

## REMEDIATION



**REMEDIATION PROJECTS COMPLETED IN 50** STATES AND CANADA

90K 350+ 40+ EPC REMEDIATION SITES IN

**25 STATES** 

YEARS OF REMEDIATION

EXPERIENCE

### PREDICTABLE REMEDIATION RESULTS, NO MATTER THE COMPLEXITIES

Remediating environmentally impacted sites can be complicated. We bring clarity and certainty to the process by developing solutions to address the unique conditions and objectives of your site.

Every environmentally impacted site is different; therefore, every site remediation approach must uniquely address whatever legacy site issues or recent incidents exist. A successful site remediation plan, design or execution demands detailed consideration of sitespecific conditions and circumstances.

Our unique approach aligns the remediation strategy with your objectives to achieve a timely and cost-effective execution. We leverage our wide-ranging capabilities to deliver remediation solutions that end with predictable results with lower cost and expedited delivery — no matter the site.

Remediation hinges on the development of an accurate conceptual site model (CSM) that directly assesses geological heterogeneity and the preferential pathways it imparts. For complex contaminated sites, Burns & McDonnell develops a process-based CSM that couples advanced site characterization and design optimization techniques with strategic remedy execution to reduce uncertainty and cost through focused, science-based implementation.

Our remediation approach begins with the end in mind for seamless regulatory risk management, cost savings and expedited site closure. We prioritize your objectives by evaluating risk assessment and mitigation, regulatory negotiations and passive, low-cost remedies as preferred alternatives to costly remedial actions.

### PROGRESS: A NEXT-GENERATION APPROACH TO REMEDIATION

Complex contaminated sites are characterized by multiple, interrelated variables that can compound miscalculations and uncertainties.

PROGRESS (Progressive Remediation Strategies) is a next-generation approach to remediating complex contaminated sites. PROGRESS addresses the greatest uncertainty facing any remediation project the subsurface itself — by placing the proper emphasis on understanding the site geologic model and building a data-driven conceptual site model that accurately quantifies the processes driving remediation performance. This results in better design decisions and more focused, cost-effective remedies that return more predictable results.

Burns & McDonnell has combined a progressive, process-based site management strategy with advanced technology, which improves the remediation process, from start to finish, by delivering focused remediation solutions that leverage the unique characteristics of each site. This approach reduces the "cloud of uncertainty" — including overall cost and risk to the client — to deliver precise, predictable results.

## PROGRESSIVE REMEDIATION STRATEGIES

Geologic foundation. Process-based execution.

#### **OPTIMIZED REMEDY DESIGN**





#### **PROJECT SPOTLIGHT**

### COST-EFFECTIVE REMEDIATION OF A DILUTE GROUNDWATER PLUME

#### Legg Co. Halstead, Kansas

Legg Co., a major manufacturer of conveyor belting products for industrial and agricultural operations, had a 60-acre dilute trichloroethene (TCE) groundwater plume resulting from historical site activities. The depth of groundwater impacts ranged from 15 to 40 feet below around surface and the plume extended over 2,000 feet from the release point. Over 50% of the plume area extended beyond Legg Co.'s property boundaries and the plume was impacting the Equus Beds Aquifer, the main drinking water source for municipalities in central Kansas. The groundwater remedy consisted of enhanced reductive dechlorination (ERD) using a non-emulsified vegetable oil electron donor substrate due to its

compatibility with high groundwater seepage velocities, low cost, and extended longevity and hydrogen production capacity. Approximately 232,000 pounds of vegetable oil substrate were delivered to the subsurface via 10 treatment curtains oriented perpendicular to groundwater flow. TCE concentrations were reduced below the drinking water standard across the site without generating persistent ERD byproducts (e.g., cis-1,2-dichloroethene [DCE] and vinyl chloride). While cis-DCE concentrations did increase initially as a result of TCE dechlorination, cis-DCE subsequently degraded without generating detectable concentrations of vinyl chloride. Advanced molecular

analytical tools were used to identify probable TCE and cis-DCE degradation pathways that resulted in complete dechlorination without vinyl chloride production. The use of the nonemulsified vegetable oil amendment provided significant cost savings by minimizing injection volumes, field injection time, and the need for multiple injection events. At a total implementation cost of approximately \$300,000, this bioremediation strategy was approximately one-fifth the cost of the conventional pump-and-treat remedy evaluated for the site, while also providing complete contaminant destruction

