Statement of Qualifications
for Designing, Building, and Operating
In Situ Thermal Remediation Projects
2013

Prepared by:

TERRATHERM

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1. TerraTherm Company Overview

1.1 About TerraTherm

TerraTherm is a worldwide leader in the development and implementation of in situ thermal remediation of hazardous waste. We advise on, design, build, and operate thermal remediation projects from concept to closure.

We offer the broadest array of thermal remediation technologies in the industry, allowing us to tailor project designs to specific site conditions, using the optimal combination of methods, without bias towards any single technology or approach.

TerraTherm partners with leading engineering firms, government agencies, corporations, and property owners in flexible, cooperative relationships to achieve cleanup goals. Our expertise, broad set of proven technologies, and seasoned staff combine to provide the most effective cleanup available for a broad array of contaminants within all soils and site conditions.

We deliver high return on investment, dramatically increase property value, and reduce liability. Our projects are neighborhood-friendly, producing minimal noise, dust, and disruption. They achieve complete results within predictable time-frames, enable final site closure, optimize property value, and eliminate the risks of liability and long-term threats from contaminants.

<table>
<thead>
<tr>
<th>TerraTherm's Corporate Headquarters:</th>
<th>International Sublicensees/Partners:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TerraTherm, Inc.</strong></td>
<td><strong>Krüger, A/S</strong></td>
</tr>
<tr>
<td>151 Suffolk Lane</td>
<td>Gladsaxevej 363</td>
</tr>
<tr>
<td>Gardner, MA  01440</td>
<td>DK-2860 Søborg</td>
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<tr>
<td>TEL: (978) 730-1200</td>
<td>Denmark</td>
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<tr>
<td>FAX: (978) 632-3422</td>
<td><a href="http://www.kruger.dk">www.kruger.dk</a></td>
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<tr>
<td>E-mail: <a href="mailto:info@terratherm.com">info@terratherm.com</a></td>
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<tr>
<td><strong>California Office:</strong></td>
<td><strong>SheGoTec Japan, Inc.</strong></td>
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<tr>
<td><strong>TerraTherm, Inc.</strong></td>
<td>Shibaura SEC Building 2nd Floor,</td>
</tr>
<tr>
<td>28900 Indian Point</td>
<td>Shibaura 3-13-1, Minato-ku</td>
</tr>
<tr>
<td>Keene, CA 93531</td>
<td>Tokyo, Japan 108-0023</td>
</tr>
<tr>
<td>(661) 823-1620</td>
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<tr>
<td></td>
<td>FAX: 81-3-3455-2480</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.shegotec.com">www.shegotec.com</a></td>
</tr>
</tbody>
</table>
1.2 History

TerraTherm was formed by a team of seasoned industry veterans with a passion for innovation and a dedication to making breakthroughs in the effectiveness of remediation technologies and processes. In 2000, a division of Royal Dutch Shell donated a cutting-edge technology to the University of Texas at Austin, which in turn licensed it to TerraTherm’s co-founders, making the formation of TerraTherm possible. Since that time, TerraTherm has broadened its capabilities, developed and patented new methods, added numerous partners, proven the applicability of thermal remediation, and completed numerous successful projects worldwide.

Milestones:

Late 1980s/early 1990s
• Shell Exploration and Production (Shell E&P), a division of Royal Dutch Shell (Shell) develops the TerraTherm In Situ Thermal Desorption (ISTD) technology as part of its effort to enhance oil recovery.

1994 to 1998
• Shell E&P recognizes the technology’s potential to clean up contaminated soil.
• Shell Technology Ventures, Inc. (STVI), a wholly owned subsidiary of Shell E&P that held the ISTD patents, and TerraTherm Environmental Services Inc., an STVI spin-off, conduct seven ISTD demonstrations and projects.

1999-2000
• Shell exits the remediation business and donates the ISTD rights to the University of Texas at Austin (UT).

2000 - 2001
• Ralph Baker, Ph.D. and John Bierschenk, P.G. secure the exclusive license to commercialize ISTD within the United States from UT.
• They co-found TerraTherm, LLC, assuming the roles of CEO and President, respectively.
• Jim Galligan, P.E. joins the company as lead engineer. TerraTherm opens offices in Fitchburg, MA and equipment facilities in Houston, TX.
• TerraTherm, LLC completes first round of funding and becomes TerraTherm, Inc.

2002
• TerraTherm secures the exclusive worldwide rights to commercialize ISTD
• Partnership with SheGoTec Japan, Inc. is established.

2004
• Six field projects underway.
• Successful completion of the first ISTD Chlorinated Volatile Organic Compounds (CVOCs) project.
• In Situ Thermal Remediation (ISTR) industry leader Dr. Gorm Heron joins TerraTherm.

2005
• TerraTherm achieves another ISTD milestone with the successful completion of its first Manufactured Gas Plant (MGP) project.
• Successful completion of a fast turnaround Brownfield cleanup of CVOCs for the City of Richmond, CA.

2006
• Successful completion of the pioneering Southern California Edison Alhambra ISTD project, achieving a No Further Action letter from the State of California.
• Partnerships forged with Krüger A/S in Denmark and Sweden.
• TerraTherm moves to larger facilities in West Fitchburg, MA.
2007
- TerraTherm secures a license to practice Steam Enhanced Extraction (SEE) from the University of California Berkeley.
- TerraTherm begins its first SEE project.
- Successful completion of the first ISTD project remediating Dense Nonaqueous Phase Liquid (DNAPL) in fractured rock.

2008
- TerraTherm utilizes ISTD to successfully treat 48,000 cy of CVOC-contaminated soil for the U.S. Air Force at Memphis Depot, TN.
- TerraTherm adds Electrical Resistance Heating (ERH) capability through partnership with McMillan-McGee Corporation.
- Successful completion of first ISTD-SEE combination at an active dry cleaning facility in Odense, Denmark.

2009
- TerraTherm is awarded the Gold Medal award for Business and Achievement in the Remediation Contracting category by the Environmental Business Journal.

2010
- TerraTherm celebrates its 10th anniversary.
- The company receives a gold medal from EBI for outstanding achievement in environmental remediation.

