MYNO

From Contamination to Community Value

Engineered Biochar for TPH-Impacted Soils and Sediments

Executive Summary

The oil and gas industry stands at a crossroads. Decades of petroleum production have left behind a legacy of complex, persistent contamination that's costly, technically challenging, and protracted to remediate. Traditional "dig-and-haul" or "cap-and-contain" approaches often fall short in achieving long-term, sustainable recovery and restoring healthy, productive soils.

In parallel, there's a growing recognition that sustainable and nature-positive approaches to remediation offer an opportunity to create new value - driving economic benefits and broadening land reuse for community gains. For example, The EPA has long-recognized the need for investing in petroleum-brownfield programs to clean up hydrocarbon-contaminated sites and promote land reuse for community amenities such as parks and recreational areas. Sustainable innovation is reshaping clean-up strategies, integrating nature-based solutions while shifting from 'dig-and-haul' to 'clean-and-restore' with an increasing focus on soil regeneration and land revegetation.

Myno Carbon's Biochar 3.0 sits at the forefront of this transformation. Engineered from sustainably sourced wood biomass and designed for sorption and microbial stimulation, Myno's biochars provide a tailored, scalable, and cost-effective in-situ approach for petroleum hydrocarbon contaminated site remediation. Specifically developed for oil & gas impacted soils, Myno's solutions sorb petroleum hydrocarbons and act as a biostimulator to promote the biodegradation and ultimate remediation of these contaminants; all while restoring soil function and sequestering carbon. Biochar's stable carbon matrix provides long-term carbon sequestration with the potential to open new pathways for green financing and broader land reuse.

"As cleanup technologies continue to advance and incentives evolve, green remediation strategies offer significant potential for increasing the net benefit of cleanup, saving project costs, and expanding the universe of long-term property use or reuse options without compromising cleanup goals.

- (US EPA, 2008)

When Cleanup Becomes Crisis:

The Multifaceted Remediation Challenge

The oil and gas industry faces a complex, persistent set of environmental remediation challenges that extend far beyond the immediate operational footprint. Sites often suffer from petroleum hydrocarbon spills which, depending on the industrial activity at the site, can include gasoline range organics (GRO), diesel range organics (DRO), or unrefined petroleum, which may contain metals and polycyclic aromatic hydrocarbons (PAH) in source oils, and require multi-faceted remediation strategies to address their varying chemical toxicities and environmental impacts.

A significant technical challenge lies in subsurface contamination, which is difficult to detect, characterize, and remediate. Hydrocarbon contamination disrupts soil microbiomes, reduces biodiversity, and impairs natural revegetation processes. Contaminants can migrate into groundwater or deep within soil layers, where traditional “dig-and-haul” approaches are either cost-prohibitive or logistically impractical.

The financial burden of remediation is equally daunting. Capital-intensive technologies, such as ‘pump and treat’ or chemical oxidation, can strain budgets through high upfront bonding costs and long-term operational expenses. These costs can also deter investors due to long-term liabilities where clean-up timelines can span decades, driving cumulative costs upward while limiting site reuse or redevelopment.

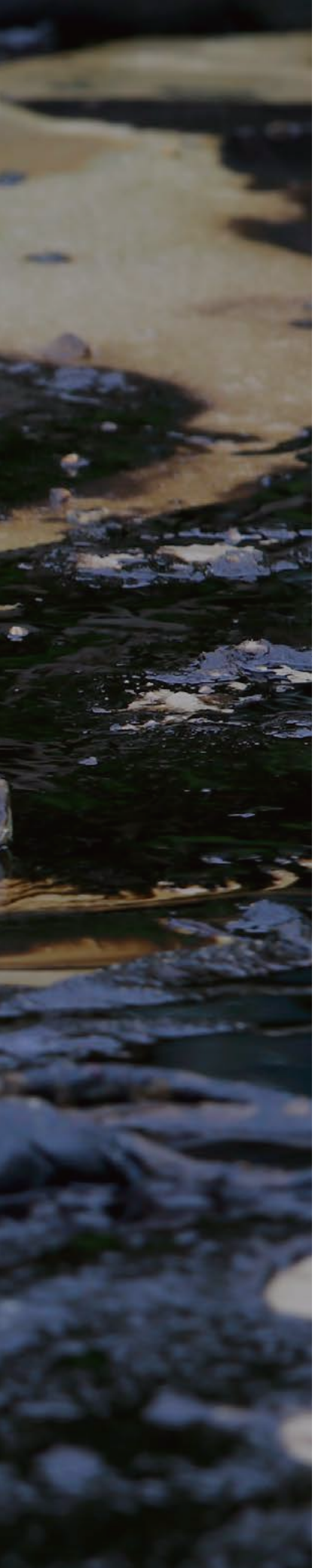
Liability exposure extends beyond direct cleanup costs to encompass third-party legal challenges, regulatory penalties, and long-term monitoring requirements. Affected communities are increasingly organized and informed about environmental health risks, demanding action and transparency in remediation progress while monitoring long-term recovery.

