Shuwaihat field – Exploration and evaluation

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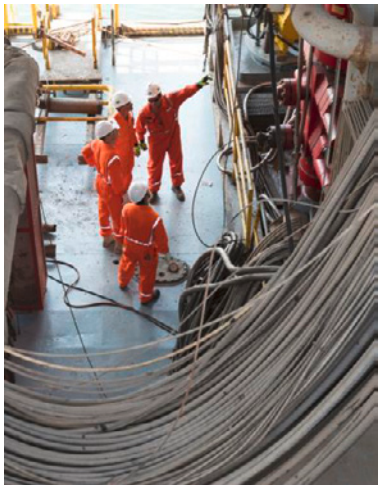
- **Collaboration between the Abu Dhabi National Oil Company (ADNOC), Wintershall and OMV**
- **Second appraisal well (SH-6) completed in 2017 offshore**
- **Wintershall evaluation based on decades of experience in producing sour gas and cutting-edge environmental technologies**

Abu Dhabi is one of the most important hubs for oil and gas activities in the Gulf region. As Germany's largest internationally active oil and gas producer, Wintershall is systematically expanding its commitment in the United Arab Emirates. As in other global activities, Wintershall is relying on the successful combination of modern exploration techniques and innovative production methods to improve the yield of complex reservoirs.



The SH-6 offshore drilling was successfully completed in May 2017.

In this spirit, Wintershall, the Abu Dhabi National Oil Company (ADNOC) and Austria's OMV signed an agreement in June 2012 to appraise the Shuwaihat sour gas and condensate field. As the operator Wintershall is responsible for the technical appraisal of the field. The Shuwaihat field is situated in the Western Region of Abu Dhabi, about 25 kilometers west of the industrial town of Ruwais. A successful evaluation and subsequent production would make Shuwaihat an important natural gas and condensate field in the western region of Abu Dhabi. It would also help to meet the increasing demand for mineral hydrocarbons in the United

Arab Emirates and contribute to the country's long-term export capabilities.

Operations on the first onshore appraisal well, the Shuwaihat-5 (SH 5), have been successfully completed early summer 2015. The evaluation results have encouraged the partners to proceed with the appraisal of the field.

Before operations the rig ENSCO-104 went through a maintenance and upgrade procedure.

In May 2017 the drilling and testing of the second appraisal well, located about 5 km offshore from the Shuwaihat Island, was completed successfully within time and budget. The SH-6 well was drilled in the crest of the field to confirm the productivity of the reservoir. The results will drive the future development concept of the Shuwaihat field.

First time in Abu Dhabi: "Mugharraq" port as supply base

Planning for the offshore well, Wintershall decided to explore means of optimizing logistics costs by using the local community port "Mugharraq" in the Western Region near by the Shuwaihat field. Historically, industrial harbors like "Mussafah" (about 250 kilometers away from the Shuwaihat field) are used for E&P activities in the region. By using the near-by "Mugharraq" port instead of a port in Abu Dhabi, and building up dedicated supply facilities, Wintershall significantly reduced the sailing time and fuel consumption to the location. This eliminated requirement for an extra supply vessel. The possibility to crew change by vessel significantly reduced the requirements for expensive helicopter flights.

The Wintershall liquid mud plant at Mugharraq port, Abu Dhabi.

Wintershall logistic support base demonstrated its effectiveness during the SH-6 operations and ADNOC therefore decided to obtain the logistic base for the future development of the Western Region.

Safe and clean sour gas production

The Shuwaihat field places particularly high demands on the exploration and production. The sour gas within the reservoir contains 23 percent hydrogen sulfide and about seven percent carbon dioxide – two highly corrosive substances that can damage the pipes and production equipment. In addition, hydrogen sulfide is already highly toxic at concentrations of just around 0.05 percent. Each sour gas production program therefore requires a high degree of safety and high-tech equipment.

As a technology-driven E&P specialist, Wintershall can draw on more than 40 years of experience in producing sour gas in Germany. For example, Wintershall has already developed 16 fields in Germany and recovered about 30 billion cubic meters of sour gas.

Highest HSE standards: A state of the art cascade system ensured security of the staff on the rig and the vessel.

For the well SH-6, Wintershall implemented an extensive detection and safety concept to handle the ultra sour gas condition safely. Fixed and portable gas detection and alarm systems were utilized to identify any release. State of the art breathing air cascade systems on the rig and the involved vessels as well as self-contained breathing apparatuses ensured the health and safety of all personnel. Throughout the Health, Safety and Environmental Impact Assessment (HSEIA) process, potential hazards and impacts were identified and mitigation measures (including emergency plans, training sessions, equipment specifications, monitoring requirements, etc.) defined.

From sour gas to methane

In case of production the downstream production plants must also be tailored to the specific properties of sour gas and associated challenges: a cleaning plant first of all removes the hydrogen sulfide from the gas using the OASE gas treatment technology developed by Wintershall's parent company, BASF. The methane produced is fed into the national pipeline network. The hydrogen sulfide is then transformed into sulfur dioxide in a so-called Claus plant and then into pure sulfur, which is sold as a raw material for the chemical industry.

At the supply base strict safety requirements apply.

Based on decades of experience, Wintershall continues to rely on innovation and high-tech expertise in the production of sour gas. In this spirit, BASF and the Petroleum Institute in Abu Dhabi agreed at the end of 2013 to enter a research collaboration to develop environmentally friendly methods for removing corrosive sulfur compounds from sour gases. The joint research will focus on methods that consume as little energy as possible. These include, for example, absorbents that can bind certain molecules to them through physical interactions. The specific results of the collaboration between the Petroleum Institute and BASF could be utilized in a possible development of the Shuwaihat field.

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