INNOVATIVE *IN SITU* APPLICATION OF PETROCLEANZE USING HORIZONTAL WELLS

CASE STUDY: Horizontal Well Injection Application Creates Zero Site Disturbance at Active Gas Station Site



REGENESIS®



OVERVIEW

BTEX contamination and free-phase product from a petroleum release was discovered in the groundwater at an active gas station in Colorado. After previous remediation attempts from prior consultants, CGRS, Inc., Paragon Consulting Group, Inc., the Colorado Division of Oil and Public Safety (OPS), and REGENESIS® collaborated to create a design that would successfully remediate the persistent groundwater contamination and free-phase product.

REGENESIS proposed a design including two horizontal wells which would administer a total of four injection events, with enhanced fluid recovery (EFR) events being performed before and after each injection. The existing vertical wells on site and horizontal wells would be used for the EFR activities. The *in situ* chemical oxidation technology, PetroCleanze™, would be administered to desorb the hydrocarbons and allow for a successful enhanced recovery. The first injection event was performed in 2018, with three additional injection events planned for 2019.

HIGHLIGHTS

- REGENESIS provided an innovative design and creative solution using horizontal wells to apply PetroCleanze and minimize daylighting
- The horizontal well system allows for the active gas station to continue to conduct business without disruptions
- Staying open during remediation efforts saved gas station owners an estimated $8,000 per day
- PetroCleanze was successfully applied despite the challenging lithology and shallow bedrock

BACKGROUND

This gas station site has a history of contamination that has been difficult to locate and remediate. Previous consultants attempted to remediate the site with a mechanical system but were unsuccessful. In particular, the site was not suited for a traditional vertical injection point strategy. For example, the lithology and the relatively shallow bedrock would have required injection points with unfeasible, 5-foot centers. Additionally, vertical injection points were not considered because injecting into the relatively shallow bedrock would increase the likelihood of surfacing. These difficulties were heightened by the requirement that remediation activities be performed with very little to no disruption to the active business. In considering these challenges, REGENESIS proposed to install two horizontal wells. These wells would prevent disruption to the business and would function alongside the permanent, gas station infrastructure.

PROJECT TIMELINE

March 2016

Groundwater sampling event observed water and free-phase product at depths ranging from approximately 15-24 feet below tops of casings. Compared to previous data, this was a significant decrease. This may be in part due to drought conditions and the draining of a nearby lake.

August 2016

CGRS, Paragon Consulting Group, Inc., and OPS discussed a joint effort for the remediation of this site

September 2016

Free-phase product was observed in MW-8.

0.75 gallons of free-phase product were removed from MW-8 using hand-bailing techniques

October 2016

Parties met with REGENESIS to request a remediation design

October 2016

CGRS submitted a corrective action plan (CAP)

April-May 2018

Directional Technologies, Inc. installed the horizontal injection wells.

