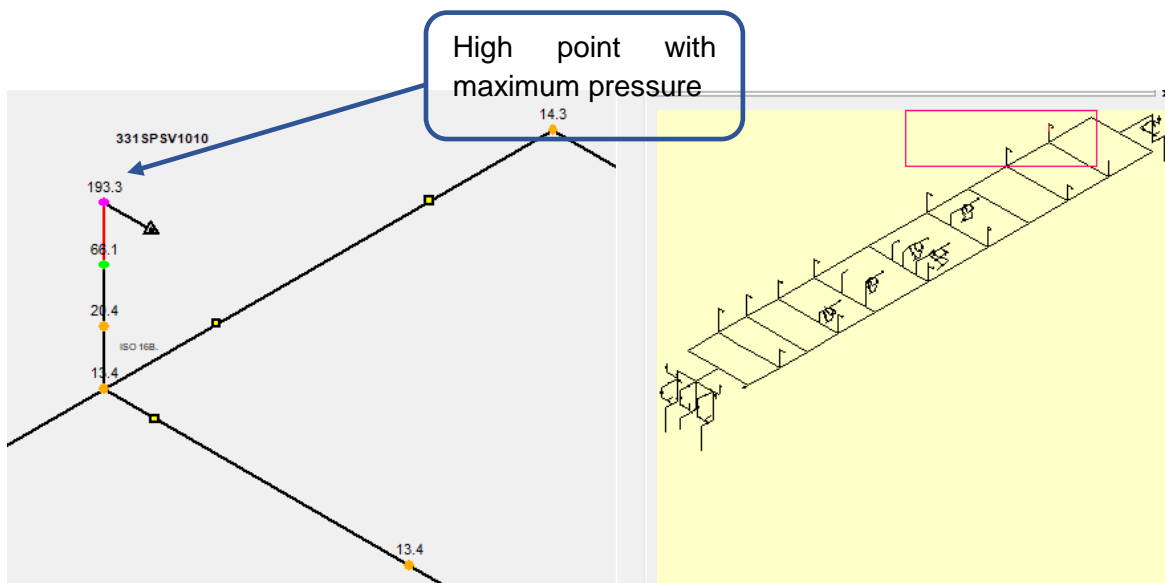
#### 4. Graphical Results:

