

Statement of Qualifications



www.1ERG.com



The Environmental Remediation Group
A Division of CES



"The Environmental Remediation Group have always proposed innovative and cost saving approaches to our environmental problems.

ERG was able to evaluate the previous remediation system, and optimize the performance, resulting in substantial improvement in performance.

Historically there were also problems with a difficult regulator. ERG improved those relationships dramatically and has made significant progress despite many challenges.

We think that ERG's use of innovative approaches to the assessment and remediation has saved us time and money. I would highly recommend ERG to anyone with environmental issues."

- Roy Saunders
Vice President - Jaco Hill

Introduction

OUR COMPANY

The Environmental Remediation Group (ERG, or "The Group") is a division of Civil Environmental Survey Group (CES), a Full Service Environmental Firm

OUR MISSION

Exceed client expectations! The Group's mission as an environmental remediation technology provider, as a **TEAM**, and as individuals, is to earn our clients' confidence as a trusted **PARTNER** in their remediation efforts, consistent in our words and performance, and as an extension of their company.

The Environmental Remediation Group was created in 2006 with an ethos to design and implement meaningful remediation solutions by offering our clients the best possible approaches using the best suited technologies, implemented by an experienced team that works to earn our clients lasting trust.

OUR GOAL

Our goal is to develop and implement sustainable, cost effective, and reliable approaches to contaminated site remediation using both proven and cutting-edge technologies through creative remediation strategies.

OUR PROMISE

Our promise is to provide our clients with honest assessments, and transparent costs.

OUR CORE TECHNOLOGIES

The Group specializes in the engineering design, construction, operation, and closure of contaminant remediation systems and approaches, offering concept through closure implementations of: **Thermal Remediation, Bioremediation, Groundwater Recirculation Systems, Air Movement Technologies (SVE, MPE, & AS), and custom Combined Remediation Approaches.**





From early planning through project closure, The Group partners closely with clients, regulatory agencies, and project stakeholders to ensure proper communication, continuous engagement, safe implementation, and project closure on time and under budget.

Our Company

The Environmental Remediation Group (The Group) is a recognized leader in the environmental remediation industry, having been at the forefront of remediation technology development and project implementation for over seventeen (17) years. With hundreds of remediation projects successfully implemented around the country using traditional, cutting edge, and combined technologies including: In Situ Thermal Remediation (ISTR), In Situ Chemical Oxidation (ISCO), Bioremediation, groundwater recirculation systems, air movement technologies, groundwater pump & treat, Permeable Reactive Barriers (PRBs), and strategic excavation(s), The Group offers its clients and project stakeholders an unparalleled breadth and depth of expertise in remediation system design and implementation over any other environmental remediation technology provider.

The Group supports its clients in remediation technology selection, feasibility studies, pilot testing, construction, operation and monitoring, reporting, and project close-out, offering a versatile and strategic extension their clients and partners' strengths and resources through proven engineering solutions and experienced technical, engineering, and field implementation experts.

The Group's foundation is our professional personnel. Our Team consists of scientists, registered engineers, geologists, and technicians whose focus and expertise is in environmental assessment, remediation feasibility studies, pilot tests, remediation system design, construction, and turnkey environmental remediation project implementation.

Our staff has an extensive history of developing and implementing innovative remediation technologies, with our key Team members having over 30-years of remediation project experience. This "hands on" experience gives us the ability to maximize the Return on Remedial Investment (RORI) on any given project, through our ability to:

- Evaluate and screen numerous remediation technologies, strategies, and combined approaches.
- Select and engineer the Best Value Approach to meet project specific constraints and goals.
- Optimize performance of remediation systems and approaches using real-time, informed, strategies.
- Control project costs and remedial timeframes through Adaptive Management Practices.
- Improve remediation system operations.
- Provide engineering support for our field operations.

The Group is a disadvantaged small business enterprise (DBE #41224 DOT) and has a strategic teaming arrangement with KEE Solutions, which allows The Group to pursue US Government remediation contracts under KEE's Service Disabled Veteran (SDVOSB) status (DUNS#: 968235676, UEI#: T7BGH1LJNCZ4, CAGE Code: 6GAQ5).

The Group's History

2006 The Environmental Remediation Group (ERG) is Formed



The Environmental Remediation Group (ERG) is founded in 2006. The founding members, Jim Keegan, Danny Baysa, and Skye Green along with other key personnel joined to form a team of pioneers in the remediation industry and in the development and operation of in situ remediation technologies, including thermal remediation and air movement technologies. ERG team members amassed an impressive list of environmental industry firsts, including: the development of vapor extraction technology; the early development and use of multi-phase extraction (MPE), the first to design and implement Air Sparging technology in California; the first to use ISCO for the remediation of MTBE in California; the first successful use of high vacuums and pneumatic soil fracturing to remove contaminants from low permeability soils (<math><10^{-7}</math> cm/s); the first full-scale application of an integrated soil vapor extraction/multi-phase extraction and Electrical Resistance Heating (ERH) system; and the first use of Electrical Resistance Heating (ERH) at a commercial Site in California.

