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MySep Case Studies

Validations and comparisons with field data

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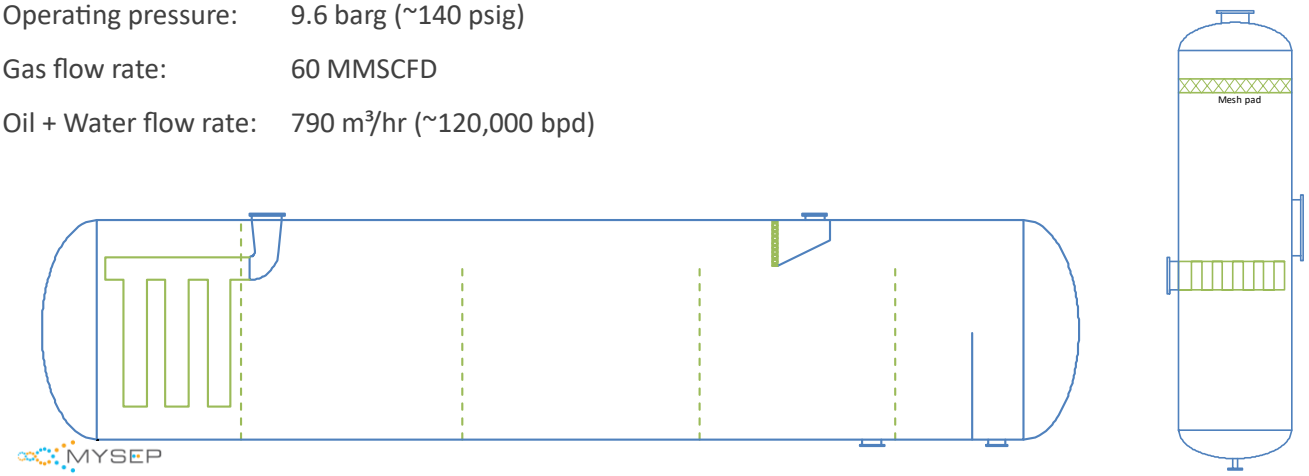
CASE STUDY 1: 1ST STAGE SEPARATOR CARRYOVER

Description: 1st Stage Separator (3-phase) feeding into two parallel compressor trains

Operating pressure: 9.6 barg (~140 psig)

Gas flow rate: 60 MMSCFD

Oil + Water flow rate: 790 m³/hr (~120,000 bpd)



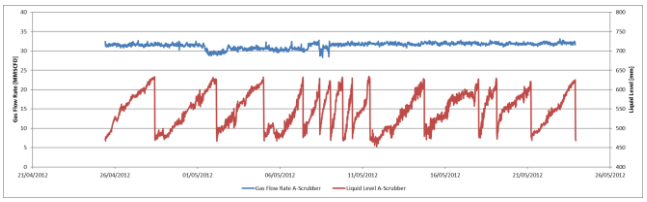
The 1st Stage separator is a horizontal 3-phase separator, fitted with inlet cyclones and a mesh-type demister as illustrated above. The 1st Stage Suction Scrubber of each of the two compressor trains is fitted with a vane-type inlet device and a mesh-type demister.

MySep analysis

The 1st Stage Separator with its internals was modelled in MySep. The carryover predicted by MySep was 12 l/hr. It should be noted that given the significant liquid load, this indicates a very good performance of the separator (~99.998% efficiency).

Field analysis

To determine the actual liquid carryover from the 1st Stage Separator, the liquid accumulation rates in the two parallel 1st Stage Suction Scrubbers was calculated from liquid level trend data logged on a data historian.



The two 1st Stage Suction Scrubbers had accumulation rates of 4.24 l/hr and 5.42 l/hr, respectively. These values are in effect the separated liquid flow rates. Using these numbers, the liquid load to the scrubbers calculated iteratively based on the separation efficiency of the vessels as evaluated by MySep. This yielded a 1st Stage Separator carryover rate of 11.7 l/hr.