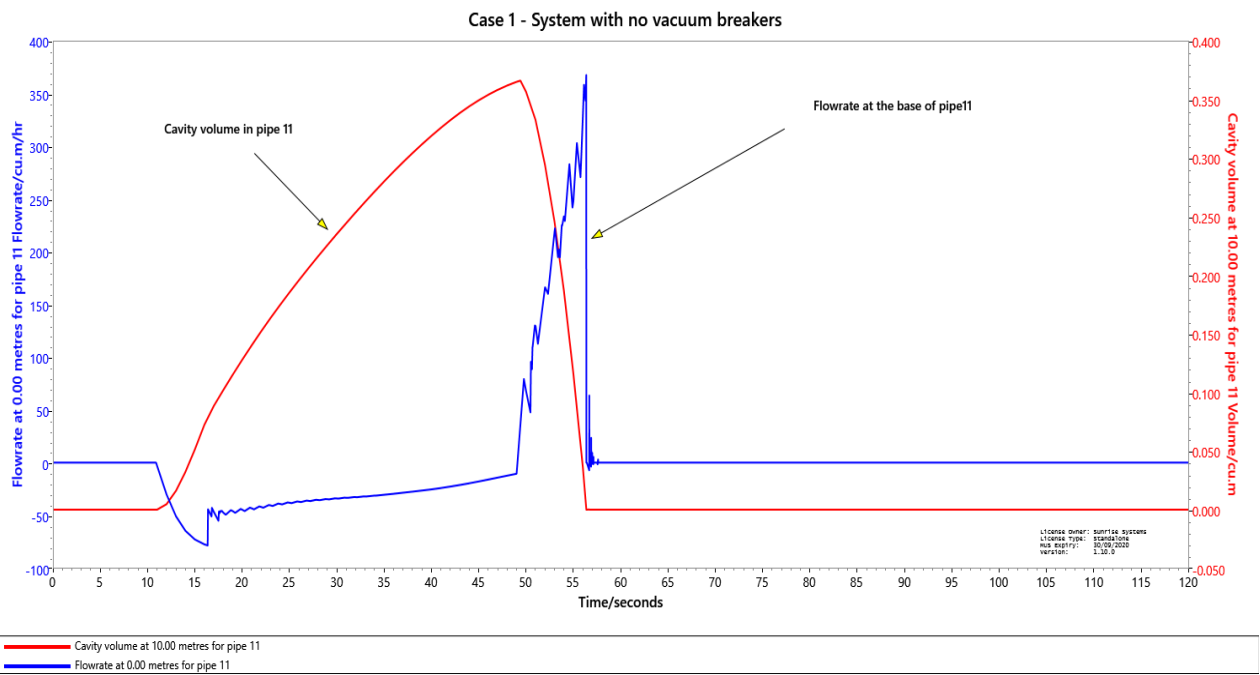
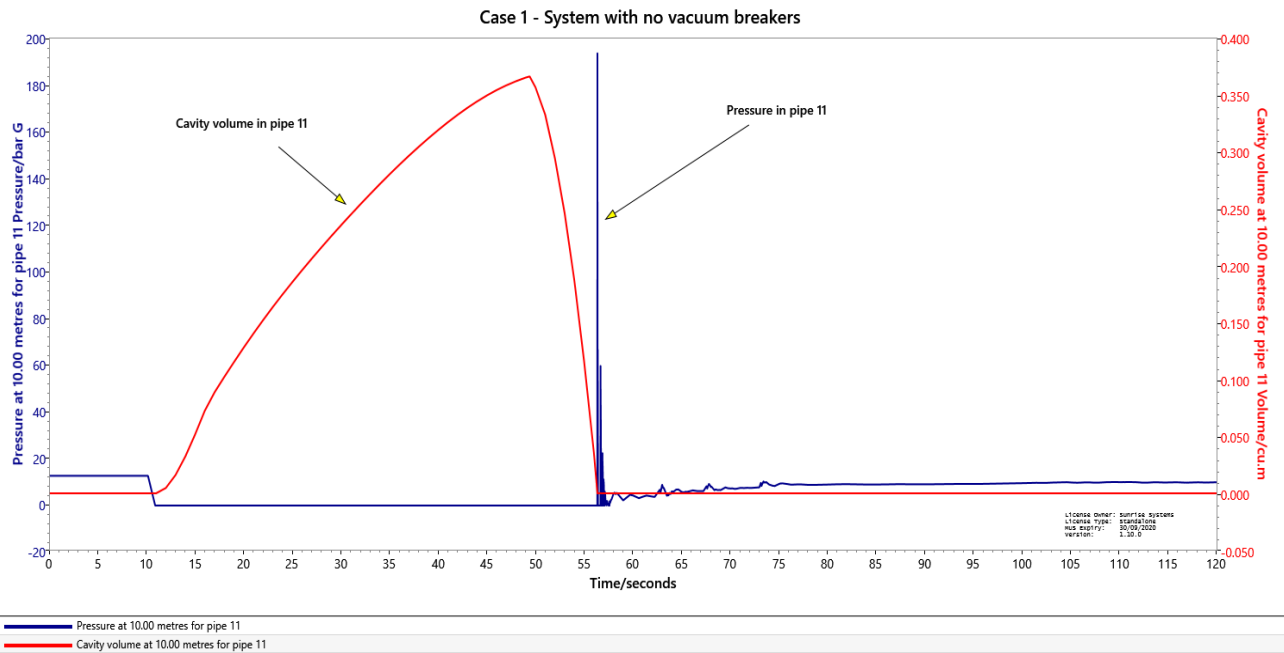
##### Case 1: System without vacuum Breakers.