May, June & July 2019

Three injection events of PetroCleanze are planned

June 2018

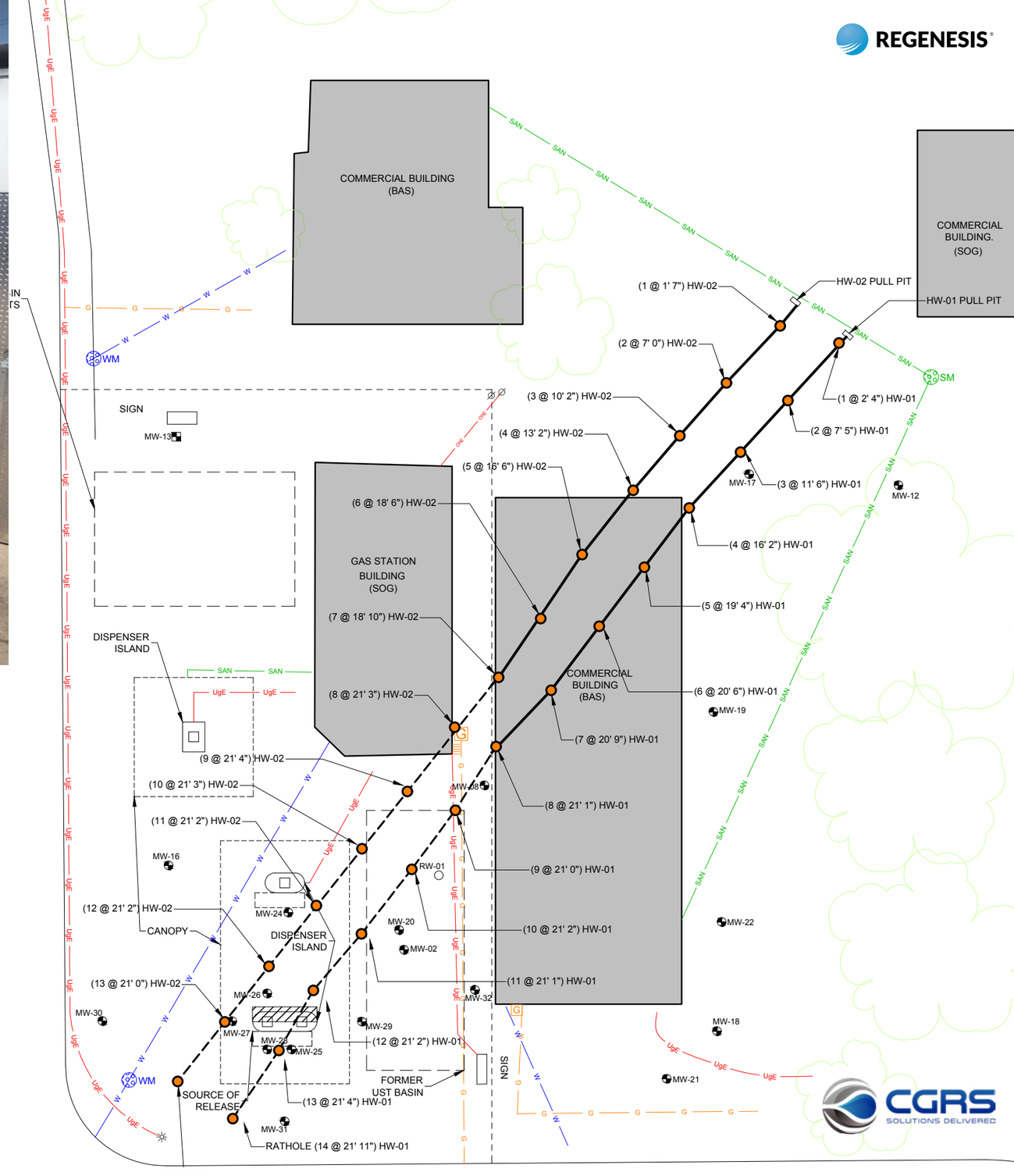
First injection event of PetroCleanze took place



REMEDIATION STRATEGY

Prior to the application, the environmental consultants needed to determine the correct depth of the water table in order to accurately target the LNAPL. Initially, the water level was at 19-20 feet below top of well casing; however, following a drought, the level dropped below these measurements. CGRS provided more recent measurements along with the historical information about the groundwater to aid REGENESIS in determining the location for the horizontal wells. REGENESIS in conjunction with Directional Technologies, Inc. designed the two horizontal wells to begin at an adjacent north property and extend underneath an adjacent east property and terminate under the southwest area of the gas station.

The two horizontal wells delivered the first application of PetroCleanze in 2018. The horizontal wells allowed for a very targeted application of PetroCleanze which enhanced the LNAPL recovery. Three weeks after the injection, the consultants performed an enhanced fluid recovery event and evaluated the groundwater for BTEX concentrations. After this first successful application, three more applications are planned to be administered in 2019.



Map depicting innovative horizontal well approach.

