



Safe and clean sour gas

BASF and Wintershall are able to team up as strong partners with their respective sour gas expertise: in the Middle East, for example, where the production of sulfurous sour gas is gaining importance. Wintershall has more than 40 years of experience in producing hydrocarbons from technically complex fields. And BASF has an internationally recognized treatment process for cleaning gas.

As Germany's largest internationally active oil and gas producer, Wintershall takes great care to use the most innovative and effective methods in its exploration and production. This allows resources to be developed that are not initially considered suitable for production. This also applies to the production of so-called "sour gas". Sour gas is natural gas that contains carbon dioxide (CO₂) and hydrogen sulfide (H₂S). The latter is already very toxic from concentrations of about 0.05 percent. Cleaning facilities are therefore also used in sour gas production to remove the CO₂ and H₂S from the gas.

30 billion cubic meters of sour gas already produced

As a technology-driven E&P specialist, Wintershall can look back on more than 40 years of experience in the production of sour gas in Germany. Wintershall has already developed 16 fields in Germany, produced some 30 billion cubic meters of sour gas and built four gas purification plants. Wintershall's first sour gas reservoir, the Düste field, was discovered back in 1961 near Barnstorf in northern Germany. Shortly after the discovery, Wintershall began constructing a natural gas treatment plant in Düste. The Rütenbrock and Staffhorst fields were also discovered in the 1960's

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Wintershall also utilizes its sour gas expertise as the operator responsible for the technical exploration and development of the Shuwaihat sour gas field in Abu Dhabi.

in Germany. Wintershall is one of the pioneers of sour gas production and has developed considerable know-how in plant design, construction, operation, production and safety.

This know-how is complemented by the expertise of its parent company: BASF has many years of experience in the manufacture of agents for gas cleaning, which along with other elements removes the hydrogen sulfide from natural gas. The products produced by using the OASE gas cleaning technology developed by BASF include the well-known solvent MDEA. This enables BASF and Wintershall to team up as strong partners with their sour gas expertise, such as in the Middle East region, for example, where sour gas production is gaining importance.

Production and safety

Wintershall has been producing natural gas since the 1960s, for example in Staffhorst (Lower Saxony). To begin with, the production of sour gas is not significantly different to normal natural gas production. The gas is brought to the surface via wells, just like natural gas. After that it is transported via a pipeline to the gas cleaning facility in Großenkneten, where the carbon dioxide and hydrogen sulfide are removed. While the carbon dioxide begins its journey back to the reservoir, the hydrogen is sent to a so-called “Claus plant”, where the H_2S is converted into water and pure sulfur. The sulfur is sold mainly as a raw material to the chemical industry in northern Germany.

Companies that wish to produce sour gas require special equipment and must comply with strict safety standards. Both the production plants and the pipes that the sour gas flows through must be specially designed to cope with the sour gas properties and the challenges they pose. For example, hydrogen sulfide is highly corrosive and can easily attack the pipes and production plants. To prevent this from happening, the wells and pipelines which the sour gas flows through are made of high-grade stainless steel alloys – otherwise the steel could become brittle and fracture.

Strict safety standards are in place since gas leaks must be prevented due to the presence of hydrogen sulfide in the sour gas. For example, during drilling operations the drilling fluid and casing strings contain so-called “ H_2S alkalinity buffers”, which break down the hydrogen sulfide and keep it in solution in the drilling fluid. It is then removed at the surface. In the subsequent production phase, numerous cut-off valves in the



Working at the sour gas production plant at the site in Staffhorst.

production wells prevent any hydrogen sulfide from leaking. Gas detectors and radio-controlled measuring stations register even the smallest concentrations of hydrogen sulfide (0.001 percent), carbon dioxide or methane in the air. And if this happens, the plant affected or the entire facility shuts down automatically.