2012 ERG Merges with CES, to Form CES Group

The Environmental Remediation Group (ERG) merges with Civil Environmental Survey (CES), to form the CES Group in 2012. ERG remains an active division of CES Group, and CES Group continues to operate at the forefront of remediation technologies, implementing several in-situ thermal remediation (ISTR) projects using ERH, as well as 100+ remediation projects involving ISCO, bioremediation, SVE, MPE, Air Sparging, groundwater pump & treat, and excavation. In addition to remediation services, CES continues to grow other core competencies, including Site Assessment; Landfill Operations, Monitoring, and Maintenance; Stormwater Pollution Prevention; OM&M and Long Term Monitoring (LTM) Projects.



The Environmental Remediation Group
A Division of CES

2022 ERG is Relunched with expanded Thermal Capabilities

CES Group brings on board Robert D'Anjou and Allen Swift to relaunch The Environmental Remediation Group (The Group) as a Division of CES Group, with Michael Dodson joining the team as Strategic Advisor. The newly amalgamated team brings with them experience successfully implementing over **90 thermal remediation projects** around the world using ERH, electric and fuel combustion TCH, as well as SEE, adding decades of experience running thermal remediation companies at the highest levels to ERG's already impressive history of remediation technology development and implementation.





Our Team of Remediation Experts

Detailed resumes available upon request.

Robert D'Anjou – President



As the leader of The Group, Rob is responsible for developing and implementing the values, vision and strategy that define our company. He is responsible for ensuring that projects are completed safely, successfully, and to The Group's highest standards. From early planning through project closure, he partners closely with clients, regulatory agencies, and project stakeholders to ensure proper communication and continuous engagement. While he is committed to all aspects of the company, Rob takes a particularly involved role in the technical design and implementation of projects and leads The Group's R&D efforts. Throughout his career, Rob has developed hundreds of remediation end-point specific conceptual site models, remediation system designs, and operational strategies, and has led the implementation of over 35 projects using in-situ and ex-situ thermal remediation and combined in situ remediation strategies which successfully met cleanup criteria and collectively removed over 5,500,000-lbs of VOCs and SVOCs.

Allen Swift – Executive Vice President



Allen joined The Environmental Remediation Group in December 2022 as Executive Vice President, leading The Group's International and Domestic business ventures. He oversees all near and long-term service offerings, directing and implementing The Group's sales, marketing, service development and strategic planning. He is also responsible for our global business development, leading the full end-to-end client management of our service outreach, opportunity development, and contracting. Throughout his twenty-five-year career, Allen has amassed an expansive breadth of experience within various sectors of the environmental industry. He has collaborated on the design, construction, and implementation of remedial systems throughout the World. Mr. Swift is recognized for effective, efficient, and personalized, business management services for clients and vendors.

Jim Keegan – Chief Financial Officer



Jim Keegan's experience spans more than two decades of engineering and leadership excellence. Mr. Keegan currently serves as the President of CES group and Chief Financial Officer of The Environmental Remediation Group, of which he is one of the founding members. Mr. Keegan is a registered Professional Civil Engineer in California and a Registered Environmental Assessor (REA) also in California. As CFO of The Group, he directs and oversees the financial activities of the company. As a board member, and President of CES Group, Mr. Keegan is a trusted technical and financial advisor, offering invaluable business leadership to The Group from his personal experiences running successful environmental companies for the last twenty years.

Skye Green – Vice President of Engineering



Skye has worked in the field of environmental engineering since 1998. She is a founding member of The Environmental Remediation Group, Board Member of CES Group, and acting Vice President of Engineering. She takes on a variety of roles and responsibilities with CES and ERG. As the Engineering Team leader, she is responsible for the project management of site assessment and remediation projects, oversees the daily operation and maintenance of those projects, and coordinates with clients and overseeing agencies to ensure that systems run smoothly with optimal results. Ms. Green is responsible for the management of technical, field, engineering, design, and construction personnel. Skye is a registered Professional Engineer in California, holds a BS in environmental engineering and a BA in English from UCI and an MS in Civil Engineering from UCLA.

Danny Baysa – Vice President of Field Operations



Danny is a founding member of The Environmental Remediation Group, Board Member of CES Group, and acting Vice President of Field Operations. Mr. Baysa has 23 years of experience working as a Field Supervisor on remedial system operations, monitoring, and maintenance. Mr. Baysa has participated in the installation, operation, maintenance, sampling, and monitoring of more than 425 environmental projects including such clients as Caltrans, LAUSD, U.S. Navy, and OC Waste & Recycling. Mr. Baysa's responsibilities include supervision of field personnel and subcontractors in conducting routine and non-routine operations, repairs, groundwater sampling, soil gas network sampling, system upgrades, system construction, operation, monitoring and maintenance of various projects including landfill post-closure maintenance and monitoring.

Michael Dodson – Strategic Advisor



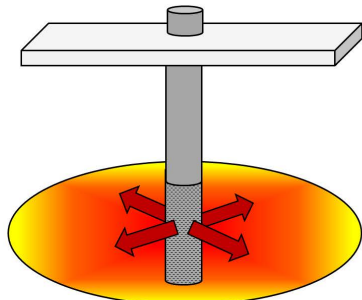
Michael Dodson serves as a Strategic Advisor to The Group. With over 31 years of experience in environmental research, consulting, and site remediation, Mr. Dodson excels at delivering effective solutions for the cleanup of fuels and chlorinated hydrocarbons. A nationally recognized expert in the application of in-situ heating technologies, Mr. Dodson was the leader of the team that commercialized the in situ electrical resistance heating (ERH) technology developed by Battelle at the DOE's Pacific Northwest National Laboratory (PNNL). He was instrumental in building the management, sales, and technical groups; creating and executing the marketing and business plans; and obtaining the capital and specialty equipment required to successfully launch ERH and ISTR into the environmental remediation marketplace and has since implemented more than 120 in situ remediation systems.