2011
- TerraTherm reports that 60 sites worldwide have been treated with ISTD.
- Linda Martin joins the company as Corporate Safety and Compliance Director.
- The Zweig Letter names TerraTherm to its 2011 Hot Firm List of fastest growing firms in the A/E/P and design-build industry sector.

2012
- Steve McInerney joins the company as Remediation Department Manager.
- TerraTherm moves to a larger facility in Gardner, MA.
- David Allworth joins the company as Chief Financial Officer.

2013
- TerraTherm is awarded a $37M project by USAID in Vietnam
- The Zweig Letter names TerraTherm to its 2013 Hot Firms List.

Technology Commercialization Timeline
1.3 TerraTherm Leadership Team

For more information on the leadership team visit www.terratherm.com/about/leadership.htm

**John M. Bierschenk, P.G.** is TerraTherm’s President and CEO. Mr. Bierschenk has overall responsibility for general management of the company. Mr. Bierschenk is a registered Professional Geologist in Pennsylvania (USA), and holds a BS in Geology as well as an MBA. He has over 25 years of technical and management experience in the environmental and energy business; working as an environmental consultant, general manager of a soil and groundwater remediation equipment company, and as an exploration geophysicist.

**Ralph S. Baker, Ph.D.** is TerraTherm’s Chairman and Chief Scientist. Dr. Baker has overall responsibility for TerraTherm’s application and development of the ISTD technology and leads many of its business development efforts. Dr. Baker is a soil physicist with over 30 years of experience, and has authored over 60 publications on in-situ remediation, including four books. Dr. Baker led the development of three comprehensive Engineer manuals written for the U.S. Army Corps of Engineers on in-situ remediation and has served as technical adviser to government and industry on many remediation projects.

**Gorm Heron, Ph.D.** is TerraTherm’s Vice President and Chief Technology Officer. Dr. Heron has 18 years of experience in assessment, design, and management of in-situ thermal remediation projects, focusing on the use of Steam-Enhanced Extraction (SEE) for treatment of CVOC DNAPL sites in soil and fractured rock. From 1997-2004, Dr. Heron served as Principal Environmental Engineer with SteamTech Environmental Services, Inc. where he designed, oversaw and operated six major steam projects. Dr. Heron provides technical leadership and oversight in the design and application of ISTD and combined ISTD/SEE systems.

**James P. Galligan, P.E.** is TerraTherm’s Principal Engineer. Mr. Galligan has 19 years of experience in estimation, detailed design, procurement, installation, and operation of in-situ remediation projects. He has been instrumental in each of the detailed ISTD remedial design and implementation efforts that TerraTherm has carried out. Mr. Galligan earned an M.B.A. from Northeastern University and a B.S. in Mechanical Engineering from Boston University.

**David B. Allworth** is TerraTherm’s Chief Financial Officer. He has more than 30 years’ experience in corporate financial management & accounting. Prior to joining TerraTherm in 2012, Mr. Allworth was the CFO for InEnTec Inc., a waste-to-energy technology company where he led efforts to raise more than $100 million through the issuance of equity, convertible debt and joint venture partnership interests. He has extensive experience in strategic planning, financial analysis, international tax & finance, and financial systems implementation.

**Mark W. Kresge, MRP** is TerraTherm’s Vice President of Information Management Systems. Mr. Kresge has 28 years of experience in the environmental consulting field, with expertise in remediation system design, cost estimating, data management, and systems analysis. His extensive background in environmental remediation allows him to provide logistical and strategic leadership and to develop informational technology architectures that are tailored to the specific needs of both the company’s staff and its clients.
1.4 Leadership Team Publication Examples

Members of TerraTherm’s leadership team are frequently invited to serve on research advisory committees and have published dozens of papers, handbooks, and presentations. A sample of those includes:


Heron, G., J. LaChance, J. Bierschenk, K. Parker, S. Vinci, R. Woodmansee, and J. Schneider. 2010. “Combining Thermal Treatment with MNA at a Brownfield DNAPL Site.” Paper E-024, in K.A. Fields and G.B. Wickramanayake (Chairs), Remediation of Chlorinated and Recalcitrant Compounds—2010. Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA; May 2010). Battelle Memorial Institute, Columbus, OH.

1.5 TerraTherm R&D

TerraTherm’s R&D efforts are focused on making our proven thermal technologies even better; advancing the efficiency, applicability and cost-effectiveness of our solutions, and sharing our findings to advance the state of the art. Our internal R&D group works with leading research institutions to develop, test, and deploy new methodologies and materials. We have frequently been selected as a key contractor in important research projects to prove the reliability of thermal methods for various contaminants, soils, and site types such as fractured rock. Our principals are frequent contributors to the remediation community; providing papers, presentations, and insight in a wide variety of forums and publications, examples include:

• Having been selected as a key contractor in important research projects to prove the thermal methods.
• Partnerships and joint projects with leading institutions for advanced research in thermal remediation, including; the University of Texas, the University of Stuttgart, and Queens University.
• Frequent presentations and panel appearances at important industry events and government sponsored conferences worldwide.
• In-house R&D and innovation to improve the reliability and cost-effectiveness of thermal solutions.
• Respected and recognized leadership staff with a history of leading publications and innovations in thermal technologies.

1.6 Research Partnerships and Joint Projects

We work closely with leading institutions such as the University of Texas, Queens University and the University of Stuttgart to improve processes and tools. Shell Technology Ventures donated patents to The University of Texas, which in turn licensed them exclusively to TerraTherm. We fund and collaborate with The University of Texas at Austin’s faculty and students in their research. This close relationship has led to many papers, graduate theses, and numerous research publications and papers.

Another example of research collaboration was a three-year SERDP-funded project featuring controlled release of DNAPL into a lower-permeability layer beneath the water table. This research was conducted at the facilities of VEGAS - the Research Facility for Subsurface Remediation at the University of Stuttgart, Germany.
1.7 Intellectual Property Examples

Patented and Proprietary Materials and Methods

TerraTherm, its licensor’s, and its leadership team have over 28 patents, and 127 International Patents on a wide range of topics. They include U.S. patents on:

- Remediation of soil in containers or piles
- Remediation of soil piles using central equipment
- Vacuum methods for removing soil contamination
- Thermal well designs
- Enhanced deep soil vapor extraction processes for removing contaminants trapped in or below the water table
- Methods for treating DNAPL by applying heat
- Electrical Resistance Heating (ERH)
1.8 Patent Examples


[28 U.S. Patents + Pending; 127 International Patents + Pending]
1.9 Commitment to Health and Safety

TerraTherm gives the utmost attention and priority to health and safety issues. We are driven to ensure that all of our procedures, processes, attitudes, and plans are highly safety-centric. This attention to detail is at the core of our company's culture, and has resulted in an impeccable safety record to date. Visit http://terratherm.com/services/build/commitment.htm for more information.