# SITE INVESTIGATION AND CHARACTERIZATION

Planning an effective investigation strategy for a complex site can be overwhelming. We select appropriate site characterization technologies to optimize data collection and support a focused remediation approach.

A balanced approach to site investigation is needed to satisfy regulatory requirements, provide data needed to select and design an effective remedy, and provide optimum return on investment. We achieve this balance using our extensive knowledge and experience interpreting subsurface conditions to develop a superior site investigation plan that optimizes data collection efforts at every stage of the project life cycle.

We leverage site characterization data — including the increasingly complex and voluminous datasets generated by high-resolution site characterization methods — to develop a superior CSM that supports remedy evaluation, selection and design efforts and improves remedial outcomes. Our portfolio of site characterization experience is extensive, from conventional drilling and soil sampling methods to the latest direct sensing tools and analytical methods for all contaminants.

From contaminant-specific direct sensing technologies (e.g. MIP, LIF, etc.) to physical and geophysical techniques, we have employed nearly every site characterization technology developed for the environmental, geotechnical, and natural resource industry. We have also investigated every class of contaminant, including radionuclides and emerging contaminants (e.g., per- and poly-fluoroalkyl substances [PFAS] and 1,4-dioxane), and have characterized sites in every major market and industry.

Learn about our capabilities addressing emerging contaminants on page 10.

### CONCEPTUAL SITE MODELS

The greatest uncertainty in groundwater remediation projects is the subsurface. We apply an innovative, geology-based approach to defining subsurface conditions and contaminant distribution.

Site geology and hydrogeology represent the fundamental controls on groundwater flow and contaminant fate and transport, and dictate the feasibility of engineered remediation strategies. Successful remediation depends on a CSM that accurately identifies the geological heterogeneity and the preferential pathways imparted by it.

An accurate and comprehensive CSM helps identify the unknown or hidden conditions at your site. By decreasing uncertainty, you can focus the remedy, drive down remediation costs, increase efficiencies and improve remedy performance. With an improved understanding of the subsurface, we can avoid significant surprises or protracted cost creep.

The CSM should be a living model that combines existing and incoming data and serves as the basis for remedy selection, design and optimization. A well-constructed CSM illuminates the path to site closure and informs decision-making by defining pathways between contaminant sources and receptors. Our approach to the CSM begins with advanced analytical techniques applied to existing data obtained through previous investigations or remediation activities. We also consider human health and ecological risk, surface features, site operations, and regulatory goals and parameters. We leverage tools and techniques to efficiently and holistically analyze site data and present subsurface conditions and site-specific remedial strategies.



#### **ENVIRONMENTAL SEQUENCE STRATIGRAPHY**

Environmental Sequence Stratigraphy (ESS), is an innovative technique for defining subsurface conditions and contaminant distribution. Beyond compiling and comparing basic geotechnical descriptions of lithology at specific boring or well locations, ESS applies geologic interpretative methods, originally developed in the oil and gas industry, to predict lithology between borings.

ESS is based on an understanding of the genetic relationship between the borehole log data and the sedimentary depositional environment, and analyzes vertical grainsize patterns associated with the sedimentary environments. By correlating sediments based on an interpretation of the chronology and environment of their deposition, ESS evaluations better define the permeability framework that dictates the flow of groundwater and migration of contaminants.

ESS has resulted in more predictable and cost-effective remediation strategies. It provides a thorough and reliable foundation for remediation system design, an application particularly important for complex sites, where high remediation failure rates are common.