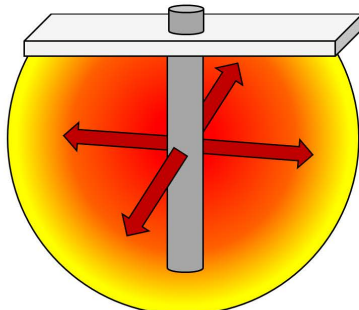
Our Solutions

THERMAL REMEDIATION

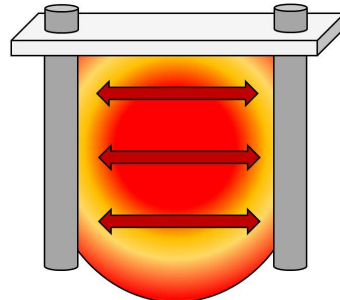
Steam Enhanced Extraction (SEE)



Thermal Conduction Heating (TCH)

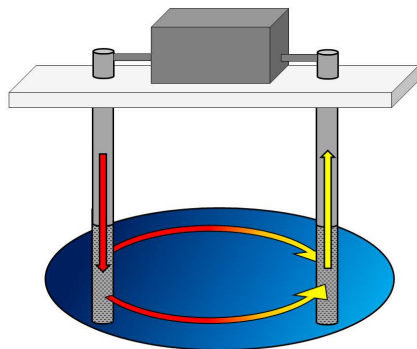


Electrical Resistance Heating (ERH)

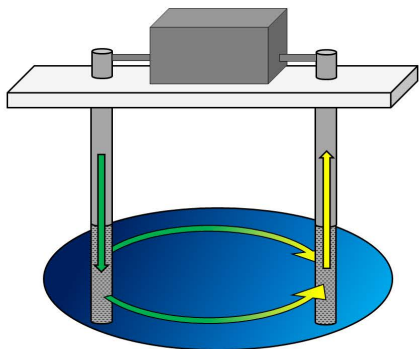


BIOREMEDIATION

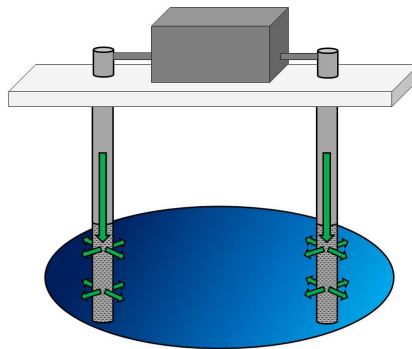
Heat Enhanced Recirculation Delivery Systems



Groundwater Recirculation Systems

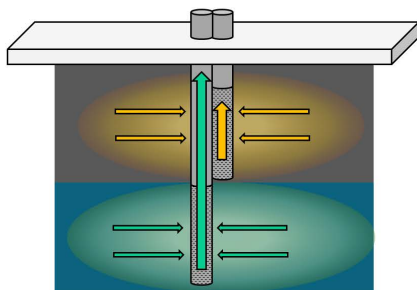


Amendment & Augmentation Injection

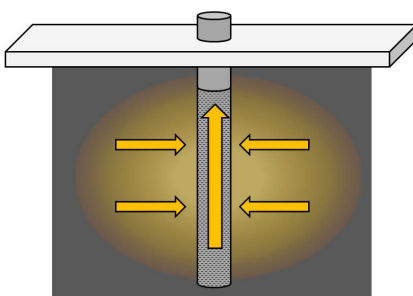


AIR MOVEMENT TECHNOLOGIES

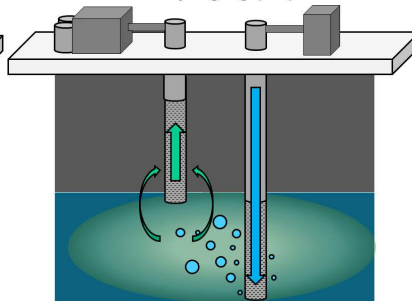
Multi-Phase Extraction (MPE)



Soil Vapor Extraction (SVE)

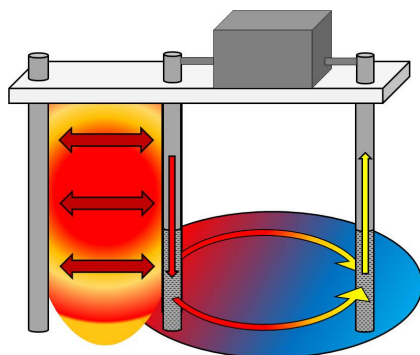


Air-Sparging (AS)

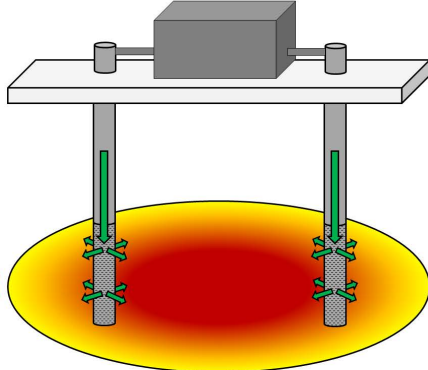


COMBINED REMEDIATION SYSTEMS

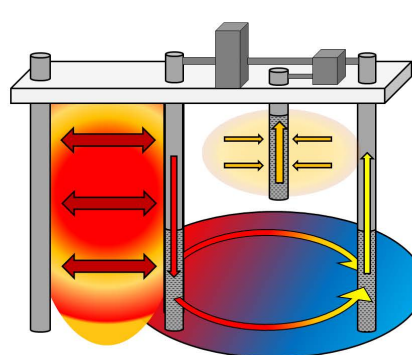
ISTR Source Zone With HERS



Post ISTR Bio-Polishing



Custom Combined Remediation Strategies





"We have been very happy with our contractor selection and ERG's performance. ERG's use of innovative approaches to assessment and remediation has saved us time and money. ERG has produced an excellent quality of work and reports, with excellent safety."