All of our field engineers, project managers, construction managers, craftsmen, and equipment operators are OSHA 40 Hour HAZWOPER trained. They also participate in training programs including:

- Electrical Safety
- Hazardous Energy Control
- Hazard Communication
- Respiratory Protection
- Powered Industrial Truck

TerraTherm’s Experience Modification Rating (EMR) is 0.90.

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2. In Situ Thermal Remediation Technologies

2.1 Introduction: In Situ Thermal Remediation

In Situ Thermal Remediation (ISTR) has become a “hot topic” for environmental consultants, regulators, developers, utilities, and other companies. Thermal remediation technologies have proven both capable and highly consistent in remediating essentially all hazardous organic compounds to levels at or below regulatory cleanup standards. As a result, the number of thermal projects has skyrocketed.

Why are so many people “thinking thermal?” The many advantages of thermal remediation include:

- Delivers robust, highly predictable results.
- Provides clean, quiet, dust free, and neighborhood friendly operations.
- Increases property values and reduces liability on the books.
- Treats inside buildings and near infrastructure.
- Eliminates contaminants in soil to non-detect levels, even to drinking water standards.
- Meets the needs of a broad range of project sites and contaminants.
- Achieves closure in short time-frames.
- Captures vapors and prevents unwanted contaminant mobilization.
- Provides cost effective remedies — often Thermal is the obvious choice.

In close cooperation with you, we design, build, and operate remediation projects from concept to closure. Our broad set of technologies and applications allow us to tailor an optimal design to your site’s soil, permeability, contaminants, location and cleanup goals. We apply each technology to its best purpose, alone or in combinations, ensuring that no method is stretched or force-fit to purposes for which another might be more cost effective or efficient. No other thermal remediation company offers this full range of options.
2.2 Thermal Remediation Technologies

TerraTherm performs screening and technology selection for all sites to determine and propose the optimal and most cost-effective heating technique or combinations. Visit http://terratherm.com/thermal/index.htm for more information.

**Thermal Conduction Heating**

TerraTherm offers **low**, **moderate**, and **high** temperature applications of Thermal Conduction Heating (TCH), as incorporated within TerraTherm’s proprietary In Situ Thermal Desorption (ISTD) technology.

Thermal Conduction is the process of heat flowing from the hot end of a solid object (like an iron rod) to the cold end. In soil or rock, heat flows from TerraTherm’s heater wells out into the formation by grain-to-grain contact (in soil) and across solid objects (rocks).

The TCH technology can be utilized to heat in situ soils and stockpiled soils and sediments. The design of the treatment system of in situ soils typically includes vertically installed heaters, whereas the design of the treatment system for the stockpiled soils (In-Pile Thermal Desorption®, or IPTD®) can incorporate vertical or horizontal heater wells.

**Steam Enhanced Extraction**

Steam Enhanced Extraction (SEE) is a highly effective technology used in the recovery of free product and the remediation of volatile organic compounds (VOCs) since the mid-1990s.

SEE achieves on-site separation and treatment through steam injection into wells and extractions of hot fluids. Steam propagation is a stable and predictable process, governed by heat transfer to the formation and has been studied intensively and utilized for oil recovery and remediation of a wide-range of contaminants.

**Electrical Resistance Heating**

TerraTherm offers an advanced form of Electrical Resistance Heating (ERH) called Electro-Thermal Dynamic Stripping Process or ET-DSP™. ET-DSP™ has been field proven on over 30 successful projects by our technology partner, McMillan-McGee Corporation. ERH has been widely applied and proven effective for free product recovery and enhanced vapor extraction at sites with volatile contaminants such as VOCs, CVOCs, and NAPLs, and is applied at low and moderate temperatures.

**Combinations**

SEE may be combined with either ET-DSP™, or with ISTD. Together these combinations comprise a glove-fit design for sites with complex geologies (e.g., silty clay aquitards, and sandy or gravelly aquifers).

A combination approach often addresses the entire target treatment zone (TTZ). At each well location, either a single full-length TCH heating element or one or more ET-DSP™ electrodes is used along the depth interval of the low-permeability material, while steam is injected into wells screened in the permeable zones. Extraction wells exert hydraulic and pneumatic control.
2.3 Thermal Conduction Heating

**What is Thermal Conduction?**

Thermal conduction is the process of heat flow from the hot end of a solid object (like an iron rod) to the cold end. In soil or rock, heat flows from TerraTherm’s heater wells out into the formation by grain-to-grain contact (in soil) and across solid objects (rocks). The fluids (water, air, NAPL) in contact with the solids also heat up at the same time. The heat moves out radially from each thermal well until the heat fronts overlap. Due to the invariance of thermal conductivity, sands, silts, and clays conduct heat at nearly the same rate, leading to highly predictable in situ heating, even in challenging and heterogeneous subsurface settings.

TerraTherm offers low, moderate, and high temperature applications of [Thermal Conduction Heating (TCH)](#). TCH has been applied as a remedial technology to sites worldwide since 1995.

### 2.3.1 TCH Installation

TerraTherm uses the TCH technology by installing a series of patented electrically-powered heaters and vapor extraction points installed in situ, and operated to heat contaminated soil to target treatment temperatures. Target treatment temperatures are typically the boiling point of the contaminant of concern at the site.
2.3.2 Benefits of TCH

Thermal conductivity values for the entire range of known soils vary by a factor of less than plus or minus three, while fluid conductivity of soils may vary by a factor of a million or more. Compared to fluid injection processes, the conductive heating process is uniform in its vertical and horizontal sweep. Transport of the vaporized contaminants is further improved by the creation of permeability, which results from drying (and, if clay is present, shrinking) of the soil close to the heaters. Preferential flow paths are created even in tight silt and clay layers, allowing escape and capture of the vaporized contaminants. TCH produces uniform heat transfer through thermal conduction and convection in the bulk of the soil volume. This allows the achievement of very high contaminant removal efficiency with a nearly 100% sweep efficiency, leaving no area untreated.