The ESS technique has been adopted by the U.S. Environmental Protection Agency and the U.S. Air Force as a best practice for developing CSMs for contaminated groundwater sites. Our ESS practice lead founded this technology, and as leaders in the ESS field, our team of professionals can apply this established technique to all phases of groundwater remediation at your site, helping you move your project to site closure.

### **EMERGING CONTAMINANTS**

Uncertainty can challenge your daily operations, and emerging contaminants can create a wide range of unsettling situations. We can help you address these uncertainties by gaining insight into your operations, developing a regulatory compliance strategy, and evaluating and applying a combination of proven and innovative remediation technologies.

Emerging contaminants, which have recently been identified as toxic and/or are the subject of new or increasingly stringent regulations, pose challenges to the industries that used them and the communities where they are identified. They can affect drinking water resources, cause environmental sites to be reopened and require operational modifications to reduce their future use. PFAS are a leading emerging contaminant of concern, along with 1,4-dioxane, microplastics and nanomaterials. While other emerging contaminants such as pharmaceuticals, endocrine disruptors. perchlorate and others are not receiving the same regulatory attention as PFAS, public concern or legal proceedings surrounding these substances may be just as concerning for certain entities.

As new regulations are established for emerging contaminants, you need a partner who understands the regulatory and risk assessment framework affecting your industry, as well as the remediation technologies and strategies available to costeffectively address your liability. Our decades of experience navigating previous emerging contaminants such as methyl tert-butyl ether (MTBE) and 1,4-dioxane, and our work supporting the U.S. Department of Defense, aircraft manufacturers, airports, refineries, chemical and industrial manufacturers. and municipalities, have equipped us to support you in developing the appropriate strategy to address the emerging contaminant issues impacting your business. Our team also has extensive experience in

site investigation, toxicology and risk assessment, remediation, water treatment and water supply systems.

We understand your needs and can help you navigate changes in a way that limits the impact to your mission or business. We bring you the right knowledge to help evaluate your operations and make informed decisions regarding how to respond to potential issues resulting from emerging contaminants. Our team is also helping shape the nation's response to emerging contaminants through participation in industry trade organizations, regulatory coalitions and the Interstate Technology and Regulatory Council.



#### **PROJECT SPOTLIGHT**

### PFAS TREATMENT ASSESSMENT

Naval Facilities Engineering Command Mid-Atlantic Cherry Point, North Carolina

The Naval Facilities Engineering Command Mid-Atlantic and Marine Corps Air Station at Cherry Point needed 8,000 lineal feet of utility corridor to support an F-35 program at the military installation. As the project was nearing completion, regulations were established that prevented the discharge of PFAS-containing groundwater to the installation's sanitary or storm sewers without treatment. Significant dewatering efforts were planned during construction, so this requirement resulted in unplanned costs and potential schedule delays. Our remediation team worked quickly to gather the data needed to support a thorough treatment evaluation, which identified and vetted various technologies to remove PFAS and co-contaminants from the waste stream. This required the collection of groundwater samples for analysis of PFAS, co-contaminants and geochemical parameters. The project also demanded the development of various treatment approaches and the assessment of the implantability, regulatory acceptance and cost of each treatment technology. Our efforts identified an economical treatment approach that reduced dewatering and treatment costs to within the original budget, allowing the F-35 program to move forward.



### FEASIBILITY EVALUATIONS

We can streamline the cleanup process by determining a clear, effective and efficient course of action for your remediation project.

When multiple treatment options exist and every vendor claims to have the best solution, it's important to have an experienced partner to help identify the most cost-effective and reliable remediation approach for your specific site. By completing a robust evaluation of various remedial technologies and strategies, we help owners identify solutions that are implementable, effective and economical.

