Saudi Aramco Improves Field Management Practices with Intelligent Surveillance

Case study: SIS customizes OFM templates and automates workflow processes for early detection and quick resolution of production performance problems

Challenge
Give engineers more time to focus on data analysis and interpretation; standardize surveillance tools so that cross-functional engineers can work collaboratively; detect production problems earlier.

Solution
Use OilField Manager® (OFM) well and reservoir analysis software to automate and dynamically integrate engineering requirements for production optimization including
- reservoir management and surveillance
- remedial well analysis
- water management
- integrated reservoir analysis
- production data monitoring
- petrophysical data analysis.

Results
Fully automated daily workflow processes for reservoir and production engineers, as well as research scientists; provided true performance monitoring with reliable real-time production and injection validation; enabled quicker, more cost-effective reservoir analysis; enhanced collaboration and decision making among multidiscipline teams assetwide.

Prolong reservoir life, maximize hydrocarbon recovery
Saudi Aramco wanted to prolong the life of its oil and gas reservoirs, while maximizing hydrocarbon recovery. Standardization and automation of processes were two main objectives as the company sought to improve overall efficiency of its reservoir management and surveillance efforts. Specifically, there was a need to better monitor production data, provide online access to hydrocarbon phase behavior and petrophysical data, and manage well test information. An overriding goal was to facilitate the collaboration of reservoir engineers, production engineers, and the Exploration and Petroleum Engineering Center Advanced Research Center (EXPEC ARC), to achieve more informed and faster decision making.

Implement an array of smart tools and processes
SIS Information Solutions (SIS) consultants created the necessary software tools to automate reservoir and production engineering workflow processes, while integrating the required data and computing processes based on the needs of the multidisciplinary team. Customized, workflow-enabling OFM templates were the foundation of these new smart tools, combined with daily workflows designed to improve Saudi Aramco’s reservoir management and surveillance activities. This comprehensive solution included tools for production data monitoring, remedial well analysis, water management, and integrated reservoir analysis, as well as a heterogeneity index and a formation damage indicator.

Integrated reservoir analysis tools.
Production data monitoring
Automated, real-time access enabled fast and informative visualization of daily production data—allowing easy visual identification of underperformance or potential issues before they became problems. Other features of the integrated dynamic surveillance system included

- real-time data coupling to productivity index (PI) and SCADA systems
- rock and fluid data analysis
- hydrocarbon phase behavior analysis
- petrophysical data analysis
- well test data management.

Remedial well analysis
A candidate recognition system was developed to identify and flag problem wells requiring immediate remediation. The system consists of various analysis tools to anticipate the onset of problems (such as high water cut, low productivity, or injectivity issues) by leveraging existing information from surrounding wells. The practice of early intervention and resolution made it possible to avoid unnecessary costs.

Water management
Water management strategies were implemented to enable rapid screening of the entire field for high water-producing wells and recommend the best reservoir management practices for candidate wells (i.e., water shutoff, stimulation, rate restriction, or sidetracking). Wells are screened by criteria based on reservoir performance. Another water diagnostic technique helped identify and control wells with high water production by locating the source of excess water (e.g., due to channeling, coning) and, again, recommending the best practice.
**Heterogeneity index**
This tool provided a convenient means to compare the performance of individual wells to the average group of wells. The heterogeneity index (HI) can be automatically calculated for any dynamic variable, such as production rate or water cut. To account for noisy or hard-to-analyze production rates, a cumulative HI was introduced for smoother curve results. Used as a daily surveillance tool, it allows engineers to rapidly identify over- and under-performing wells and recommends the best completion practices.

**Formation damage indicator**
A formation indicator was introduced to spot production problem areas and damaged wells. Calculation of the skin factor easily indicates which wells have formation damage problems using a steady-state flow equation. For wells with limited pressure data, the equation is correlated with the formation damage index (FDI). Engineers can quickly and easily identify and quantify all damaged wells in a given field in much less time than traditional methods.

**Reservoir analysis**
An integrated reservoir analysis tool was also developed, detailing the workflow process that allows engineers and geoscientists to view, report, map, and analyze reservoir performance and production data. This tool aids analysis of reservoir performance through historical production/injection data, production forecast using decline curve analysis, single and multiple production well logs, stratigraphic cross sections, well deviations, and wellbore schematics of a particular well or group of wells in a given field. Additionally, the same tool can be used for waterflood management, by monitoring flood front movement and studying water encroachment by mapping fluid contact movement through time and by geochemical water analysis.

**Improved field management efficiency and user productivity**
This project automated the daily workflow processes of reservoir and production engineers at Saudi Aramco, providing online access to critical data—not only for enabling close monitoring of well performance, but also for instantaneously predicting oil and gas production rates, detecting production problems, and tracking compliance with reservoir management guidelines. Access to historical production data up to the present was another key to improved reservoir analysis and forecasting capabilities.
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Using the new set of integrated tools, engineers can more efficiently manage Saudi Aramco's oil and gas fields throughout the E&P lifecycle, make better-informed and faster decisions based on up-to-date production data and automated analysis, manage more wells in less time, and detect production problems early in the well's life.

As a result of this engagement, the company has experienced an improved efficiency of field management practices and increased user productivity.

**Schlumberger Information Solutions**

Schlumberger Information Solutions (SIS) is an operating unit of Schlumberger that provides software, information management, IT, and related services. SIS collaborates closely with oil and gas companies to solve today's tough reservoir challenges with an open business approach and comprehensive solution deployment. Through our technologies and services, oil and gas companies empower their people to improve business performance by reducing exploration and development risk and optimizing operational efficiencies.

E-mail sisinfo@slb.com or contact your local Schlumberger representative to learn more.

“We realized considerable time savings with pertinent data being automatically updated, validated, and used in the analysis, minimizing human errors and leading to improved efficiency in our field management practices.”

Dr. Mohammed Issaka
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