TCH can be applied at low (<100°C), moderate (~100°C), and higher (>100°C) temperature levels to accomplish the remediation of a wide variety of contaminants, both above and below the water table.

We most often apply TCH to achieve 100°C for treatment of VOC sites. We are often being placed in a box for the more difficult sites - while we actually can be competitive on all thermal sites.

TCH is the only ISTR technology capable of achieving target treatment temperatures above the boiling point of water.

TCH is effective at virtually any depth in almost any media.

TCH works in tight soils, clay layers, and soils with wide heterogeneity in permeability or moisture content that are impacted by a broad range of volatile and semi-volatile contaminants such as:

- DNAPL
- LNAPL
- Tar
- PCBs
- Pesticides
- PAHs
- Dioxins
- Chlorinated Solvents
- Explosives Residue
- Heavy Hydrocarbons
- Mercury

### In Situ Thermal Remediation

**Lower, Moderate and Higher Temperature Applications**

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<th>temperature range</th>
<th>Lower below 100°C</th>
<th>Moderate ~100°C (212°F)</th>
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<tr>
<td>Multiple Applications</td>
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<td>VOCs / CVOCs</td>
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<td>Heating Methodology</td>
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</tr>
<tr>
<td></td>
<td>thermal conduction</td>
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</table>
2.3.3 TCH Applicability

TCH technology can be utilized both for in situ soils and stockpiled soils and treats both Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs). The design of the treatment system for in situ soils typically includes vertically installed heaters whereas the design of the treatment system for the stockpiled soils typically incorporates horizontally installed heaters. Examples of the elements of each system are shown below:
Works Inside Buildings and Near Structures

The TCH technology can operate inside and near buildings and infrastructure. This capability has been field proven in several projects. The photo below shows installation inside a working dry cleaning plant in Denmark.

Applicable Above and Below the Water Table

The TCH technology can be applied to contaminants in soils both above and below the water table where the soils can be heated up to target treatment temperatures. Contaminants such as TCE, PCE, and other VOCs that do not require treatment temperatures higher than the boiling point of water, can be treated simply by steam distillation. Contaminants such as PAHs, dioxins, PCBs, and other SVOCs that require higher temperatures are treated by boiling off the water within the treatment zone, and then by heating the soil to the designated treatment temperatures. Where significant groundwater flow is present, additional measures such as groundwater management or a hydraulic barrier may be required.
2.4 Steam Enhanced Extraction

*What is Steam Enhanced Extraction?*

Steam Enhanced Extraction (SEE) achieves on-site separation and treatment through steam injection into wells and extraction of hot fluids. Steam propagation is a stable and predictable process, governed by heat transfer to the formation, and has been studied intensively for oil recovery and remediation of a wide range of contaminants.

TerraTherm offers [Steam Enhanced Extraction](#), a technology that has proven highly effective for the recovery of free product and the remediation of volatile organic compounds (VOCs).

TerraTherm uses SEE at low and moderate temperatures. It is applied through the installation of steam injection and extraction wells that are used to inject steam into the subsurface while simultaneously extracting steam, vapors, mobile non-aqueous phase liquid (NAPL), and groundwater. The injected steam is used to heat the subsurface to target treatment temperatures, typically the boiling point of the contaminant of concern at the site.
SEE Contaminant Removal and Destruction Mechanisms:

- Displacement as a NAPL phase and extracted with the pumped groundwater.
- Vaporization in the steam zone.
- Accelerated vaporization and extraction is achieved in the vapor phase through pulsed pressurization and depressurization cycles.
- Dissolution, destruction, and removal with the extracted water.

SEE is a Good Fit for Sites with Significant Groundwater Flow

SEE is a logical choice for large and deep sites with significant groundwater flow. The process allows for high net extraction of fluids and displaces large amounts of groundwater towards the extraction wells. As a result, less water has to be heated to allow the formation to reach target temperatures. In addition, this displacement facilitates hydraulic control of NAPL mobility. The steam sweeps through the formation and the accompanying pressure gradient displaces the mobile NAPL and vaporized components as an oil front, which is recovered when it reaches the extraction wells.

Pressure Cycling for Improved Contaminant Removal Rates

Another significant benefit of SEE is the ability to conduct pressure cycling to improve contaminant removal rates dramatically. After the target zone has been heated and the majority of the NAPL extracted as a liquid, pressure cycling is induced by varying the injection pressure and the applied vacuum. This has been demonstrated to achieve very low concentrations in the original source zone.
2.5 Electrothermal Dynamic Stripping Process™, Electrical Resistance Heating

What is Electrical Resistance Heating?
When electrical current is passed through the soil, the resistance it encounters causes the soil and fluids to heat up, due to Ohmic (or Joule) heating. The current flows from one electrode to another, primarily through the soil water. Once the water boils off, electrical conductivity becomes negligible and heating ceases; thus, water is added at each electrode to keep them from drying out. Heat-up with Electrical Resistance Heating (ERH) is limited to the boiling point of water. McMillan-McGee’s Electrothermal Dynamic Stripping Process™ (ET-DSP™) is an advanced ERH technology.

Electrical Resistance Heating has been widely applied and proven effective for free product recovery and enhanced vapor extraction at sites with volatile contaminants such as VOCs, CVOCs, and NAPLs, and is applied at low and moderate temperatures. TerraTherm offers an ERH technology called Electro-Thermal Dynamic Stripping Process or ET-DSP™. ET-DSP™ has been field proven on over 30 successful projects by our technology partner, McMillan-McGee Corporation.

2.5.1 ET-DSP™ Process
Electrodes are installed in wells throughout the contaminated soil and groundwater volume. The electrode array is connected to a Power Delivery System unit that uses standard, readily available three-phase power from the grid. The process begins by passing current between electrodes causing the soil temperature to rise. This increased temperature results in the volatilization of contaminant compounds into the vapor phase for removal with vapor extraction techniques.

