

CASE STUDY

DIESEL IN CENTRAL SAUDI ARABIA



Background

CLIENT: Saudi Arabian Environmental Consulting Firm, on behalf of a major Oil & Gas Company

DURATION: 3 years

LOCATION: Central Saudi Arabia

PROJECT VALUE: \$350,000 CDN

At an active bulk fuel facility in central Saudi Arabia, historical spills and leaks had resulted in up to 2.8 metres of LNAPL (Light Non-Aqueous Phase Liquid) floating on a perched water table. The site and geographic location required a flexible, low-infrastructure solution that could withstand the extreme climactic conditions without interfering with the facility's operations.

Considerations

The oil & gas company hired a local environmental consulting firm to characterize the site. Characterization revealed two important factors:

Perched aquifer: The diesel was located on a perched aquifer. Ensuring that the installation did not penetrate the underlying aquitard was imperative.

Varied NAPL transmissivity: NAPL transmissivity testing indicated transmissivity varied by 4–5 orders of magnitude. Despite thick layers of LNAPL (> 2 m), the LNAL would not flow into the extraction wells quickly; so, an aggressive technology like dual-phase extraction would not work.

Approach

VACUUM-ENHANCED PNEUMATIC SKIMMING

To meet the challenges associated with this site, IRSL recommended extracting the LNAPL through vacuum-enhanced extraction wells instrumented with pneumatic skimmers.

A full-time engineer remained on-site for the project's 3-year duration to continuously adjust and optimize the system to compensate for the varying degrees of NAPL transmissivity.



GEOLOGY: Perched aquifer,
Silty sand

APPLIED TECHNOLOGIES

Free product removal was completed through vacuum extraction wells instrumented with pneumatic skimmers equipped with hydrophobic filters. The filters allowed only the LNAPL to pass, leaving the water behind, while the vacuums increased the radius of the skimmers.

THE SYSTEM

This system was flexible enough to fulfill a number of important criteria:

- Minimal and low-maintenance equipment, requiring minimal power. Equipment and replacement parts had to be transported from North America.
- The vacuum system and skimmers could be easily moved, adjusted and optimized.
- The efficiency of the filtration negated the need for a treatment system.

Challenges

A number of conditions made this project exceptionally challenging:

- Large variations of 4-5 orders of magnitude in the NAPL's transmissivity across the site required extensive, continuous optimization with regard to cycle length, numbers, and skimmer position.
- Careful attention was required to avoid penetrating the aquitard and spreading contamination.
- The extreme climatic conditions required equipment designed to withstand very high temperatures, humidity, corrosion, and dust.
- The active bulk fuel facility's rigorous health and safety regulations required all equipment to be explosion-proof and highly secured.

Results

- Over 71,000 litres of diesel were removed over the course of the project.
- The extracted liquid was greater than 99.997% diesel, minimizing the need to treat extraneous water and translating into real cost savings for the client.
- The purity of the recovered diesel enabled the company to stream it into their production, effectively paying for the project.
- The pilot project was deemed a complete success, initiating plans for several full-scale projects.



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