Feasibility evaluations are a critical part of the remediation process, completed after the site investigation is completed and the conceptual site model is calibrated. Our multidisciplinary team collaborates throughout the project to identify relevant data gaps that, once addressed, allow us to assess the appropriateness of remedial technologies and prepare remedial cost estimates with greater accuracy. This provides you with increased certainty when planning remediation and forecasting cost.

### **RISK ASSESSMENTS**

A risk assessment is critical to the cost and outcome of a remediation project. We can provide a clear understanding of site risks to inform strategies that protect human health and ecological receptors while minimizing remediation obligations and cost.

In many cases, risk assessments establish remedial action objectives and establish a framework for all future remediation efforts. When performed correctly, risk assessments can also inform innovative, risk-based strategies that minimize the scope and cost of active remediation.

Alternative cleanup goals and rightsized remedial efforts developed and negotiated based on risk assessments can help save money on remediation costs. Our work — including Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) human health and ecological risk assessments, state-defined risk assessments, ecological surveys and environmental assessments — has withstood the scrutiny of regulatory agencies around the world.

Our diverse group of toxicologists, biologists and hydrogeologists uses the latest software tools, statistical methods and literature references to assess exposure pathways and risks for all relevant environmental media and receptors. Risk assessment is often an iterative process, working to identify and fill data gaps to refine an understanding of exposure pathways and receptor risks.

Our firm is nationally recognized for our risk assessment capabilities. We leverage our strong relationships and reputation with the regulatory community into excellent negotiating positions for our clients.

### REMEDY EXECUTION AND CONSTRUCTION

When it comes to remedy implementation, success is measured by attaining goals, maximizing cost savings, minimizing risk and reducing impact all while maintaining an unwavering focus on safety.

Today's remediation projects require design and construction teams that foster innovative solutions in the face of complex site conditions, persistent contaminants and challenging regulatory climates. These projects require the utmost cooperation and teamwork among responsible parties, the owner or occupant, the design engineer and the remediation team.

As an integrated design, consulting and construction firm, we provide you with a single source of responsibility from planning and permitting through site restoration and closure. We are design-builders with the ability to blend the cultures of design, environmental services and construction to seamlessly deliver your project. Having a fully integrated engineering and construction team working together provides a single source of responsibility, faster project completion, early known cost, open book team approach, enhanced quality, and lower overall project cost. Whether the remedy involves amendment injection, heavy earthwork construction or groundwater extraction and treatment, our teams can provide turnkey remedy implementation services, including demolition, design, construction, siting and permitting, commissioning and operation.

#### Learn more about our project delivery on page 30.

#### **PROJECT SPOTLIGHT**

#### MGP REMEDIATION

Confidential client Illinois

A 4-acre manufactured gas plant that was in operation from 1883-1951 required remediation. A review of the CSM and remediation technology research indicated that conventional MGP site remediation techniques (e.g., excavation) would be impractical and cost prohibitive; therefore, an alternative in situ remediation technology, electrical resistance heating (ERH), was selected. ERH, combined with multiphase extraction, was economically feasible and compatible with site conditions. This approach was used to remove 47,900 gallons of DNAPL from the site at half the cost estimated for a conventional approach.

### SYSTEM OPTIMIZATION AND REMEDY TRANSITION

Many sites are prime candidates for cost-saving optimization strategies or transition to more passive remedies. This not only saves costs but can result in a safer, more sustainable remedy that expedites site closure.

Over the years, remediation systems have been installed that are currently operating at varying degrees of efficiency. Some systems may not have fulfilled their intended purpose or met original schedule expectations. For others, what was state of the art and cost-effective at the time of installation may now be obsolete based on recent innovations and technology advancement. We provide in-depth analysis of system performance, evaluate subsurface conditions to identify factors impeding performance, and develop measures that maximize contaminant removal and save you money. Our approach

to remedial process optimization includes an integrated system of information acquisition and analysis and continuous optimization actions and reactions to meet owner-specific objectives. Our team of technical staff can provide the system inspections and process analyses needed to identify repairs or modifications required to improve performance or maintain efficient operation.