Comprehensive computer controls are used to regulate and optimize the thermal response of the target formation.
2.5.2 ET-DSP™ Advantages

ET-DSP™ features efficient energy delivery, convective heat transfer in permeable settings, and uniform temperature monitoring. These features are not found in other ERH technologies. ET-DSP™ project cycles are also shorter because of its rapid installation process and quick achievement of target temperatures.
2.6 Technology Combinations

Combining Thermal Conduction Technologies provides an optimal solution for many sites. TerraTherm has demonstrated that Steam Enhanced Extraction may be combined with either Electrical Resistance or Thermal Conduction methods for a glove-fit design for sites that include complex geology and layers with highly permeable materials (e.g., sandy or gravelly aquifers).

A combination of TCH or ERH and SEE often addresses the entire target treatment zone (TTZ). At each well location, TCH or ERH is used along the entire depth interval, and steam is injected into the permeable zones.

Each of the heating technologies is applied where it is most effective.

TCH or ERH:

- Heats at all depths, including the bottom of the treatment zone, where it can form a “hot floor” that prevents downward migration of condensate and/or DNAPL.
- Heats the near-surface soils such that shallow NAPL condensation is prevented; and heats thick clay layers.
- ERH is applied at temperatures at or near the boiling point of water.
- TCH may be chosen across a wide range of temperatures, and is the logical choice for higher temperature applications where high boiling contaminants are targeted for removal.

Combined with SEE:

Heats the permeable zones and builds a high pressure steam filled zone that reduces the water flow into the TTZ by reducing or negating the inward hydraulic gradient, and by reducing the relative permeability of water within the steam saturated porous media.

The combined technologies approach optimizes overall heating and treatment efficiency, often reducing both the operational period and the overall project cost.
3. Services

TerraTherm advises on, designs, builds, and operates In Situ Thermal Remediation (ISTR) projects from concept to closure.

Our breadth of technologies and field experience combine to maximize our ability to tailor solutions and provide creative problem solving. TerraTherm provides the people, equipment, project management, safety process, logistics, and regulatory understanding required for smooth and successful projects with positive, predictable outcomes.

At each phase of a project, we listen carefully and work as partners with our clients to create and execute the most cost-effective and timely path to your cleanup goals.

For more information about TerraTherm services visit: [http://terratherm.com/services/index.htm](http://terratherm.com/services/index.htm)
4 Site Types, Applications and Projects

Get it right the first time

When it comes to remediation projects, getting it right the first time is the key to cost-effectiveness and value. To design the optimal solution and deliver on promised cleanup goals and timeframes, we work with you to gain a profound understanding of all aspects of the site including contaminants, geology, location, and potential complexities.

Permeability and Geology

Permeability and geology are key factors that guide the selection of the optimal Thermal Remediation Technology(ies) and remediation design for a given site. Our technologies have been proven effective across a wide range of site conditions.

Thermal Conduction Heating (TCH), Steam-Enhanced Extraction (SEE), and Electrical Resistance Heating (ERH), offer flexibility that can be matched to almost any site, both above and below the water table. Using each of these technologies alone or in combination, we are able to treat a wide variety of geologies including:

- Tight soils
- Clay layers
- Fractured rock
- Unconsolidated soils
- Complex stratigraphies
- Soils with wide heterogeneity in permeability or moisture content
- Above and below the water table
- Unsaturated zone
- Saturated zone
- Smear zone

Example Site Types and Applications

- Manufactured Gas Plants (MGP)
- Brownfields
- Railroad and Wood Treatment sites
- Fractured rock sites
- Inside and near buildings and infrastructure
- Rapid site cleanup, for closure and resale

For more information about site types and applications, visit: http://terratherm.com/projects/applications/index.htm
4.1 Contaminants of Concern

In Situ Thermal Remediation (ISTR) techniques will treat just about any organic compound, including:

- Trichloroethene (TCE), tetrachloroethene (PCE), 1,2-dichloroethene (1,2-DCE), trichloroethanes (TCA), and other halogenated hydrocarbons, often referred to as chlorinated solvents
- Dense and light non-aqueous phase liquids (DNAPLs and LNAPLs)
- Polychlorinated biphenyls (PCBs), Polychlorinated dibenzodioxins and furans (PCDD/Fs), better known as simply Dioxins
- Polycyclic aromatic hydrocarbons (PAHs), often present in creosote at wood treatment sites, and coal tar at former Manufactured Gas Plant sites
- Pesticides and herbicides
- Petroleum, petroleum products and their volatile constituents including benzene, toluene, ethylbenzene, xylenes (BTEX), and methyl tertiary butyl ether (MTBE)
- Any other volatile or semi-volatile hydrocarbon
- Nearly any other organic compounds or combination of organic compounds

Mercury, a volatile metal whose boiling point is within the PCB range, can also be treated by appropriate use of ISTR techniques.

Visit our website [www.terratherm.com/projects/contaminant/index.htm](http://www.terratherm.com/projects/contaminant/index.htm) for more information on CVOCs, SVOCs, and DNAPL as well as descriptions of selected projects and examples of applications for certain site types by industry, location, or contaminant. You may also wish to use the site search tool to locate the information you need on specific keywords, such as a contaminant or site geology; see the resources section for FAQs, white papers, and more. Also, please feel free to contact us with any questions about your site or about ISTR. Email us at info@terratherm.com.
Appendix A: Project Case Study Examples

TerraTherm has completed numerous full-scale and pilot remediation projects at contaminated sites on five continents. Our technologies offer flexibility not only in the variety of contaminants that they can treat, but also in the applicability of the technologies to various site types.

TerraTherm’s projects represent a wide variety of site applications including:

- Manufactured Gas Plants sites
- Brownfield redevelopment
- Fractured rock sites
- Inside & near buildings & infrastructure
- Rapid site cleanup, for closure and Resale

If you are interested in a site or project type not listed above, please contact us to discuss your site.

On the following pages, we provide some brief case study examples. For more case study examples, please visit http://terratherm.com/projects/index.htm
Commercial Project — MGP Gasholder

**Project Name:** In-Situ Thermal Desorption (ISTD) of Former Manufactured Gas Plant (MGP) Gasholder

**Project Location:** North Adams, Massachusetts. Property adjacent to commercial, industrial, and residential areas. **Owner:** Massachusetts Electric Company (MEC), a subsidiary of National Grid

**Consultant:** Brown and Caldwell

**Time Frame:** August 2003 - June 2005

**Site Information:** MGP operations began in the 1860s and continued until 1952. Abandoned gasholder contains approximately 2,010 cubic yards (cy) (1,537 m³) of soil and debris contaminated with coal tar. The 62 ft (19 m) diameter by 18 ft (5.5 m) deep gasholder has brick walls and a bottom believed to be constructed of concrete.