"We would recommend ERG as an environmental consultant and contractor."

- Gary Hutsell
Assistant Public Works Director



Clients are Our Business

While remediation is our goal, and honesty is our promise, respect is the foundation of our company and is the driving force that directs us. This respect starts with a shared respect for the natural world and the future of humanity, and can be seen echoing throughout our organization, from the technologies we develop, approaches we propound, to the way we conduct business on every project and with every client. The success of our company exists upon our ability to earn our customers' respect, trust, and intentionally seek opportunities, ventures, and relationships that share this mutual respect.

Environmental consultants, engineers, regulators, government agencies and real estate developers trust The Group to achieve Project Goals, knowing our expertise and industry knowledge has been proven time and again at the job site. A key component of our success involves partnering with our clients and becoming an extension of their capabilities. This corporate strategy fosters the transfer of ideas, techniques, and innovations. From early planning through project closure, The Group partners closely with clients, regulatory agencies, and project stakeholders to ensure proper communication, continuous engagement, safe implementation, and project closure on time and under budget. Our past clients include:





Thermal Remediation Technologies

Overview

The Group and its core team members have industry leading experience in the design, construction, and implementation of all three thermal remediation technologies.

As a company, we have implemented nineteen (19) thermal remediation projects. Within our organization, our team of thermal remediation experts have collectively designed, built, and operated over 90 different thermal remediation projects. Starting with the very first commercial projects in the 1990's, our team has been the heartbeat of the thermal remediation industry for over 28-years, designing and implementing some of the most advanced thermal projects ever endeavored, with accolades that include:

- The commercial development of Electrical Resistance Heating (ERH) in the 1990's.
- Implementing the first ever Electrical Resistance Heating Projects in the 1990's
- Fifty-Nine (59) ERH Projects (1995-2019).
- Twenty-One (21) TCH projects using electric and fuel based TCH (2016-2022).
- Ten (10) SEE Projects (2000-2020)
- Three (3) high temperature (>300 deg C) ex-situ thermal remediation (ESTR) projects to remove SVOC impacts, totaling over 60,000-cubic yards of treated soils.
- Seven (7) highly innovative Combined Remediation Technology projects using heat enhanced biotic and abiotic degradation and integrated ISTR source zone remediation, alongside additional in situ remediation technologies including MPE, SVE, and Chemical Injection.
- The largest ever high-temperature (300-500°C) implementation of ISTR at an MGP site (2020-2022).
- The first successful ISTR projects implemented in Australia (2020-2022) and Singapore (2020-2022).

Thermal Conduction Heating (TCH)

TCH uses heaters powered by fuel combustion and/or electrically resistive heating elements, which generate and propagate heat in the subsurface through thermal conduction from the heaters to the surrounding soil. TCH can be useful in lower temperature applications, targeting operating temperatures as low as 40 degree C where the overall strategy is to maximize heat enhanced biodegradation, 40 to 70 degrees C temperatures to maximize hydrolysis and free product removal, all the way to high temp applications reaching over 350 degrees C for SVOC, PAH, PFAS or other applications where recalcitrant compounds require temperatures above the boiling point of water. Thermal conductivity varies insignificantly across a wide range of soils, lithologies and hydrostratigraphic conditions, affording TCH applications a great deal of control and precision.

Electrical Resistance Heating (ERH)

ERH uses electrodes, placed in 3-phase or 6-phase arrays, to force a controlled current through the subsurface, propagating from electrode to electrode. Soil between electrodes resists that current flow and electrical energy is transformed into heat energy, causing the soil matrix to heat. ERH is an effective option for low to moderate temperature applications up to ~100 degrees C. ERH can be applied with a great degree of control especially for low temp applications as it does not generate "hot spots" around each electrode well as is the case for TCH based technologies. As such, ERH can be a very important technology for low temp applications, such as heat enhanced bioremediation, as a few degrees can determine whether degradation reactions fully proceed.

Steam Enhanced Extraction (SEE)

SEE involves the injection of steam at variable pressures and flow rates through screened injection wells placed throughout a treatment volume. This is coupled with MPE and/or groundwater extraction wells to ensure hydraulic control and to mitigate any off-site migration of contaminants. This technology is ideal for remediation of VOCs and free product in highly transmissive intervals that feature high permeability lithology and groundwater flow rates that would otherwise render ERH or TCH impossible. However, SEE is limited to 100 degree C applications, and the Site conditions that permit SEE to be effectively implemented are specific and highly restrictive.