Remedial process optimization measures can be implemented at various stages of the project life cycle. In many cases, existing site and remediation performance data can be used to refine the conceptual site model and identify cost-saving optimization or remediation transition strategies. We routinely employ innovative CSM refinement tools such as ESS, 3D visualization and advanced modeling techniques to develop, simulate and design optimization measures. These tools, along with statistical analysis, can also be used to support transitions from active remedies to low-cost, passive options such as monitored natural attenuation, or to reduce monitoring obligations.



#### **PROJECT SPOTLIGHT**

### REMEDY OPTIMIZATION AND TRANSITION AT A GRAIN ELEVATOR SITE

#### Bunge North America Kansas City, Kansas

A former grain fumigant tank that leaked carbon tetrachloride and other contaminants of concern (COC) left Bunge North America with a site that required aggressive remediation. The project was complicated by the inaccessibility of the source area, significantly elevated COC concentrations, heterogeneous subsurface conditions and the presence of LNAPL. We partnered with Bunge to design, pilot test and implement a focused source zone remedy consisting of a dual-phase extraction system. After 6 years of operation, the DPE system had recovered approximately 9,000 pounds of COCs while successfully maintaining hydraulic control of the source area and reducing the overall extent of the groundwater contamination plume. The DPE system was continuously optimized over this time period, with optimization efforts including vacuum pressure adjustments, cyclical extraction well operation and rigorous preventive maintenance. An innovative surfactantenhanced extraction (SEE) remedy was then implemented to maximize the productivity of the DPE system and address residual source zone contaminants, including LNAPL. SEE removed an additional 1,200 pounds of COCs, allowing the DPE system to be shut down and replaced by a passive in situ remedy. This project was the recipient of an *Environmental Business Journal* Technology Merit Award in 2018.



#### **CUMULATIVE CONTAMINANT MASS REMOVAL**

### DECOMMISSIONING AND DEMOLITION

Closing a facility is a significant decision and a complex process. We take the time to carefully study and help you plan for the next phase.

To avoid safety risks and costly maintenance, you need a partner to help safely and efficiently decommission, decontaminate, isolate and demolish your obsolete facilities.

The potential for hazardous materials and contaminated soil

and groundwater at your site poses risks for your schedule and budget. To aid in the decommissioning and demolition process, our environmental professionals perform hazardous materials assessments to assist in planning and cost estimating, and to support safe execution of demolition activities. We also conduct the subsurface investigations required to identify and quantify contaminants that can impact your project. We then recommend remediation strategies and apply proven and innovative approaches to deliver cost-effective, timely site closure.

#### **PROJECT SPOTLIGHT**

#### INTEGRATING CLEANUP WITH DEMOLITION

Loveland Products/Crop Production Services Nebraska

A 6-acre Loveland Products fertilizer plant site in Nebraska required expedited corrective action for metals contamination under the Resource Conservation and Recovery Act (RCRA). Our team proposed an adaptive site management plan that integrated soil remediation with the facility's decommissioning and demolition process. Close collaboration with regulatory agencies and innovative approaches led to the success of this \$5.8 million project, which received a Merit Award in the environmental category of the Engineering Excellence Awards from the Nebraska chapter of the American Council of Engineering Companies. The project demolished 36 buildings and structures and disposed of nearly 9,000 tons of contaminated soil. More than 7,160 tons of concrete from the demolished structures was rubblized and used as backfill, an efficient alternative to purchased fill. The adaptive approach saved Loveland Products an estimated \$2.1 million while meeting its aggressive time schedule and reducing its long-term environmental risks.

### MANUFACTURED GAS PLANT SITES

Manufactured gas plant sites pose unique challenges and risks. We have the experience, safety record and resources to transform your site from a liability to an asset.