SUMMARY

The innovative remedial design has made it possible for the gas station to remain operating with little to no disruptions. The horizontal wells were designed to work alongside the existing gas station infrastructure and they allowed for a highly focused application of PetroCleanze, with minimal surfacing. After a successful application in 2018, three more applications are planned for 2019 in order to treat the remaining contamination. Additional applications may be necessary to achieve the regulatory closure requirements. The site consultants and engineers anticipate a successful Tier I or Tier II site closure following these remediation events.

The horizontal injection wells were successfully installed through the weathered bedrock zone at 21 feet bgs. Reinforced grout/bentonite seals around the riser portion of the horizontal well casing were necessary to prevent daylighting of injected fluids. During initial injection testing, the horizontal wells performed at flow-rates of approximately 45 gallons per minute (gpm) with 10 to 13 pounds per square inch (psi) of pressure.

Site remediation activities were conducted beneath the feet of undisturbed customers, saving the gas station owners an estimated $8,000 per day through the remedial construction

TECHNOLOGY

PetroCleanze™ is a customized formulation of the widely used RegenOx *in situ* chemical oxidation (ISCO) technology. This two-part reagent contains purposefully enhanced, detergent-like properties which significantly increase the desorption rates of hydrocarbons bound in saturated soils. Once the hydrocarbons are liberated into the dissolved-phase, they are more readily available for removal using a range of enhanced recovery techniques.

PetroCleanze is designed to increase the viability and efficiency of enhanced recovery techniques such as dual-phase extraction, vacuum enhanced extraction and pump and treat systems. Based on site conditions, the PetroCleanze driven enhanced desorption process makes it possible to clean up heavily impacted sites faster and more cost-effectively than through traditional mechanical means or stand-alone ISCO approaches. In cases where significant contaminant mass removal is required, multiple injections of PetroCleanze followed by multiple contaminant extraction events is advised. PetroCleanze also incorporates chemically engineered technology that avoids the addition of problematic carbon loading associated with standard surfactant-based technologies. Instead, PetroCleanze creates surfactants in place thereby enhancing the hydrocarbon removal process.

PETRO CLEANZE™
Enhanced Desorption

Key Benefits:

- Designed for use in conjunction with physical and/or mechanical enhanced recovery systems
- Unique product chemistry proven highly effective on petroleum hydrocarbon contamination
- Powerful oxidation reactions equal to that of standard RegenOx oxidize more readily available hydrocarbons
- Stays in-place providing an activation site for multiple applications if and when required.
- Engineered chemistry does not add surfactants but creates them aiding in enhanced hydrocarbon removal
- Avoids problematic carbon loading associated with the use of standard surfactant based technologies



ABOUT THE CONSULTANT

CGRS began almost 30 years ago as an environmental consulting, compliance and construction company providing industry and regulatory compliance expertise and services to owners and operators in the upstream and downstream petroleum industry.

Over time we have diversified to meet the ever changing customer needs by becoming experts in the markets of Natural Resources/Environmental, Liquid and CNG Fueling, Oil & Gas, Water and Waste Water.

And we are always on the lookout for the next opportunity to help our clients succeed. We have evolved to offer a much wider range of services: Compliance Inspection and Testing, Permitting, Engineering/Design, Construction, Design/Build, Leak Detection, Water Quality Sampling and Assessment, Air Emissions Management, SPCC, Mapping and Aerial Services, Reclamation and Material Management…just to name a few!

Our expertise is multifaceted; we have subject matter experts in diverse yet synergistic areas and truly are a one stop shop for our customers.

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ABOUT DIRECTIONAL TECHNOLOGIES

Directional Technologies is among a handful of horizontal directional drilling contractors in the world experienced in using horizontal directional drilling technology to install Horizontal Remediation Wells for environmental remediation applications.

As horizontal directional drilling specialists, Directional Technologies has extensive experience and all necessary equipment for making trenchless installations for a wide range of clients from telecommunications electrical, natural gas, water mains, and other utility services.

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FIND THE RIGHT SOLUTION FOR YOUR SITE



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