Conclusion

It can be seen from the above that the MySep prediction of the 1st Stage Separator carryover (12 l/hr) is in very close agreement with that observed in the field (11.7 l/hr). This is particularly notable given the high liquid load on this vessel.

CASE STUDY 2: GAS PLANT OPERATING LIMIT

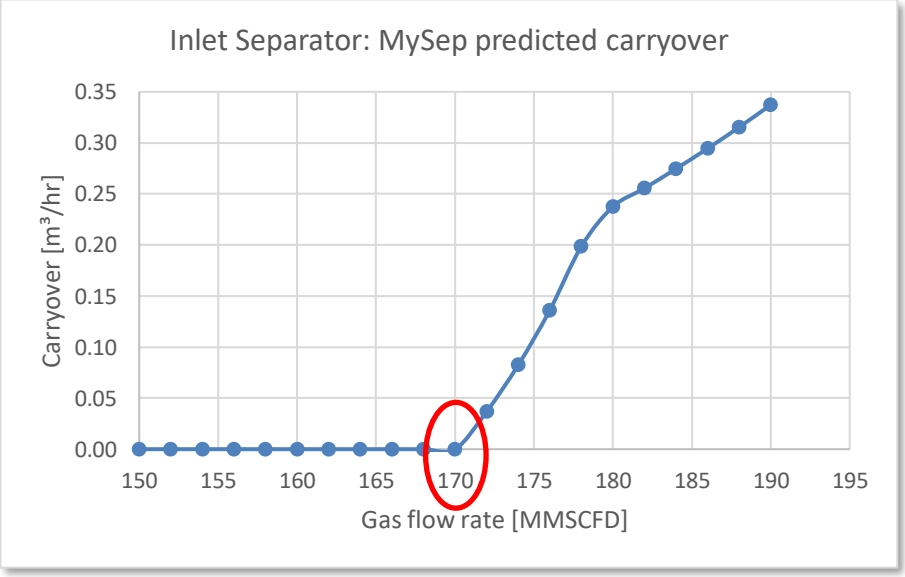
Description:	Gas Plant Inlet Separator
Operating pressure:	72.4 barg (~1050 psig)
Gas flow rate:	~170 MMSCFD
Hydrocarbon liquid:	577 kg/m³, 0.17 cP, ~10 dyne/cm

The Inlet Separator is fitted with an Inlet bend and a mesh pad. This Case Study is of particular interest in view of the operating pressure and hydrocarbon liquid properties. High operating pressure and low hydrocarbon liquid density, viscosity and surface tension typically pose challenging conditions for separation: Small droplets and high mist fractions in the inlet piping as well as performance degradation of separation equipment.

MySep analysis

The Inlet Separator with its internals was modelled in MySep. The particular interest for the Inlet Separator was how it would perform under various gas flow rates, and in particular, how far could it be "pushed". To investigate this, use was made of the External Data Processing tool supplied with MySep. This tool enables users to run a large number of operating cases through a MySep model. MySep then returns all key vessel performance characteristics for each case.

For the Inlet Separator, a range of gas flow rates was run. The resulting carryover predicted by MySep is illustrated in the graph shown to the right. It can be seen for gas flows up to 170 MMSCFD MySep predicts this vessel to have minimal carryover. Beyond 170 MMSCFD, vessel carryover is predicted to increase rapidly.



Field analysis

In the field, the gas throughput through the Inlet Separator was steadily increased. The operator reported the following: *"It was around 170 MMSCFD where MySep started to predict big problems with carryover and we experienced this in the facility"*.

Conclusion

The point at which MySep predicted a rapid increase in carryover matched very closely the gas throughput at which the operator observed carryover effects becoming problematic.