Manufactured gas plant (MGP) sites are often large and complicated. With extensive experience remediating MGP sites, including many located in congested urban areas, we understand not only what remediation approaches work, but how to most effectively implement the solution. We have experience implementing traditional excavation techniques that may require earth retention and air monitoring systems, as well as more innovative solutions such as in situ solidification/stabilization, in situ chemical oxidation, and thermal treatment. We also have the resources to guide you through the risk assessment process and develop a path to regulatory closure for your site. Our team's top priority is finding the right solution to meet your needs and to implement it safely.

Many MGP sites have live utilities or other critical structures that must be protected during remediation. All of our work is performed by a team backed by an exceptional safety record – one of the top in the industry. Our firm can safely investigate current conditions and evaluate the right alternatives for you to safely, efficiently and economically remediate your site. Many of the sites we've helped remediate have been repurposed for beneficial use. We have the full-service capabilities to design and execute site restoration to meet your specific plans for the property.



### VAPOR INTRUSION ASSESSMENT AND MITIGATION

When it comes to toxic vapors, careful consideration is needed to evaluate exposure, assess risks and mitigate potential impacts to human health.

When volatile chemicals are released onto properties, they can permeate the soil and underlying groundwater. In time, they can volatilize and migrate into buildings in gaseous form, leading to vapor intrusion. Depending on the concentrations of these chemicals and their toxicity, volatile chemicals in the indoor air might produce human health concerns. Vapor intrusion assessments help determine potential health risks to occupants of the structures whether the buildings are occupied now or otherwise vacant with potential occupancy in the future.

When an imminent threat to people within a building exists, short-term actions such as optimizing HVAC systems or reducing time spent in impacted areas may be implemented. Longer-term solutions could include reducing source concentrations, installing sub-slab ventilation systems and/or vapor barriers or restricting future use of the site. Our team has experience completing every step of the vapor intrusion assessment process and has performed vapor intrusion assessments on petroleum, chlorinated solvent, and methane impacted sites. We have also installed vapor intrusion mitigation systems in residential, commercial and industrial settings and specified measures to prevent vapor intrusion into newly constructed buildings.



#### **PROJECT SPOTLIGHT**

AND MITIGATION

#### Confidential client

St. Louis, Missouri

Historical leakage of solvents from an aircraft parts manufacturing facility resulted in the contamination of shallow soils and groundwater. The client selected Burns & McDonnell to conduct a vapor intrusion (VI) investigation and risk assessment, which demonstrated the need for vapor mitigation systems in multiple residential dwellings located near the manufacturing facility. In accordance with an EPA consent order, our team conducted site investigation activities consisting of groundwater, soil gas and residential in-home sampling, including sub-slab vapor and indoor air sampling.

VAPOR INTRUSION INVESTIGATION

The results of the investigation indicated that VI mitigation was necessary for multiple residences. Due to elevated health concerns, VI mitigation was preemptively implemented within the entire residential neighborhood, consisting of 59 single-family residences and 49 apartment units, to eliminate any potential vapor intrusion concerns. VI mitigation was accomplished through the installation of sub-slab depressurization (SSD) systems. During SSD installation, existing foundation drain sumps were retrofitted and sealed, as were cracks and joints in the floor slabs. Verification sampling of indoor air was performed following VI mitigation system installation. The results of this sampling were below both the EPA action levels and the more conservative Site-Specific Screening Levels for Residential Indoor Air.

### REGULATORY NEGOTIATION AND CONSULTING

When the potentially responsible party (PRP) at a contaminated site is identified, management is often concerned about a lengthy, complicated and costly process. We can help navigate the regulatory process and develop strategies that result in a more favorable outcome.

Negotiation of regulatory settlements with state or federal agencies is a critical aspect of the remediation process. With decades of experience interacting with agencies across the country, we can assist you in taking practical steps to manage your risk profile and avoid common mistakes that can increase your regulatory obligations. Our technical skills and experience, coupled with our knowledge of state and federal requirements, allow us to present defensible arguments that can lead to reduced actions and site closure.