The plant sites are divided into various safety zones. All the staff who work at production sites are trained especially for this and carry special equipment. No special protective gear is required outside the production facilities, whereas in the vicinity of the production facilities all the staff carry escape sets which can be used as breathing masks if needed. Small, portable detectors immediately notify the staff about any gas leak. Some operational sites also have particularly sensitive zones. If sour gas were to escape here unexpectedly, this would happen at high pressure. For this reason, protective equipment with an independent oxygen supply is mandatory in such zones. Comprehensive risk analyses are conducted at regular intervals to identify the risks and, on the basis of these analyses, the necessary safety measures, emergency plans, training requirements or specifications for equipment are determined.

The treatment process

As well as operating production facilities, Wintershall has experience in gas treatment. Several steps are necessary to isolate the hydrogen sulfide from the gas and convert it into liquid sulfur: first, the sour gas is fed into a cleaning facility where the MDEA solvent developed by BASF is applied.

The solvent is a watery alkaline solution that works like a detergent and removes the hydrogen sulfide and the carbon dioxide from the gas. At the beginning of this purification process the alkaline solution and the gas meet on a large surface area made of stainless steel sheets. The solution contains an alkaline compound containing nitrogen – the so-called “amine”. This amine absorbs the H₂S and CO₂ in an acid-base reaction. The cleaning solution containing these elements is then disposed of following this reaction. The gas that has been freed from the acidic elements in this purification process is then dried and can now be fed into the national pipeline network. The remaining, highly concentrated hydrogen sulfide is sent on from the purification plant to the so-called “Claus” furnaces. There a third of the hydrogen sulfide is burned. The sulfur dioxide generated reacts with the remaining two thirds of the gas to form pure sulfur and water. The liquid sulfur can be taken away in rail tank wagons or converted into solid granules. It is purchased by the chemicals



All the staff working at a production well at the natural gas production facility in Staffhorst wear special equipment such as respiratory masks.

and rubber industries. They use the sulfur for manufacturing, for example, car tires, fertilizers or medicinal products.

Cooperation with BASF: Sour gas expertise exported

With more than 300 reference plants, BASF is now one of the leading companies in gas cleaning. The chemical company develops solvents for its customers that are individually adapted to the composition of the gas and the needs of the plant. Wintershall uses this skill for new projects.

New project in Abu Dhabi

One of the most important centers of the oil and gas business in the Gulf region is Abu Dhabi. The emirate needs an increasing amount of energy to cover domestic demand, including for electricity production and sea water desalination plants. Whilst in past decades it focused almost entirely on oil to meet this demand, the development of gas fields is now growing in importance. Many of the gas reservoirs in the region contain sour gas with a high concentration of hydrogen sulfide.

The Shuwaihat reservoir, which lies partly under the mainland and partly under the sea of the Arabian Gulf, is situated in the Western Region of Abu Dhabi about 25 kilometers west of the industrial town of Ruwais. The condensate-rich natural gas in the Shuwaihat field contains about 20 percent hydrogen sulfide and about seven percent carbon dioxide. To produce this gas, which was discovered in four wells between 1957 and 1984, the state-run Abu Dhabi National Oil Company (ADNOC) looked for international partners with long-term experience in sour gas production. It chose Wintershall, which not only managed to convince ADNOC with its expertise in plant construction, operation and production, but also with its trump card: BASF as an expert in gas cleaning. Wintershall, ADNOC and Austria's OMV agreed in June 2012 to undertake the technical evaluation of the sour gas and condensate field Shuwaihat. As the operator Wintershall is responsible for the technical exploration and development of the field. The first onshore exploration well was completed successfully in 2015. The second appraisal well was drilled offshore in 2017. The evaluation and planning phase will be completed end of 2017. If the positive expectations are confirmed, Shuwaihat could become part of an integrated development plan for the region.



The Shuwaihat reservoir, which is situated in the western region of Abu Dhabi, lies partly under the mainland and partly under the sea of the Arabian Gulf.

Images are available for downloading at www.wintershall.com in the Mediathek.