Today's Remediation Revolution:

A More Integrative & Tailored Approach

In response to these challenges, the oil and gas industry is undergoing a notable shift through the evolution of green and integrated remediation strategies that rebuild soil health and biodiversity, while providing quantifiable results that satisfy regulatory and economic requirements. Myno Carbon's Biochar 3.0 is engineered to meet today's more dynamic, tailored, and integrated clean-up objectives. Myno's biochars are chemically stable, highly carbonized, and engineered for sorption and biostimulation. Its high surface area and micro- to mesoporous structure provide an ample micro-environment for co-location of total petroleum hydrocarbon (TPH) contaminants and microbial colonization, enhancing both contaminant removal via biodegradation while cultivating soil regeneration.

Myno Carbon's vision is to transform petroleum site reclamation from a cost center into a catalyst for regenerating value - whether a site is active, in transition, or retired.



A New Model for More Effective Regeneration

Today, forward-thinking remediation strategies go beyond legacy ‘cap-and contain’ methods by either integrating regeneration during production or transitioning post-industrial land from containment to true recovery.

On one end of the spectrum, ‘remediate-as-you-go’ approaches deploy multiple technologies simultaneously during production, with a strong financial case for concurrent remediation. Early intervention prevents small spills from becoming major contamination events and proactive, in situ clean-up methods can reduce operational downtime, shrink environmental footprints, accelerate recovery timelines, and avoid high post-production disposal costs.

While legacy sites also represent one of the largest untapped opportunities for sustainable remediation and regeneration, including the millions of acres of brownfields, superfund zones, and post-industrial lands that have undergone partial remediation but continue to harbor residual petroleum hydrocarbons (TPH). These sites often remain constrained by lingering contamination in soil or groundwater that prevents redevelopment, ecological recovery, or regulatory closure.

A New Model for More Effective Regeneration

Myno Carbon's engineered biochars are safe, green remediation solutions that concurrently promote the degradation of hydrocarbon contaminants, restore soil health, and sequester carbon. Biochar's safety profile makes it suitable for active site deployments. It poses minimal health risks to workers (potential for dust, which is mitigated through PPE), while application requires minimal or no specialized handling, which can occur during routine maintenance windows or alongside standard site activities without operational disruption. Versatility in operational deployment is another advantage, which can include several scenarios:

Preventive application:

Proactive placement in high-risk areas to prevent contamination migration

Responsive deployment:

Rapid application of biochar booms following spill events to contain and treat contamination immediately

Systematic treatment:

Phased application across entire sites to gradually reduce contamination loads

Enhanced natural attenuation:

Integration with existing natural attenuation strategies to accelerate cleanup timelines

Myno's biochars have a pore structure and surface chemistry that bring rapid benefits to site-clean up by effectively adsorbing hydrocarbon contaminants, including benzene, toluene, ethylbenzene, and xylene (BTEX) compounds, polycyclic aromatic hydrocarbons (PAHs), and other petroleum hydrocarbon components. Its high surface area enables rapid contaminant uptake and long-term sorption combined with a biostimulation action whereby biodegradation is promoted. Beyond contamination removal, Myno Carbon's biochar helps to rebuild soil structure, enhances water retention, neutralizes pH, and creates a foundation for long-term ecological recovery. The wood-based biochar's stable carbon structure persists for decades, providing lasting soil restoration that can lead to broader brownfield redevelopment and reuse.

From capping contamination to cultivating biodiversity

For post-project remediation, the industry is also transitioning beyond the traditional “clean-and-cap” paradigm, which focused primarily on contaminant removal or immobilization without addressing broader ecological function and land regeneration. Current best practices emphasize ‘clean-and-restore’ remediation that removes or mitigates contaminants while simultaneously rebuilding revegetation by improving soil health.

Today’s soil restoration protocols address multiple components of its health concurrently: reconstructing physical structure, reestablishing nutrient cycling processes, stabilizing pH, and reintroducing beneficial microbial communities, often to support revegetation.