### SEDIMENT INVESTIGATION AND REMEDIATION

Contaminant sources know no boundaries. We couple our field investigation experience with innovative laboratory testing to customize remediation solutions that address complex problems and increase project success rates.

Environmental impacts can accumulate in the sediment of water bodies located near contaminant sources. We help you understand the transport pathways, design and test potential remediation solutions in our sediment lab, and then finalize designs and execute remedies in the field.

With professionals who have written best practices for sediment investigation and remediation, we bring the exact experience you need to tackle your sediment project, no matter the size or complexity. Our sediment remediation lab allows us to perform physical modeling of natural and engineered systems, such as sediment caps and the migration of viscous liquids in granular media. Backed by field assessments and analytical techniques, we are able to simulate and examine complex remediation processes in the lab, focusing our attention on techniques and alternatives that succeed in the field. This approach provides you confidence that your challenges are being answered with the appropriate remedial solutions Sediment contamination is often the result of historical operations at multiple neighboring industrial facilities. Consequently, the evaluation of responsible parties and remediation cost allocation can be a critical component of many sediment remediation projects. Our knowledge of sediment chemistry, forensic analytical techniques, and depositional patterns and groundwater-surface water interactions allows us to design and execute field and laboratory tests to evaluate challenging site-specific questions.



### **RISK TRANSFER STRATEGIES**

Keeping up with the changing world of environmental regulations can be difficult for businesses and organizations. Risk transfer strategies simplify the process and protect your assets.

With unknowns related to environmental cleanup costs and the potential for changing regulations, we can ease your financial uncertainty by employing our risk transfer strategy (RTS). Using an RTS contract, we can proactively manage costs associated with environmental liabilities, helping you meet your closure obligations and protect your balance sheet.

Under the traditional environmental cleanup model, an environmental contractor will provide an estimate

of cleanup costs, leaving the risk of cost overruns and unknowns to be borne by the property owner or responsible party. RTS breaks this mold and provides an alternative to the traditional model.

We proactively manage environmental cleanup liabilities by contractually shifting cost risk from one party to another. Liability is transferred from the property owner to a contracting firm using a liability transfer contract backed by a specially designed environmental assurance program that covers potential cost overruns.

Our team uses RTS to establish fixed environmental remediation costs that are backed against overruns by financial assurance provided by Burns & McDonnell. The certainty provided by this model minimizes the impact of remediation cost fluctuations and overruns and removes the burden of environmental cost liability from the shoulders of the property owner.



#### **PROJECT SPOTLIGHT**

# REMEDIATION OF A CHLORINATED SOLVENT SOURCE ZONE

Confidential client Thousand Oaks, California

Historical aerospace and automotive manufacturing operations resulted in chlorinated solvent soil and groundwater impacts, including a 16,200-cubic-yard source zone that extended over 100 feet below ground surface. Burns & McDonnell was contracted to conduct site characterization, CSM development, risk assessment, groundwater modeling and source zone treatment evaluation, design and full-service execution.

A combined remedy consisting of in situ thermal desorption (ISTD) and steam-enhanced extraction (SEE) was selected to address the source area. The liquid and vapor waste streams generated by the remediation process required treatment via thermal oxidation (emissions) and physical separation, pH adjustment, air stripping, granular activated carbon (GAC) adsorption. and reverse osmosis (wastewater). Our team completed all necessary engineering design, project planning and permitting activities associated with remedy implementation. Site construction activities consisted of demolition, utility service construction, treatment and well field process equipment installation, and the construction of 109 remediation

wells and monitoring points. During operation of the remediation system, Burns & McDonnell managed the site; conducted sampling, data collection and performance assessment; and maintained permit compliance.

The thermal source remedy was successful in removing over 22,400 pounds of volatile organic compounds (VOCs) in less than 6 months. The \$8 million project was completed without a recordable injury, on schedule and \$800,000 under budget.