Bioremediation Technologies

Overview

The Group offers turnkey bioremediation solutions, including data gaps investigations, microcosm studies using powerful MBT diagnostic tools and analyses, equipment design, system construction, operation, and closeout. Our bioremediation technologies and systems provide several customizable technologies and approaches to best fit almost any project, timeline, and budget. Whether it's a large-scale heat enhanced closed-loop anaerobic bio-recirculation system or a few slug injections of nutrient amendments and bioaugmentation cultures, we have industry leading solutions being delivered by world renowned experts. The Group's Bioremediation Experts have designed, implemented, and optimized groundwater recirculation systems to effectively stimulate the enhanced in situ aerobic and anaerobic biodegradation of contaminated Sites at over 100 industrial projects throughout North America.

Heat Enhanced Recirculation System(s) (HERS™)

The Group's automated/programmable closed-loop heat enhanced groundwater recirculation systems (HERS™) are designed to extract, heat, and reinject the heated groundwater after it is amended with a mixture of electron donor and nutrients.

This mixture of electron donor (i.e., substrate) and nutrients are required for stimulation of microorganisms present in the aquifer. The addition of heat to the extracted groundwater will help maintain the elevated groundwater temperatures that remain after the initial remedial phase (i.e., in situ thermal) which will promote faster growth and metabolic rates for the desired microbial community. This system can be custom designed for anaerobic or aerobic bioremediation applications alike.

Utilizing an automated process for extracting groundwater from the aquifer, heating it to 95-110 degrees F, adding electron donor and nutrients, and reinjection of the amended water to the aquifer will significantly shorten remedial timeframes. A wealth of successful heat-enhanced bioremediation projects, backed by comprehensive research and publications, indicate that at elevated temperatures up to ~105°F (~40 °C), anaerobic dehalorespiring bacteria degradation kinetics increase significantly, reducing remedial timeframes by approximately one-fifth of the time required under ambient temperatures, which is even further compounded by the added efficiencies of the recirculation component to this approach.

Aerobic Recirculation System(s)

The Group offers closed loop automated recirculation systems that can optimize nutrients, groundwater geochemistry, and DO levels prior to reinjection, optimizing groundwater conditions as the system promotes increased contact and artificially induced transport mechanisms.

The programmable system can be modified throughout the operation based on ongoing performance data, which will optimize the supply of nutrient and amendment distribution within the target treatment zone and allows targeting of zones that may have higher or persistent concentrations of contaminants. The programmable system is capable of pulse-injection of the substrate to prevent injection well biofouling and can be utilized to make ongoing pH adjustments. The recirculation loop also has the added benefit of providing a degree of hydraulic plume control to protect downgradient receptors and limit further LNAPL, DNAPL, and aqueous phase petroleum hydrocarbon migration.

Our team offers turnkey services for the implementation of these systems, including additional microcosm studies, custom equipment designs, through implementation and project close out. The Group will guide you through the entire process, and ensure your petroleum impacted Sites meet project goals in a timely and cost-effective manner.

Anaerobic Recirculation System(s)

The Group's automated/programmable closed-loop anaerobic groundwater recirculation systems are designed to extract and reinject the extracted groundwater after it is amended with a mixture of electron donor and nutrients and augmentation cultures (when necessitated), optimizing anaerobic groundwater conditions as the system promotes increased contact and artificially induced transport mechanisms. This mixture of electron donor (i.e., substrate) and nutrients are required for stimulation of microorganisms present in the aquifer.

The programmable system can be modified throughout the operation based on ongoing performance data, which will optimize the supply of electron donor distribution within the target treatment zone and allows targeting of zones that may have higher or persistent concentrations of contaminants.

The programmable system is capable of pulse-injection of the substrate to prevent injection well biofouling and can be utilized to make ongoing pH adjustments. The recirculation loop also has the added benefit of providing a degree of hydraulic plume control to protect downgradient receptors and limit further DNAPL, and aqueous phase CVOC migration.

Our team offers turnkey services for the implementation of these systems, including additional microcosm studies, custom equipment designs, through implementation and project close out. The Group will guide you through the entire process, and ensure your chlorinated solvent impacted Sites meet project goals in a timely and cost-effective manner.



Air Movement Technologies

Overview

The Group offers turnkey MPE, SVE, and AS solutions, including; equipment design, system construction, operation, and closeout. The Group's Air Movement Systems provide a number of customizable technologies and approaches to best fit almost any project, timeline, and budget. The Group's Air Movement Technologies Experts have unparalleled experience, implementing hundreds of projects since our experts first helped pioneer the commercialization and development of vapor extraction technology; oversaw the early development and use of multi-phase extraction (MPE), were the first to design and implement Air Sparging technology in California; and were part of the first successful use of high vacuums and pneumatic soil fracturing to remove contaminants from low permeability soils (10^{-7} cm/s).



Multi-Phase Extraction Systems (MPE)

Multi-phase extraction (MPE), is an in-situ technology that uses pumps or entrainment (slurping) to remove various combinations of aqueous phase contaminated groundwater, as separate-phase contaminant free product occurring as light non-aqueous phase liquids (LNAPL) or dense non-aqueous phase liquids (DNAPL), and as contaminant mass sorbed to the soil matrix as contaminant vapors. Extracted liquids, NAPLs, and vapor are treated and collected for disposal.

Multi-phase extraction also allows for dewatering the saturated zone, exposing the previously saturated zone to air flow from soil vapor extraction (SVE).

