

Well Dynamics

Publieke samenvatting / Public summary

Aanleiding

In case of steady state operation the phenomena in the reservoir and the well take place at different time and length scales and generally consideration of their interactions is not required. However, for transient phenomena (even single phase gas flow but especially in case of water banking or meta-stable production) coupled-model simulations are required. However, there is serious concern about the predictive capabilities of the currently available coupled modeling tools especially in terms of the local hold/up pressure drop description in the well and the fast dynamics of the liquids in the near-well zone. To improve predictive capabilities, fundamental understanding of these dynamic phenomena - in particular the liquid flow - is required. The observation and description of the relevant mechanisms from field data only has proven to be very difficult due to large uncertainties in reservoir heterogeneity and the difficulty in measuring the direct liquid inflow. Improved insight in dynamic flow phenomena and improved predictive capability for dynamic flow behavior in gas production or storage wells will unlock potential for optimization of dynamic production and storage scenarios.

Doelstelling

The central goal of the project is to improve our understanding and prediction of complex dynamic behavior in gas production or storage wells. The main questions are: • Do current dynamic multiphase models sufficiently describe the behavior in the well? If not, these will add a large uncertainty to determine the dynamic reservoir

Projectinformatie / Project information

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Publicaties en materialen / Publications and attachments

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response based on field data. • Do current dynamic (near) well models sufficiently describe the liquid behaviour in the well-near well zone during start-up/shut-in? • If not, how can these well and near well models be improved? • How can the complex dynamic behavior in the well and in the near well bore be evaluated and used for model improvement / model validation? o How can we evaluate field data containing a high degree of uncertainty (especially with regard to fluid inflow)? o How to downscale and simplify the well - near well bore region to a level where controlled experiments can be done for validation of the models. o How to combine experimental and field data to improve predictive capabilities?

Korte omschrijving

The following activities are proposed: • Well data validation (are the base models sufficient to describe transient well behavior?) • Collection and assessment of field data on gas well dynamics; • Field data analysis (can the start-up and shut-in of gas and liquid behavior be described based on field data only?) • Theoretical and numerical investigation of requirements and boundary limits of an experimental setup to ensure the proper evaluation of the relevant dynamic phenomena; • Assessment of the capabilities and requirements of the proposed approach - choice on how to proceed: with an experimental set up or a data driven approach • The (detailed) design of an experimental set up; • The construction and commissioning of the experimental set up; • The execution of an experimental program on well dynamics; • Recommendations for improved prediction of gas well dynamics (model validation if relevant, or model generation). Although modeling work has been reported on well-reservoir dynamics, validation by controlled experiments is not known to us. The suggested approach is fundamental in nature, hence also unproven and contains a high degree of uncertainty and unresolved iss

Resultaat

The ultimate goal is to improve / optimize the operation of gas storage and production wells by

improved prediction of dynamic gas well behavior. This project will deliver: a) Evaluation of current tools/models to predict steady state and dynamic well and near-well behavior. b) Predictive models for these dynamic phenomena, either based on existing models, new models or data driven algorithms. c) Recommendations on start-up and shut-in behavior for wells depending on the well and reservoir state and parameters Depending on the decision point: d) A set of experimental data of selected dynamic phenomena to be used for mechanistic studies and modeling (b) or e) A method / set-up for studying well-reservoir dynamics by experiments and field data.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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