**CoCs:** Contaminants of Concern are as follows: Coal tar containing benzo(a)pyrene [B(a)P] concentrations as high as 650 mg/kg; naphthalene 14,000 mg/kg; benzene 6,200 mg/kg; and Total Petroleum Hydrocarbons (TPH) 230,000 mg/kg.

**Soil Characteristics:** Mixture of sand, gravel, cobbles, bricks, concrete fragments, ash, and clinker.

**Groundwater:** Perched water was encountered within the gasholder at 5.5 ft (1.7 m) below ground surface (bgs). The regional groundwater table is beneath the holder.

**Contract Type, Project Goals:** Guaranteed performance contract to achieve a Permanent Solution in accordance with the Massachusetts Contingency Plan (MCP), by eliminating DNAPL within the holder and reducing concentrations of VOCs, SVOCs, and TPH below MCP Upper Concentration Limits (UCLs), so that residual risk is minimized. **Achieved all remedial goals** (see table below).

### Pre- and Post-Treatment Soil Concentrations Within the Construction Worker Exposure Depth

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Pre-Treatment mg/kg</th>
<th>Post-Treatment mg/kg</th>
<th>Reduction %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>2068</td>
<td>0.35</td>
<td>99.98%</td>
</tr>
<tr>
<td>Anthracene</td>
<td>19</td>
<td>0.48</td>
<td>97.47%</td>
</tr>
<tr>
<td>Benzo(a)anthracene</td>
<td>20</td>
<td>0.51</td>
<td>97.45%</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>20</td>
<td>0.33</td>
<td>98.35%</td>
</tr>
<tr>
<td>Chrysene</td>
<td>20</td>
<td>0.71</td>
<td>96.45%</td>
</tr>
<tr>
<td>Fluoranthene</td>
<td>43</td>
<td>1.02</td>
<td>97.63%</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>679</td>
<td>5.7</td>
<td>99.16%</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>107</td>
<td>3.82</td>
<td>96.43%</td>
</tr>
<tr>
<td>Pyrene</td>
<td>65</td>
<td>1.12</td>
<td>98.28%</td>
</tr>
<tr>
<td>C11-C22 Aromatics, unadj.</td>
<td>4000</td>
<td>43.15</td>
<td>98.92%</td>
</tr>
</tbody>
</table>

All below UCLs

**Project Approach:** Installation of 25 thermal wells spaced on -12 ft (3.7 m) centers, to a depth of -18 ft (5.5 m) bgs. Operate in three stages: 1) dewatering; 2) thermally-enhanced free-product recovery with gentle heating (produced > 16,000 gallons of coal tar); and, 3) ISTD to achieve target interwell temperatures of 617°F (325°C). Thermocouple arrays enable monitoring of subsurface temperatures. Water treatment by oil-water separator, clay-carbon media, liquid-phase granular activated carbon (GAC). Vapor treatment by regenerative thermal oxidizer with backup vapor-phase GAC.

**Project Staffing:** As General Contractor, TerraTherm, Inc., has provided all project design, construction, operation, and equipment.

**Subcontracting:** TerraTherm subcontracted for some labor, drilling, and electrical services.

Visit our website! [www.terratherm.com](http://www.terratherm.com)
**Project Name:** Former Wood Treatment Area

**Project Location:** Alhambra, California

**Owner:** Southern California Edison (SCE)

**Consultant:** Shaw Group

**Time Frame:** May 2002 - Early 2006

**Site Information:** SCE’s Alhambra Combined Facility occupies approximately 33 acres and is currently used for storage, maintenance, and employee training. The former wood treatment area (AOC-2) occupies a 2-acre portion of the site. SCE carried out wood treatment at the area from approximately 1921 to 1957, by immersing utility poles in creosote. The total treatment volume is approximately 16,200 cy of vadose zone soil, and includes a variety of buried subsurface features, including treatment tanks, the structural remains of the former boiler house and tank farm, and various buried utilities.

**CoCs:** Contaminants of Concern are as follows: polycyclic aromatic hydrocarbons (PAHs) are present in site soils to a maximum concentration of 35,000 mg/kg and mean concentration of 2,306 mg/kg Total PAHs; pentachlorophenol (PCP) to a maximum concentration of 58 mg/kg and mean concentration of <1 mg/kg; and dioxins (expressed as 2,3,7,8-tetrachlorodibenzo-p-dioxin [TCDD] Toxic Equivalency Quotient [TEQ]) to a maximum concentration of 0.194 mg/kg and mean concentration of 0.018 mg/kg.

**Site Characteristics:** Soils within the thermal treatment area are composed of fill and silty sands, inter-bedded with sands, silts, and clays. The average thermal treatment depth is approximately 20 feet below ground surface (bgs) and in some areas extends to over 100 feet bgs. The depth to the water table is greater than 240 feet bgs.

**Project Goals:** The soil remediation standard for PAHs (expressed as benzo(a)pyrene [B(a)P] toxic equivalents) is 0.065 mg/kg; for PCP, 2.5 mg/kg; and for dioxins (expressed as TEQ), 0.001 mg/kg.

**Project Time Line:** ISTD Phase 2 treatment: July 2004- September 2005; Demobilization from the site was completed in March 2006.

**Project Results:** All remedial goals met (see figure above). Agency oversight provided by California’s Department of Toxic Substances Control under California’s Expedited Remedial Action Program (ERAP).

**Project Approach:** In-Situ Thermal Destruction (ISTD) remediation at the Alhambra facility includes the following design features: a) minimum target temperature of 635°F (335°C), maintained for 3 days; b) 7.0-ft spacing between thermal wells; c) 785 thermal wells (131 heater-vacuum and 654 heater-only wells); d) insulated surface seal; and, e) thermal oxidizer, heat exchanger, and granular activated carbon (GAC) for off-gas treatment.