###### PRESSURE EXTREMA

Maximum pressure is 193.298 bar G  
 on pipe 11 at the outlet  
 at time 56.37000 seconds

Minimum pressure is -0.960000 bar G  
 on pipe 11 at the outlet  
 at time 10.91000 seconds



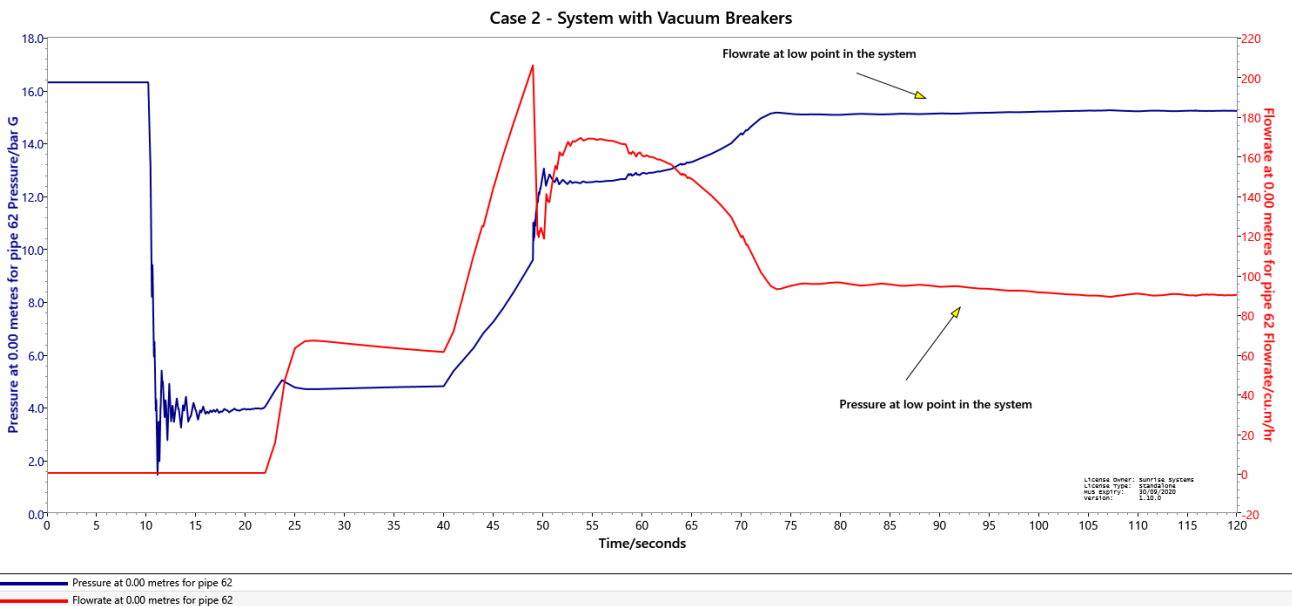
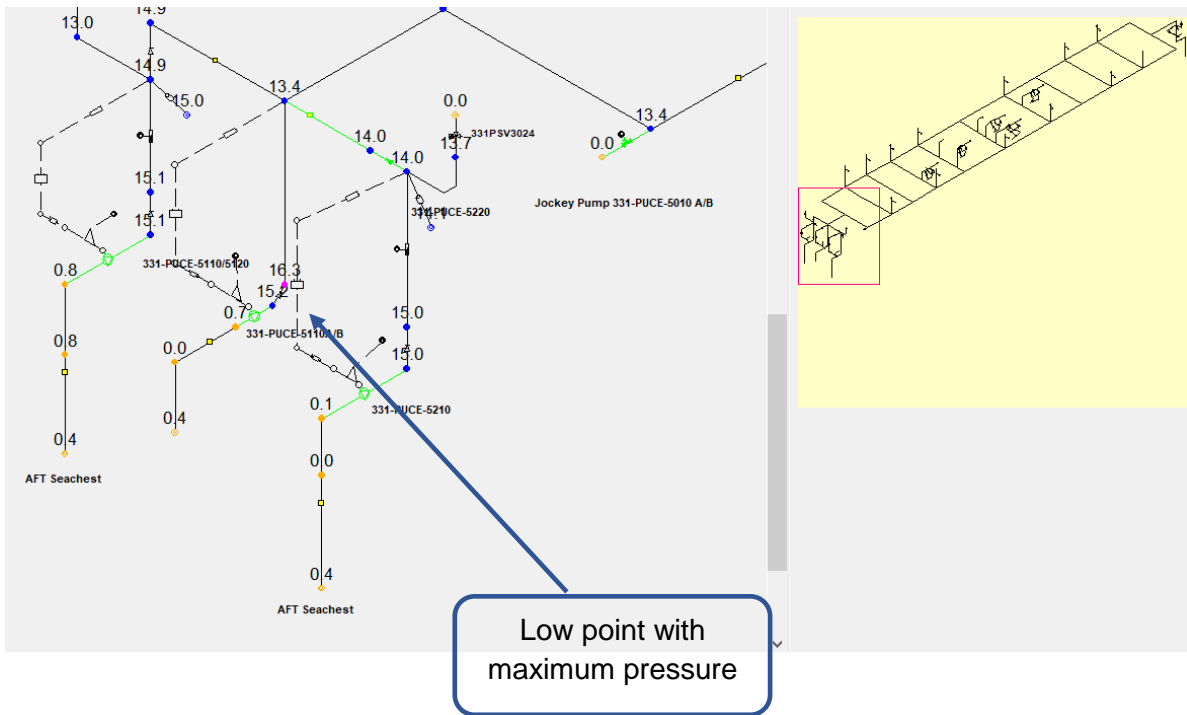