Improving soil aggregation is a hallmark benefit of Myno Carbon’s engineered biochar through its dual-action performance that extends beyond contaminant adsorption. Scientific literature demonstrates that these biofilms further degrade hydrocarbons while increasing microbial diversity and improving soil aggregation via multiple pathways (referenced in Chart A). Additionally, application of alkaline wood-based biochar has demonstrated an increase in the pH of contaminated soils, which further promotes beneficial microbe activity. Biochar’s high cation exchange capacity can also improve nutrient cycling (NH^{4+}, K^{+}, Ca^{2+}, and Mg^{2+}) while enhancing water retention. For these reasons, biochar offers broad biostimulation benefits to regenerate soil while helping to stimulate micro-habit growth.

Myno Carbon Biochar

A Catalyst for Hydrocarbon Remediation and Soil Recovery

Biochar provides multi-faceted benefits for in-situ biodegradation of petroleum hydrocarbons while improving long-term soil quality. Below are findings from numerous scientific studies that demonstrate biochar's capacity to promote beneficial microbial growth and improve soil recovery in petroleum-impacted lands.

Chart A. Summary of biochar biostimulation benefits related to petroleum hydrocarbon biodegradation.

High water-holding capacity	Protects microbial consortia from desiccation and sustains metabolic activity under variable moisture conditions (Karpinnen et al., 2017).
High porosity and large surface area	Provides protection and micro-habitat for microbial colonization that forms biofilms for contaminant sequestration, similar to the mechanisms reported for colloidal activated carbon (Zhang et al., 2019; Bolan et al., 2023).
Nutrient retention and co-location with Carbon	Exhibits a synergistic effect in promoting microbes (including a high-cation exchange capacity) for nutrient retention and slow release to support biodegradation and biostimulation (Bolan et al., 2023).
Presence of various functional groups	Provides food for microbes (in addition to the carbon-source from petroleum hydrocarbons) and offers scaffolding for electrostatic interactions and covalent bonding, to aid in the stability of microbes, particularly in areas of contamination. (Zhang et al., 2019; Bolan et al., 2023).
Biochar's stability	Wood-based biochar is especially stable over long periods of time due to high fixed carbon content, which further promotes the growth of beneficial microbes for hydrocarbon degradation while cultivating soil health.

From generic clean-up to targeted & climate-positive treament

No two contaminated sites are identical - soil composition, contaminant types, groundwater flow patterns, and operational constraints all vary significantly. Tailored clean-up strategies recognize these complexities, employing field-data collection to inform customized treatment methods that target specific contaminants. A targeted approach accelerates cleanup timelines for greater regeneration impact while reducing total remediation costs by making treatment more cost-effective.

Carbon-smart and nature-positive solutions are gaining further traction as viable remediation alternatives for tailored clean-up. By using remediation materials such as Myno's engineered biochar that permanently stores carbon in soils, operators can attract climate-aligned investors and access sustainability-linked funding. Myno Carbon's Biochar 3.0 solutions transform degraded sites into safer, more valuable community assets while strengthening an operator's social license. Collectively, these shifts reframe remediation from a liability requiring repair into an opportunity to restore land and build lasting value.

Conclusion

Let's start the conversation. Whether your goal is to reduce land liability of ongoing oil & gas production, accelerate site recovery, attract sustainability-linked investment, or unlock new commercial opportunities.

Myno Carbon is committed to helping the oil and gas industry move beyond costly traditional remediation methods through green, integrated land regeneration strategies that harness the power of engineered biochar. Companies adopting this scalable approach can reduce environmental liabilities while positioning themselves as leaders in a rapidly evolving regulatory and investment landscape. By simultaneously addressing contamination, restoring soil health, sequestering carbon, and enabling productive land reuse, Myno Carbon delivers comprehensive remediation solutions from biochar that benefit the environment, the bottom line, and the community.

About MYNO

The journey that brought us here started with deep frustration at how slowly the world has moved to address pollution and climate change. Our CEO and co-founder, Thor Kallestad, began his career in environmental remediation before spending years in the oil and gas industry. He realized that true change would only come when economic, environmental, and technical realities aligned. Myno Carbon was created to accelerate that alignment. Our mission is as ambitious as it is necessary; to profitably reduce greenhouse gases at a scale to meaningfully impact climate change. Over the course of our journey, we've come to see clearly one of the most effective ways to achieve our mission, is to use engineered biochar to help clients, industries and ecosystems remove toxic contaminants while sequestering carbon.

To get there, we are building a network of Carbon Removal Facilities (CRFs) that transform waste biomass into high-performance biochar and renewable energy. These facilities are designed not only to scale climate impact but to enable multiple new and sustainable, remediation solutions.

The distance between damage and regeneration is bridged by bold, science-led action. This manifesto is just the beginning.

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