The measured dioxin emission rate for compliance with the air discharge permit is 0.036 billionths of a pound of TCDD TEQ/hr. this is equal to <1 millionth of a pound, a very low amount and less than one-thousandth of the annual TCDD TEQ emission from a typical hazardous waste treatment unit.
Project Location: Richmond, California

Owner: Richmond Redevelopment Agency

Consultant: Geomatrix Consultants

Time Frame: 2005

Site Information: The City of Richmond's 14-acre site, known as the former Terminal One, was operated as a shipping and bulk storage terminal from about 1915 to the 1980s. The portion of the property being treated is known as the "Southwestern Tank Farm" where solvents and petroleum products were stored in above ground tanks. The total treatment volume is approximately 6,700 cu yd; of which, a small portion is under a warehouse that will be demolished after the thermal treatment is complete. The Southwestern Tank Farm is slated to become a recreational area as part of a 250 unit residential community after site cleanup is completed.

CoCs: Contaminants of Concern are as follows: tetrachloroethene (PCE); trichloroethene (TCE); cis-1,2-dichloroethene (DCE); and vinyl chloride (VC).

Soil Characteristics: Soils within the thermal treatment area are composed of Bay Mud, a dark greenish gray lean clay with minor amounts (<5%) of sand. A 2-3' layer of fill exists above the Bay Mud. Thin interbedded layers with abundant shells (a few inches thick) have also been observed. The average thermal treatment depth was approximately 20 feet below ground surface (bgs).

Groundwater: Depth to water beneath the site is approximately 3 feet bgs.

Summary of Results:

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Remedial Goals</th>
<th>AVG Pre</th>
<th>AVG Post</th>
<th>No. of Samples</th>
<th>% Reduction AVG Pre to Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCE</td>
<td>2,000 ug/kg</td>
<td>34,222</td>
<td>1.055</td>
<td>54</td>
<td>&gt; 99.96%</td>
</tr>
<tr>
<td>TCE</td>
<td>2,000 ug/kg</td>
<td>6,650</td>
<td>64.68</td>
<td>64</td>
<td>&gt; 99.03%</td>
</tr>
<tr>
<td>cis-1,2-DCE</td>
<td>17,000 ug/kg</td>
<td>63</td>
<td>41</td>
<td>63</td>
<td>&gt; 99.49%</td>
</tr>
<tr>
<td>VC</td>
<td>230 ug/kg</td>
<td>932</td>
<td>&lt; RL</td>
<td>&lt; RL (i.e., ND)</td>
<td></td>
</tr>
</tbody>
</table>

**Project Approach:** In-Situ Thermal Desorption (ISTD) remediation at the Southwestern Tank Farm includes the following design features: a) minimum target temperature of 100°C; b) 12.0-ft spacing between thermal wells; c) 139 thermal wells; d) vapor barrier; e) granular activated carbon and potassium permanganate for off-gas treatment.

**Project Staffing:** As General Contractor, TerraTherm, Inc., has provided all project design, construction, operation, and equipment.

**Subcontracting:** TerraTherm subcontracted for construction labor, drilling, and electricians.

**Project Summary:** Site mobilization occurred in late January 2005. Site construction was completed in May 2005. Startup of the ISTD system occurred on schedule in early-June 2005 and treatment was completed on time (100 days) and on budget in September 2005. *All remedial goals met* (see table above). Demobilization from the site was completed in November 2005.
ISTD Case Study:  
Dunn Field, Defense Depot (DLA),  
Memphis, TN

Project Information
At a former Defense Logistics Agency (DLA) site in Memphis, TN known as Dunn Field, which is part of the Memphis Defense Depot (a CERCLA NPL site), TerraTherm was selected by e²M to design and implement In Situ Thermal Desorption (ISTD) for treatment of chlorinated solvents in soil. The Contaminants of Concern (COC) include TCE, PCE and Vinyl Chloride. The project was funded by the U.S. Air Force (USAF). Eight separate treatment areas covering a total of 53,000 square feet comprised a total target treatment zone (TTZ) volume of 48,000 cubic yards.

Subsurface Geology/Hydrogeology
The upper 30 ft (the TTZ) consisted of a loess deposit (silt, silty-clay and silty sand). Underlying the TTZ were fluvial sands/gravels to 100 ft bgs, over clay. Groundwater was at 75 ft bgs.

Project Goals
Soil remedial goals (RGs) for the primary COCs were as follows: 1,1,2,2-Tetrachloroethane (TCA), 0.0112 mg/kg; Tetrachloroethene (PCE), 0.1806 mg/kg; Trichloroethene (TCE), 0.1820 mg/kg; and Vinyl Chloride (VC), 0.0294 mg/kg. By contrast, the mean pre-treatment concentration of TCE was 73 mg/kg. Achievement of these remedial goals is equivalent to removing approximately 99.9% of the contaminant mass.

Project Approach
TerraTherm designed and installed 367 heaters wells and 68 vacuum extraction wells within the eight treatment areas, most at 17-ft spacing. The heater wells were designed to operate at temperatures of 1,000 to 1,100°F, to achieve Target Treatment Temperatures in the formation of 195 to 230°F. The extraction manifolds from each of the eight TTZs connected to a centralized AQC system.

Air Quality Control (AQC) System
Components included an influent heat exchanger, a moisture separator, positive displacement blowers, an air drier and vapor phase GAC vessels.

Performance and Cost
Remedial goals were achieved at all 8 treatment areas in November 2008. TCE concentrations in soil were reduced from a pre-treatment mean of 73 mg/kg to a post-treatment mean of 0.045 mg/kg, representing a removal of >99.9%. The estimated mass removed was in excess of 12,300 pounds. The overall turnkey cost of the project, including power, was $79/cy.