CASE STUDY 3: LIQUID MOTION VALIDATION

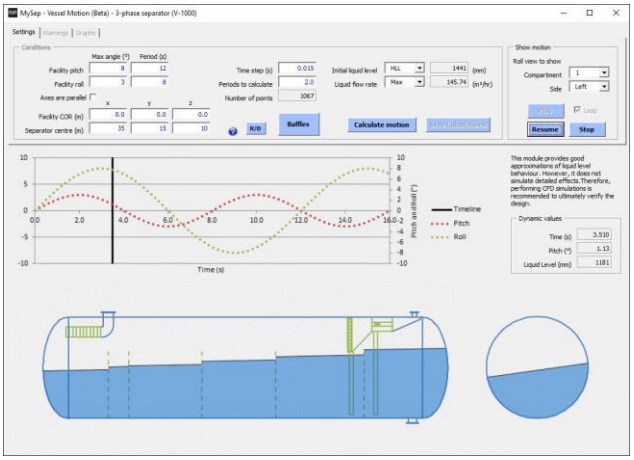
Description: Validation of MySep Motion module using Computational Fluid Dynamics

Vessel size: 2000 mm ID x 7000 mm T/T

Facility Pitch angle/roll: 8° / 24 seconds

Facility Roll angle/roll: 10° / 20 seconds

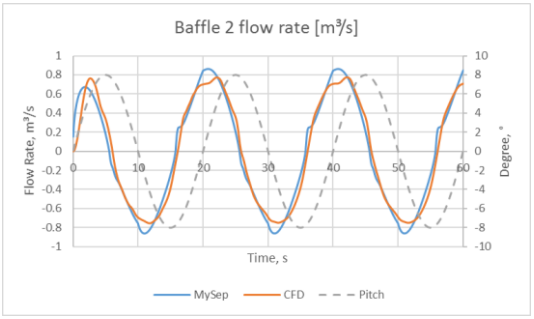
Anti-sloshing baffles: 2 off, 36% Nett Free Area

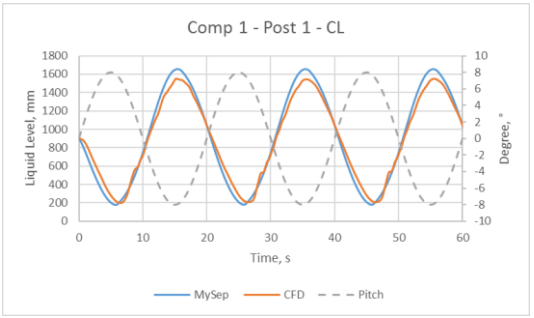


The Motion module in MySep enables rapid simulation and analysis of liquid level behaviour in separation vessels resulting from motion of the floating facility (e.g. an FPSO). The method developed and adopted in the MySep Motion module to resolve liquid motion is based on the physics of fluid dynamics. It is, however, a simplified model, to enable rapid solution in minutes, rather than in days/weeks associated with a rigorous Computational Fluid Dynamics (CFD) model. Validation of MySep modelling against the full CFD rigour shows the approach can be used with confidence to screen process designs.

Comparison of MySep and CFD predictions

During the MySep and CFD simulation, the liquid level heights at various locations in the vessel, as well as the flow rate through the perforated anti-sloshing baffles are monitored. This produced a very large amount of data for comparison. The two charts to the right show a selection of data comparisons. Overall, it was seen that the MySep is in close agreement with CFD in terms of synchronicity of the time transient behaviour. MySep predicted slightly higher peaks in the liquid levels than CFD, which would lead to somewhat more conservatism. The model in MySep assumes the liquid level is flat (no waves), which explains the more erratic nature of profiles predicted by CFD. It was also seen that for some monitor locations, a repetitive pattern was only established after a few periods with CFD, whereas MySep predicted this within the first period. A more comprehensive outline of validation comparisons can be found in the Vessel Motion Modelling White Paper which can be downloaded from: www.mysep.com/Downloads.aspx





Conclusion

The comparison with CFD gives a high degree of confidence that the Motion module in MySep provides reliable predictions for the purpose of evaluating designs for moving liquid levels due to facility induced motion.

MORE INFORMATION ON MYSEP

MySep extension for process simulators:	www.mysep.com/Videos/RunTime-introduction-video.aspx
Video showing the Motion module:	www.mysep.com/Videos/Motion-video.aspx
User Testimonials:	www.mysep.com/Testimonials.aspx
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