### ENVIRONMENTAL EMERGENCY RESPONSE

Emergency situations are, by nature, a challenge to plan for and difficult to manage. Our experienced personnel can work to mitigate impacts and initiate prompt remedial action.

An incident involving a pipeline, storage tank, tanker truck, rail car or well site necessitates a response that is quick, reliable, efficient and, most importantly, safe. We can respond rapidly to your situation and deploy mitigation efforts and containment strategies to keep impacts to a minimum. When the unexpected happens, we can safely address environmental impacts and restore your site to maintain operations and achieve compliance with rules and regulations.

Our team has experience mobilizing emergency response teams for releases of refined petroleum products, crude oil, liquified petroleum gas, fertilizers, ammonia, brine and many other chemicals and products. We strive to work as an extension of your team, providing support all the way to site closure.

Our professionals have unique experience developing software tools to automate and enhance coordination, planning and operations during emergency response efforts. These tools provide access to realtime information even before access to the site is possible. This type of insight expedites communications and remediation plan development to accelerate cleanup operations.

#### **PROJECT SPOTLIGHT**

### EMERGENCY PREPAREDNESS AND RESPONSE TOOL

TC Energy Alberta, Canada

When TC Energy's Keystone Pipeline experienced a release, the ensuing emergency required swift and decisive action. Fortunately, our team had recently developed an emergency preparedness and response tool (EPRT). This situation put the nimble and fully integrated software tool to the test. The EPRT presented real-time data in a web-based format that provided locational awareness to both preparedness and incident data as well as a platform for viewing field resources, photos and environmental data. Our team also utilized drone technology to observe and assess current conditions. This tool automated and enhanced coordination, planning and collaboration, giving TC Energy the ability to quickly and accurately locate and diagnose problems. Once the emergency response was complete, we completed sampling and testing to determine the necessary remedial approach.

### PROJECT DELIVERY

When it comes to delivering on time and within budget, how you approach a project makes a difference. We offer a variety of project delivery methods to meet all your needs.

#### ENGINEER-PROCURE-CONSTRUCT (EPC) AND DESIGN-BUILD

The EPC and design-build delivery approaches are ideal for fast-track projects — reducing owner risk, shortening project schedules, providing a single point of contact, increasing cooperation, optimizing owner staffing, and establishing an environment for design and construction innovation. We build relationships with trusted vendors and contractors to keep your project moving forward.

#### **DESIGN-BID-BUILD (DBB)**

Giving you flexibility and control, the DBB approach leverages a working relationship as the project is developed. Changes to the design do not incur costly change orders, and you don't have to specify all requirements at the beginning of a project. DBB also allows you to determine contractors and material vendors for your project.

#### **OWNER'S ENGINEER**

As owner's engineer, we operate as a seamless extension of your organization. We work in close partnership with you, bringing seasoned veterans with current technical knowledge and experience.

#### PROGRAM MANAGEMENT

Through program management, our team integrates with yours as a trusted partner and extension of your staff. We help you coordinate project planning, design and construction services at all stages, allowing you to remain focused on your core business. We work with you to select consultants and subcontractors, administer contracts, track schedules and budgets, assist with labor relations, implement safety programs, coordinate with government agencies, and manage public relations.

#### CONSTRUCTION MANAGEMENT

Our construction professionals work closely with contractors, vendors and owners to create a partnership focused on safe, efficient, successful execution of your project.



### THE BURNS & McDONNELL DIFFERENCE

True partnerships lead to successful projects. At Burns & McDonnell, we dedicate experienced and innovative leaders to your work, beyond the specific needs of a particular job and always with safety in mind. We build long-term relationships as our people — engineers, architects, construction professionals, scientists and more — become valued extensions of your own teams, often for decades at a time. It's a point of pride that our clients find it difficult to tell the difference between a Burns & McDonnell employee and one of their own. And that's no surprise, considering that we, as employeeowners, carry the commitment of ownership: We succeed when you do.

Learn more at burnsmcd.com.



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