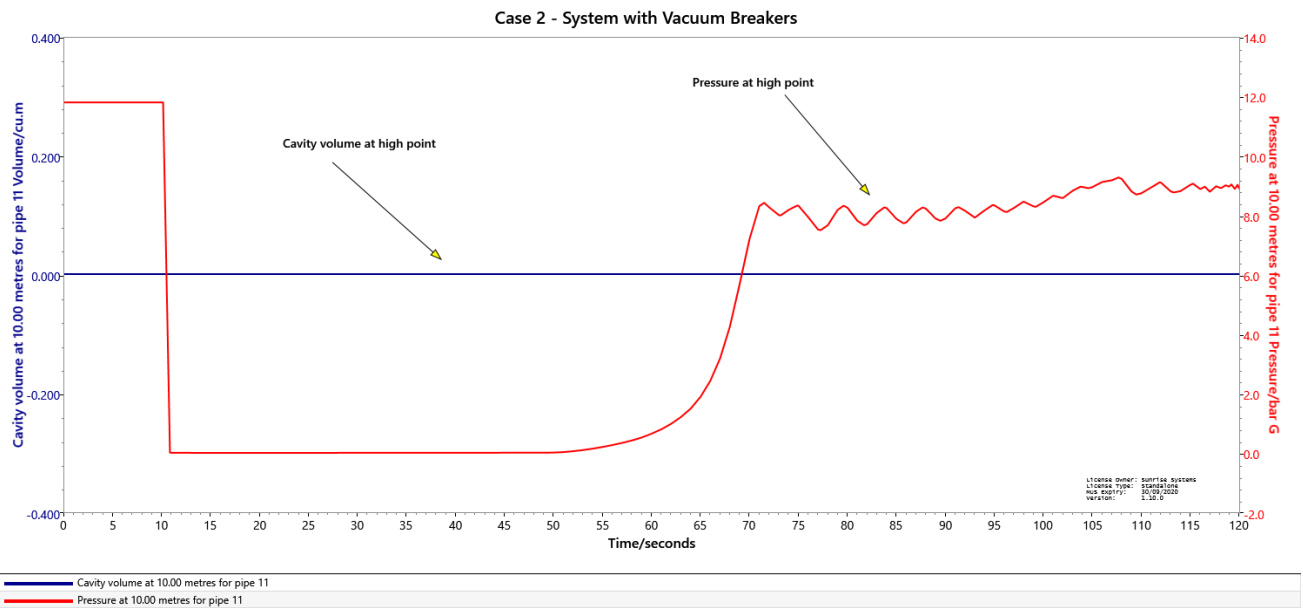
**Case 2 – System with vacuum breakers**

PRESSURE EXTREMA

Maximum pressure is 16.2841 bar G  
 on pipe 62 at the inlet  
 at time 3.720000 seconds

Minimum pressure is -0.960000 bar G  
 on pipe 60 at the outlet  
 at time 10.980000 seconds





## 5. Conclusion:

The simulation results show that cavitation is likely unless surge alleviation devices are installed. Cavitation is likely at the high points of the system. The potential pressure surge is around 193.3 barg. By installing 13 vacuum breakers at the high points cavitation is eliminated and the pressure surge comes down to 16.3 barg

If you have any questions about this case study, or any other of PIPENET's capabilities, please email us at [pipenet@sunrise-sys.com](mailto:pipenet@sunrise-sys.com).