The Group's automated/programmable Multi-Phase Extraction Systems are custom designed for each application, and offered as turnkey services include wellfield and equipment design, subsurface installation, operations, maintenance, through project closeout.



Soil Vapor Extraction Systems (SVE)

Soil vapor extraction (SVE) is an in situ remedial technology that reduces concentrations of volatile contaminant species adsorbed to soils in the unsaturated (vadose) zone. During SVE, a vacuum is applied through wells near the source of contamination in the soil. Volatile constituents of the contaminant mass transition to the vapor phase through various physio-chemical mechanisms, and the vapors are drawn toward the extraction wells. Extracted vapor is then treated as necessary (commonly with carbon adsorption) before being released to the atmosphere. The increased air flow through the subsurface can also stimulate aerobic biodegradation of some of the contaminants, especially those that are less volatile. Wells may be either vertical or horizontal. The Group's automated/programmable Soil Vapor Extraction Systems are custom designed for each application, and offered as turnkey services include wellfield and equipment design, subsurface installation, operations, maintenance, through project closeout.



Air Sparging (AS)

Air sparging is a subsurface contaminant remediation technique that involves the installation and operation of air injection wells alongside soil vapor extraction wells. The system is operated such that injection of pressurized air into contaminated groundwater and moist soils cause contaminants to transition to the vapor phase, which are then extracted by the soil vapor extraction wells screened in Vadose zone soils.

The Group's automated/programmable Air Sparging and Soil Vapor Extraction Systems are custom designed for each application, and offered as turnkey services include wellfield and equipment design, subsurface installation, operations, maintenance, through project closeout.

"Cleaning up the environment shouldn't come at the cost of the environment."

Robert D'Anjou - President

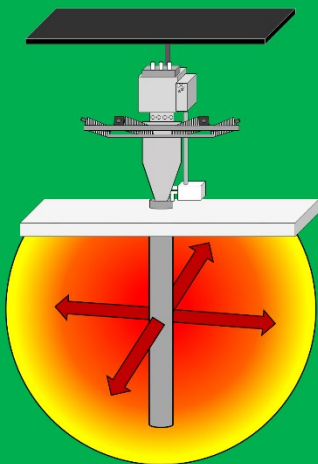


Green Remediation Technologies

Overview

The goal of The Group is to develop and implement sustainable, cost effective, and reliable approaches to contaminated site remediation using both proven and cutting-edge technologies through creative remediation strategies. This core value is driving us to lead the field in the development of sustainable, green, remediation technologies and approaches, that minimize the carbon emissions and improve the overall environmental footprint of our remediation projects. The Group has several technologies it has developed and are patent pending, and many more currently under R&D, which will be brought to marketplace in the very near future.

Hybrid Energy Thermal Remediation (HETR)



Sustainable Thermal Remediation Options Exist!

The Group's Patent Pending Hybrid Energy Thermal Remediation (HETR™) system provides a simple, cost effective, renewable energy based & sustainable option to tradition thermal remediation technologies. The HETR™ transforms and applies multiform energy to an individual, or multiple connected, points, well(s), or installations, by means of convective, conductive, and radiative heat transfer to an outer casing, which in turn thermally conducts heat to contaminated media in contact with the device, including soils, groundwater, and non-aqueous phase liquids. The HETR technology is well suited to thermal remediation applications targeting temperatures anywhere from 35 degrees C all the way up to 400 degrees C.

In various configurations, the HETR™ system can be designed to utilize variable energy reliance from either source, be it fuel combustion, or electric heating, and both energy systems can be configured and utilized in a grid-connected modality, partial grid connected modality, or entirely isolated from grid. Furthermore, this device allows differential heat application both longitudinally within the well and laterally across a wellfield, affording greater control of heat distribution than many traditional thermal technologies.

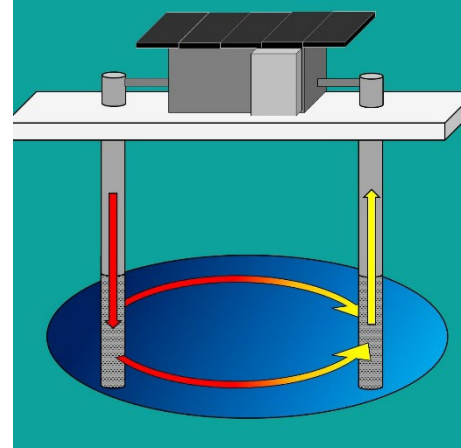
In all its variations, the HETR™ technology significantly reduces the carbon footprint of thermal remediation projects, increases the efficacy of energy consumption and utilization, minimizes reliance on traditional energy sources requiring heavy infrastructure and helps circumvent many traditional utility availability constraints.

Off-Grid Renewable Energy Recirculation Systems

The Group's automated/programmable closed-loop groundwater recirculation systems can be designed to include renewable energy sources that allow these systems to be implemented completely off-grid, without the unreliable fuel-based generator systems.

Integrating both solar energy and other alternative energy generation systems in the Heat Enhanced Recirculation System (HERS) technology, allows for 24-7 renewable energy generation from solid state devices with no moving parts so they can operate with minimal O&M and are perfectly suited for remote applications or urban settings alike.

