

Colloidal Carbon and Bioremediation Addresses Petroleum Contamination

Cascade Chemistries Prevent Hazardous Migration From Underground Storage Tanks In A Rocky Mountain Town

PROJECT DETAILS

PROJECT: Active Gas Station

LOCATION: Minturn, CO

SERVICE: Injection of ColloidalChem+Bio™

CONTAMINANT: Petroleum

CHALLENGE

Benzene Plume from Underground Storage Tank Threatens Small Town

In a former railroad town built during Colorado’s mining boom, the leading edge of a benzene plume from an underground storage tank (UST) was traveling downgradient from an active gas station. The owner needed to stop the contaminant migration before it worked its way to several neighboring homes or eventually into the nearby Eagle River, known for excellent fly fishing.

Minturn is a small town in a wilderness area ten minutes from Vail, with a population of 1,000 that grows as tourists, skiers, and other outdoor enthusiasts visit. The entire town is only eight square miles, with the Eagle River running through. The busy gas station is located on a small two-lane road with sidewalks and a mix of commercial and residential buildings in the neighborhood.

High concentrations of petroleum and its byproducts, including benzene, are considered highly hazardous and are closely regulated. Many states have enacted regulations pertaining to owners and operators of USTs for assessment and cleanup of petroleum contaminated sites. In this case, the gas station owner received funding from the Colorado Petroleum Storage Tank Fund to support the safe and effective petroleum remediation process.

An attempt was first made to address the petroleum issue by focusing on the problematic underground storage tanks: repairing the leaks and treating contaminants released around the tanks, based on the belief that there wasn’t much migration away from the gas station. But more recent data showed that the contaminants had migrated downgradient towards the nearby houses.



SOLUTION

Colloidal Carbon with Biological Enhancement

Based on their review of the in situ data, Cascade’s experts proposed in situ injection of the Cascade Chemistries product ColloidalChem +Bio™, a special formulation of the activated carbon product, ColloidalChem™, to absorb the benzene, coupled with an anaerobic bioremediation enhancement.

HOW COLLOIDALCHEM + BIO™ WORKS

Injecting ColloidalChem + Bio creates a permeable reactive barrier where petroleum contaminants are rapidly adsorbed. Over time, added electron acceptors (e.g., slow-release sulfate) consume the petroleum sorbed to the carbon.

The benefits of ColloidalChem +Bio include low pressure delivery and distribution within the subsurface without the need for fracturing, a rapid decrease in groundwater contaminant concentration after application, and sustainable reductions over time without rebound.

Hydraulic fracturing with larger activated carbon particles was considered however, this wasn’t suitable for the site near the Eagle River, as it might create a direct flow path for contaminants and amendments to reach the river. The fracturing process often leads to “daylighting” or “surfacing” – when the injected material returns to the surface. This means the treatment doesn’t remain underground where needed, resulting in ineffective contact and wasted product.

Chemical oxidation was also an option, but that was ruled out because it lacked the necessary persistence to treat the contamination. Another option would have been to inject calcium peroxide for aerobic bioremediation – but the contaminant concentrations were too high for that to be effective.

The client knew that ColloidalChem alone could achieve the project goal, but they wanted to demonstrate enhanced treatment with ColloidalChem +Bio. Cascade designed the project, planning the amount and volume of the amendment, while the client selected the locations for the permeable reactive barriers. To create the permeable reactive barriers, the Cascade team used direct push injection.



PROJECT EXECUTION

Resolving Unexpected Challenges

Minturn, CO sits at an elevation of almost 8,000 feet, with snow on the ground much of the year, making project timing critical. Cascade's experienced project manager scheduled the project for late spring, knowing they needed to plan and execute it within a narrow window when the weather and environmental conditions were conducive.

Two major challenges surfaced quickly at the site; Cascade's innovation and experience immediately came into play.

Cascade's policy is to conduct "potholing," also known as utility clearance - digging down to five feet to clear any utilities before beginning to drill. The crew discovered that the driveway area was overloaded with gas, electric, and water lines. Because of this unusually high number of utilities, the crew began carefully using hand digging and soil vacuuming to reach the five feet of depth. They then found the second challenge: large cobbles in the injection area. While this lithology is not uncommon near a river, especially one that descends from the Rocky Mountains, the size and extent of the cobbles was much greater than the client had anticipated. Some were 18 inches in diameter, the crew had to rapidly mobilize robust potholing equipment to the site in one day.

The unexpected subsurface utilities prevented safe access to all the planned injection points. Ultimately, thirty-two thousand pounds of CollodialChem +Bio amendment was injected into fewer points than originally planned; the injection points were strategically located for maximum distribution to intercept contaminated groundwater migration, and the volume per injection provided optimized contact. Based on available data and expertise, the Cascade crew was confident that the barrier installed would provide adequate protection against the advancement of the plume.

While other companies might have given up when facing these unexpected challenges, Cascade dealt with the problems presented by the large cobbles and many utility lines. Many years of experience has prepared the team for these situations; there are always unknowns in the subsurface.

Cascade completed the project in five injection days with a four-person crew. The team followed Cascade's safety policies to prevent injury and, even with the additional challenge of multiple utility lines, there were no line strikes, no loss of power, and no injuries.

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CONCLUSION

Experience Leads To Safe and Successful Injection

Cascade's field experts adapted to significant cobble conditions and overloaded utilities to inject the full amount of the amendment into the designated area. Omitting the utility zone from the injection points should not impact overall performance of the barriers.

After the injection was completed, the client checked the monitoring wells and found that adequate distribution did happen. An ongoing monitoring program will ultimately confirm achieving the goal of reducing risk to the homes and Eagle River downgradient from the gas station.

The keys to success on this project were:

- Choosing a highly effective remedy for the petroleum contaminant; ColloidalChem + Bio to absorb the benzene and enhance anaerobic bioremediation of petroleum contaminants
- Quickly overcoming the unexpected challenges with a field service team that had the right experience, get'r done attitude, and equipment as well as the crucial ability to mobilize contingency options while following strict safety protocols to prevent accident and injury from utility strikes.