Dynamic Simulation of Gas-lift Wells and Systems

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This recommended practice is under the jurisdiction of the API Committee on Standardization of Production Equipment (Committee 19).

This document presents recommended practices for dynamic simulation of gas-lift wells and systems. Included are steady state models, pseudo steady state models, and dynamic numerical models. Other API specifications, API recommended practices, and Gas Processors Suppliers Association (GPSA) documents may be referenced in system design and operation.

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Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

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1 Scope

This recommended practice (RP) provides guidance and background for the application and use of dynamic simulation of gas-lift wells and their related systems. Discussion is included for use of steady-state, "pseudo" steady-state, and dynamic numerical models. Also presented are guidelines to facilitate the application of these techniques to optimize well/system integrity, operations, life cycle design, and production. Additionally, a range of artificial lift and natural flowing systems and topics (e.g. gas well liquid loading) are addressed. The dynamic simulation recommendations (e.g. stable flow, hydrates, waxes, corrosion, liquid loading, and complex wells) can be implemented in other production systems (e.g. natural flowing wells).

This RP is also designated for managers, production technologists, reservoir engineers, facilities engineers, production engineers, well testing engineers, well analysts, operators, and researchers who want to gain a general understanding of dynamic simulation, areas of application, added values, and benefits. The contents compare transient vs steady-state techniques and provide readers with when and how each technique may be effectively applied.

Not included are technical requirements for the hardware of the dynamic simulation system, the specifics of the system calculations, the responses to the output of the dynamic simulation data output, and specifics of what actions are required after the provided data is considered.

An extensive bibliography is provided of documents for additional information on the topics included.

2 Normative References

There are no normative references in this document.

3 Terms, Definitions, Abbreviations, and Symbols

3.1 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
beaning-up
The process of increasing the wellhead choke size to adjust the flow rate for adjustable choke.

NOTE For fixed chokes, this the same process, excluding shutdown periods.

3.1.2
black oil correlations
Assumes that the reservoir fluids consist of three phases: oil, water, and gas.

NOTE These are defined with a minimum of information [specific gravity, gas-oil ratio (GOR), and water cut], with gas dissolving in oil and oil vaporizing in gas. Water is assumed to be inert. Use correlations to determine the fluid properties at different pressures and temperatures (P-T).

3.1.3
boundary conditions
Fluid type, flow rate, pressure, and temperature values assigned to the selected model boundaries (inputs, outputs, and surrounding environment of the model) used in solving the differential equations that apply to dynamic simulation.