Renewable Energy Recirculation Systems



Project Case Studies

Remediation Projects Using a Range of Technologies, Approaches, and Implementation Strategies





THERMAL

Technology:

Electrical Resistance Heating

Electrode Pattern:

76 electrodes - Three Phase Array

Treatment Area:

16,300 square feet

Treatment Interval:

Variable (55-ft bgs max)

Treatment Volume:

21,900 cubic yards

Extraction System:

MPE and SVE

Liquid Phase Treatment:

OWS separation, LPGAC treatment

Vapor Phase Treatment:

Thermal Oxidizer

Regulatory Driver:

Navy, Washington State Dept. of Ecology, EPA

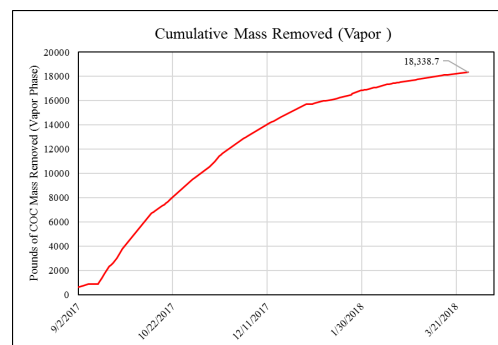
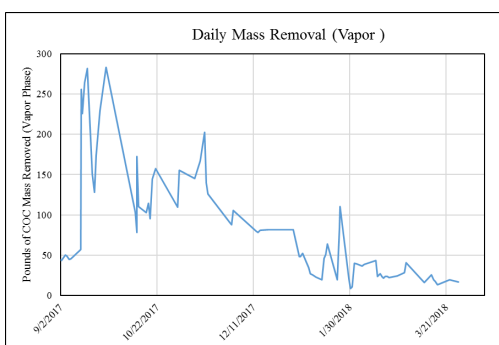
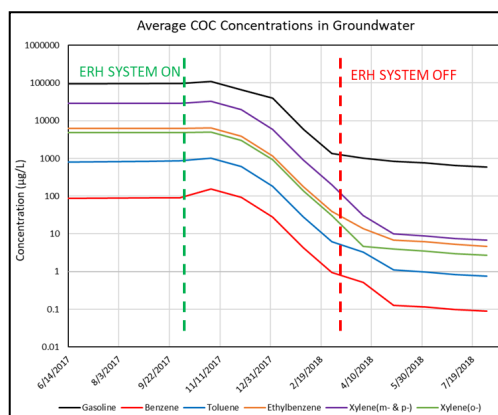
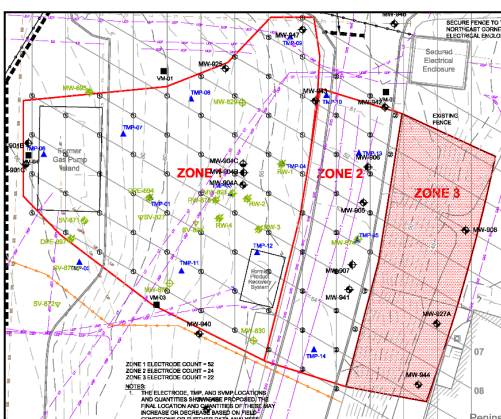
JACKSON PARK NEX GAS STATION SOURCE AREA REMEDIATION

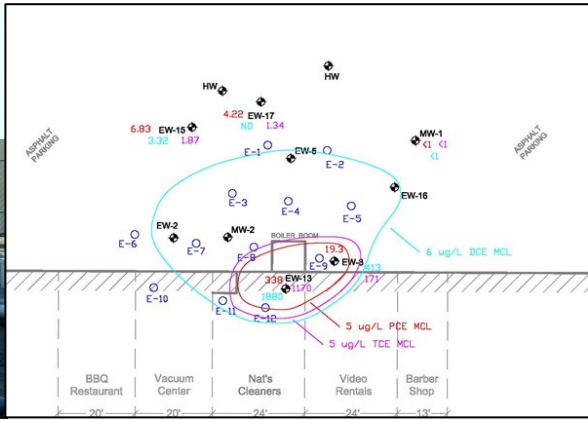
NAVFAC CONTRACT NO. - N62470-13-D-4808

BREMERTON, WA

Summary - The Group was contracted by Tetra Tech EC, Inc. (TtEC) through KEE Solutions a SDVOSB as the prime contract holder, to remediate the Site using a combination of continuous electrical resistance heating (ERH) and periodic dual-phase extraction (DPE). The Group worked with the Thermal Remediation technology vendor, Global Remediation Solutions (GRS), a company at that time being led by Michael Dodson, Robert D'Anjou, and Allen Swift, **representing a full circle project case study for our team**, as these three individuals have since joined The Group as part of our core team of Thermal Remediation Experts.

The Jackson Park Navy Exchange (NEX) Gas Station Leak Area is located within the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site near the city of Bremerton, Washington. The selected treatment remedy for the source area was electrical resistive heating (ERH) with dual phase extraction (DPE) This in situ treatment technology was performed in the upper 55 feet of the subsurface, throughout the region of Vashon Till soil and perched groundwater that exceeded cleanup levels and in the upper portion of the aquifer with the highest dissolved concentrations. A total of 76 electrodes were constructed and installed at 15-ft on-center to treat a volume of 21,900 cubic yards to depths up to 52-ft bgs. The contaminants of concern (COCs) at the Jackson Park Site are gasoline range total petroleum hydrocarbons (TPH-G) with an appreciable quantity of BTEX compounds. 19,000 lbs of COCs were removed in the vapor phase and dissolved phase concentration of TPH-G and BTEX were reduced by 99%.





