WATER INJECTION PUMP STATION

Concept & Location

The Kingdom of Saudi Arabia is the world's largest exporter of oil and petroleum. KSA holds the world's largest known reserves of oil and the oil exports are the Saudi economy's biggest export and revenue generator.

The bulk of the oil production happens at five key locations in Ghawar, which is often called as the world's largest oilfield. The super-giant field is 280 kilometers in length and consists of five contiguous oil fields from north to south: Ain Dar, Shedgum, 'Uthmaniyah, Hawiyah and Haradh.

Ain Dar was the first location where oil drilling was resumed post World War 2, owing to its close proximity to the producing facilities at Abqaiq. The Ain Dar oil well was drilled in 1948 put into production in early 1951 and has produced nearly 152 million barrels of oil and is still pumping out 2,100 barrels per day (bpd).

The Hawiyah oil well was drilled in 1953, and the well was put on stream in 1966, when the Hawiyah Field was developed. The Hawiyah oil field has produced 51 million barrels of oil, and continues to produce 4,600 bpd.

The oil fields are operated and maintained by the world's biggest petrol company, Saudi ARAMCO. Saudi ARAMCO has steadily refined and improved oil production techniques and adopted new technology to improve the productivity at each oil well.

Water injection is a relatively modern technique that is employed to ease the extraction of oil. Pumping stations inject pressurised jets of water into the oil wells, which provide additional pressure support to maintain reservoir capacity by pushing oil to the surface. This is also known as secondary recovery, and offers a stepwise improvement in pressure support and eases the displacement of oil from the outer edges of the oil field toward the central regions to sustain oil production.

Saudi ARAMCO wanted to construct a modern Water Injection Pumping Station (WIPS) at the crucial oil wells at Ain Dar and Hawiyah. The Main Contractors for the project, a Joint Venture between Saipem & Snc- Lavalin , chose Drake & Scull Construction's KSA subsidiary International Centre for Civil Contracting (ICCC) to carry out the complete civil works for the massive industrial project.

ICCC combined its rich local experience and technical expertise to undertake the civil, structural and architectural work which involved the earthwork, demolition, civil works, concrete works, underground utility, and structural steel works.

The entire project was completed from start to finish in two years and became a solid testament of ICCC's ability to carry out massive complex industrial projects for the Oil and Gas Industry.

Scope of Work

The WIPS projects required construction activity to be carried out at two different locations. The scope of work on each site was different, catering to the unique geographical nature and production capacities of each.

The scope of work on the Ain Dar site covered:

- Construction of new underground drainage for new equipment (including septic tank, manholes, neutralizations pits, soak pits, valve boxes, catch basins, leach field system, sanitary and oily water sewer system, etc.)
- Fencing, gates and Site Preparation with Final Grading and Paving
- General Demolition
- Construction of Guard House, Prayer Shelter/Support Buildings
- Foundations for KO Drums, Pipeline Supports, Lube Oil, Potable Water Tank, Switchgear, Diesel Generators and IA Compressors
- Construction of UPS & Battery Buildings, Maintenance Buildings, Control Buildings, Steel Platforms, Pipe Supports and Platform Supports
- Pavements & Asphalt Areas
- Construction of Pump Stations Foundation (including foundations for Air Cooler, Filter House, Control Cabin, Equipment Stack, Exhaust Stacks, Mineral Oil Mist Eliminator Skid, and Fuel Gas Skid)
- Modification of Foundations for Pumps
- Construction of Substation Buildings, New Transformer/ Switchgear, Maintenance Buildings, Construction of Water Tank Foundations
- Construction of Electrical Duct Bank and Pullboxes, Steel Structures, Cable Racks, Steel Pipe Supports , and Walkways

The scope of works on the Hawiyah Site included:

- Construction of new underground drainage system for new equipment (including manholes, neutralization pits, catch basins, oily water system, sewage piping system, etc.)
- General Demolition
- Storage Buildings, Air Compressor Foundations, Kerosene Tank Foundations
- Pavements & Asphalt Areas, Evaporation Ponds, Fences and Gates
- Final Grading/Paving/Marl/Road
- Construction of Pumping Station Foundations (including foundations for Air Cooled Heat Exchanger, Filter House, Control Cabin, Equipment Stack, Exhaust Stack, Lube Oil Evaporation Separator, Fuel Gas Filter Skid and other Miscellaneous Foundations for CGT 9001)
- Construction of Instrument Air Compressors Foundations
- Construction of Lube Oil Storage Facilities & Pump Foundation
- Construction of New Storage Buildings

- Construction of Pipe Ways Foundations
- Construction of Surge Relief Skid Foundations
- Construction of Fuel Gas Filter
- Construction of CO2/Battery/Panel Buildings
- Construction of UPS Room (featuring an Extension Electrical Substation)
- Construction of Support Buildings and Miscellaneous Pipe Support Foundations
- Installation of Pressure Control Valves
- Construction of Temporary Instrument Air Compressors
- Installation of Structural Steel Works and Pipe Racks
- Construction of Instrument Air Receiver, Air Dryer and Air Compressor Sheds
- Surge Relief Skid Shed
- Pipe Supports

Innovation

The requirements of the project were very complex, owing to the critical nature of the oil wells to the Saudi Arabian economy. ICCC worked in constant consultation with Saudi ARAMCO and combined their collective wisdom in tandem to execute the WIPS project.

From a logistics point of the view, the remote location of the 2 sites, far away from the nearest urban centre, proved to be quite a challenge in terms of material movement and manpower accommodation. To tackle the problem, ICCC setup an accommodation & laydown yard for each site, in the heart of the desert. Specialist teams were assigned the responsibility to ensure that procurement & materials arrangement were carried out in a smooth manner.

There was also a challenge in terms of security for the critical oil fields, which were severely restricted in terms of access. Since the WIPS was to be installed alongside the existing ARAMCO Plant , ICCC arranged for a unique tagging system that merged the ICCC manpower into ARAMCO's ID system, to allow for a free movement of manpower within the sites.

At its peak, the manpower on both project sites totaled around 800 personnel overall which provided ICCC with invaluable experience on how to tackle such massive industrial complexes in such remote locations.

The WIPS were successfully installed and integrated into the Existing ARAMCO oil plants and became a vital part of enhancing the longevity of the Ain Dar and Hawiyah oil fields.

The WIPS is a successful showcase of ICCC and DSC's capabilities to address the needs of the industrial and the Oil & Gas sectors.