COMBINED THERMAL REMEDY

CARSON PLAZA

COMBINED N-SITU REMEDIATION OF AN OPERATING DRY-CLEANING BUSINESS USING THERMAL REMEDIATION

CARSON, CA

Summary – The Group’s personnel performed an Electrical Resistance Heating (ERH) remediation of Tetrachloroethene (PCE) and trichloroethene (TCE) in soil and groundwater for Behullar Properties LLC. The guaranteed remediation contract was based upon reducing existing groundwater concentrations to MCL’s and obtain a no further action letter from the Los Angeles Regional Water Quality Control Board (LARWQCB). Groundwater concentrations were reduced by approximately 98% and the Site was submitted for regulatory Closure.

The soil and groundwater beneath an operating dry-cleaning business and strip mall in Carson, California was impacted with tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride to a depth of 25 feet below ground surface (bgs). Initial soil concentrations at a depth of 16 feet bgs have maximum values of 860 µg/kg PCE and 1,700 µg/kg TCE. Initial groundwater concentrations in the hot spot area were 4,600 µg/L PCE and 18,000 µg/L TCE. The Group’s team used Multi Phase Extraction (MPE) and Electrical Resistive Heating (ERH) combined to remediate both the soil and groundwater at the project site.

MPE was used to treat the down gradient dissolved phase groundwater plume and ERH was used to focus treatment in the source areas soil and groundwater. The Site is currently submitted for regulatory closure.

After only sixty-five days of ERH operation soil and groundwater contaminant concentrations levels were reduced to below MCLs, approximately 177 pounds of VOC’s were removed, and the project was submitted for no further action with one year of rebound monitoring.

Soil Cleanup Goals

Treatment Interval (ft bgs)	trans-1,2-DCE	cis-1,2-DCE	TCE	PCE
	(ppb)	(ppb)	(ppb)	(ppb)
0 ft bgs	106	63.6	53	53
5 ft bgs	76	45.6	38	38
11 ft bgs	40	24	20	20
16 ft bgs	10	6	5	5
21 ft bgs	10	6	5	5
Groundwater Clean-up Goals	10	6	5	5

Technology(s)

ERH & MPE

Electrode Pattern:

11 electrodes - Three Phase Array

Treatment Area:

11,070 square feet

Treatment Interval:

0 to 30-ft bgs

Treatment Volume:

12,300 cubic yards

Extraction System:

MPE and SVE

Liquid Phase Treatment:

LGAC treatment

Vapor Phase Treatment:

VGAC treatment

Regulatory Driver:

Los Angeles Regional Water Quality Control Board (LARWQCB).



SHANNON'S MARKET

COMBINED IN SITU REMEDIATION USING ISCO AND MPE

MERCED, CA

Summary –The relevant work performed includes preparation of environmental documents, Work Plan for Bench Scale testing of ISCO, Assessment Work Plan, Health and Safety Plan, O&M Plan, QA/QC Plans, Corrective Action Plan (CAP), Implementation of CAP, Perform construction, operation, maintenance, O&M related sampling, and monitoring of remediation system in accordance with local regulations and CERCLA. ERG also developed technical memorandum/reporting to regulatory agencies and client including inspection findings, modeling, sampling, testing, and reviews. Conducted evaluation of sampling strategy and operations to maximize program performance. Evaluated system design and optimized performance by implementing innovative technology enhancements. Provided technical and administrative support for public involvement activities. Conducted verification activities such as soil and groundwater sampling, soil gas sampling and reporting. Managed and disposed of wastes generated during performance of the project.

Sites contaminants include chrome, arsenic, MTBE, BTEX, PCE, Vinyl Chloride, free product. The site consisted of a dissolved phase benzene and MTBE plume extending down gradient 480 feet beneath residences and businesses. Free product was also trapped in the saturated zone beneath a low permeability layer. ERG conducted a review of an existing Air Sparging and SVE system to optimize performance and evaluate system design. Initial system optimization resulted in three orders of magnitude increase in mass removal and improved quality of operation. ERG's value engineering and performance review indicated that technology upgrades would optimize system performance, enhance efficiency, improve quality, and reduce life cycle costs. ERG implemented the technology enhancements by conducting bench tests for ISCO, performed pump and treat pilot test, and then designing, constructing, operating, sampling, and monitoring a soil and groundwater remediation system. Initial technology enhancements reduced in-situ groundwater concentrations by an average of 90% within 3 months. ERG also conducted groundwater sampling of 24 groundwater monitoring wells. The technical approach used a phased implementation of a combined remedy of MPE and ISCO. Free product recovery was completed near the source area. Remediation system included 750 scfm Thermal with 200 gpm GAC water treatment system. ERG maintained all interface with the regulatory agency including providing technical and administrative support for public meetings, and reporting.



COMBINED IN SITU REMEDY

Treatment Technologies:

Air Sparging,
Multi-Phase Extraction,
In Situ Chemical Oxidation

Contaminants:

MTBE
BTEX
PCE
Vinyl Chloride
(Comingled As NAPL)

Extraction System:

750-SCFM MPE System

Liquid Phase Treatment:

OWS separation, LPGAC
treatment

Vapor Phase Treatment:

Thermal Oxidizer with
VGAC





Do You Have a Contaminated Site, and Need Remediation Expertise?

Contact us today for a free estimate.



The Environmental Remediation Group

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