The site was awarded the 2009 Secretary of Defense Environmental Award for Environmental Restoration on June 3, 2009. According to an April 21, 2009 press release from the DLA announcing the award, “A key component of the program’s success is the use of thermally-enhanced soil vapor extraction, which removed more than 15,000 pounds of contaminants from the soils. In addition to meeting the established goals ahead of schedule, the process saved taxpayers more than $2.5 million.”
**Project Location:** Southeastern US  
**Owner:** Confidential  
**Consultant:** Rogers & Callcott Engineers, Inc.  
**Time Frame:** 2006-2007

**Site Information:** Site is an active manufacturing facility. TCE is the primary contaminant of concern (COC) present in the subsurface and appears to have been released via a sump/catch basin system associated with an aboveground TCE storage tank and a TCE reclamation unit. The Target Treatment Zone (TTZ) or source area is associated with the former TCE storage and reclamation area and is approximately 33 ft x 76 ft (2,508 ft²) extending from ground surface to approximately 10 feet below the typical bedrock surface or 85 feet below ground surface (bgs). The total volume encompassed by the TTZ is 7,900 cubic yards. The extended TTZ depth allowed for undulations in the bedrock surface and ensured treatment of all of the soil within the TTZ. The heated interval extended to approximately 90 ft bgs to ensure complete heating of the TTZ.

**CoCs:** Trichloroethene (TCE)

**Soil Characteristics:** The source area targeted for treatment (i.e., TTZ) was underlain by 4 geologic units. The units are listed below in order from the ground surface down.

1) **Fill (re-worked saprolite):** 0-25 ft bgs
2) **Saprolitic Soil (weathered granite):** 25-55 ft bgs
3) **Partially Weathered Bedrock:** 55-75 ft bgs
4) **Fractured Bedrock:** The bedrock surface undulates with an average depth to the bedrock surface of approximately 75 ft.

The water table is at the bottom of the saprolitic soil at approximately 55 feet bgs, resulting in a total saturated thickness of approximately 20 feet of soil and partially weathered bedrock overlying the fractured bedrock.

**Project Approach:** ISTD remediation at the Southeastern US Active Manufacturing Facility Site included the following design features: a) minimum target temperature of 100°C; b) 15-ft spacing between thermal wells; c) 24 thermal wells; d) vapor barrier; e) heated interval extending from 1 ft to ~90 ft bgs (i.e., approximately 15 ft into the top of bedrock).

**Project Results:** The project was finished within the planned 120 day heating period and the treatment zone reached steam temperatures within 100 days. All remedial goals were reached. The ISTD heaters and vapor collection system operated continuously 100% of the time with no failures or downtime. Laboratory data from sampling showed that the 95% UCL of the TCE concentrations in soil above and below the water table was less than 0.02 mg/kg.
Appendix B: Applicable Systems and Contracting Qualifications

Corporate Project Management and Financial Data Management Systems

TerraTherm maintains an integrated project management system and protocols designed to ensure consistency of project planning, execution, oversight, and accountability. Each TerraTherm Project Manager has many years of experience in project management. Weekly project review meetings with Senior Management facilitate timely communications and ensure each project stays on track. TerraTherm utilizes several up to date project management tools and accounting systems to enable the successful scheduling, implementation, and tracking of projects. Our accounting system has undergone a Defense Contract Auditing Agency (DCAA) assist audit and a USAID survey audit.

Representations and Certificates (for Government Contracting)

TerraTherm, Inc. meets the definition of a Small Business for nearly all government procurements. Our Representations and Certifications are available online at www.bpn.gov (our D&B number is 00-266-6522).

Corporate Quality Assurance/Quality Control (QA/QC) Program

TerraTherm is typically responsible for developing and implementing a Quality Assurance/Quality Control (QA/QC) program for each major project. As a component of such project-specific programs, a Quality Assurance Project Plan (QAPP) is developed, as well as a Sampling and Analysis Plan (SAP). It is the ultimate responsibility of the Corporate Officers to ensure that the plans meet both corporate and client requirements prior to their submittal and that they are adhered to in all respects.

Major Elements of TerraTherm’s Corporate QA/QC Program Include:

Maintenance of a Lessons Learned Process and Database: TerraTherm regularly convenes a Lessons Learned Committee, comprised of engineering and field staff, which scrutinizes all significant design features, construction methods, and operational procedures. Decisions are made concerning needed changes and a database is maintained and distributed to ensure that the resulting improvements are promulgated to all staff.

Standard Operating Procedures: TerraTherm has developed a series of Standard Operating Procedures (SOPs), including Engineering Review; Constructability Review; Hot Soil Sampling; Accident Reporting & Investigation; and Operations Data Management/Reporting.

Project Technical Reviews: Project Technical Reviews are carried out biweekly for most major projects. Such reviews include senior staff not involved in the day-to-day project or technical management of the projects. The purposes of such reviews are to review project progress against planned milestones; ensure that QA/QC requirements are being adhered to; and enable timely response to issues that may arise.
Appendix C: TerraTherm Sustainability Policy

TerraTherm is a Contributor to the Sustainable Remediation Forum (SuRF)

TerraTherm endorses and contributes to the efforts of the Sustainable Remediation Forum (SuRF) in working to define sustainability and social responsibility as they relate to site cleanup. TerraTherm strives to establish and maintain a leadership role in the evolution of sustainable remediation through improvement in all operational aspects.

Ancillary Environmental Impacts from Cleanups

Our In Situ Thermal Remediation (ISTR) technologies prevent migration of contaminants from the site. In addition, since there is no excavation or transportation of materials, airborne contaminants, dust, and noise are virtually non-existent. Treatment of collected gases is thorough with odorless and clean vapor emissions. As a result, ISTR is a leading method in preventing ancillary environmental impacts.

Energy Consumption and Greenhouse Gas Emissions

TerraTherm’s ISTR technologies employ electrical power. Since our project cycles are short and predictable, total energy use is well defined and the need for repeated applications or long-term operations and maintenance is eliminated; therefore, remediation is rapid and is inherently more sustainable than potential trial-and-error approaches that may use more resources, delay redevelopment, put Greenfields at risk of development, and create more emissions in the long run. TerraTherm has participated in cutting edge Life Cycle Assessments to evaluate the sustainability of our projects and find ways to make them more sustainable. TerraTherm offers verifiable Carbon Offsets to our clients for TerraTherm field projects. Offsetting the carbon footprint of a typical ISTR project adds less than 1% to the project cost. Such initiatives have been successful in steadily increasing the energy efficiency of our technologies through R&D and innovation. The rapid and final site cleanup advantages, extremely high level of safety, cleanliness of our operations, and low community impact combine to make ISTR a logical and leading choice for sustainability. These factors greatly outweigh the slight carbon impact incurred in the use of electrical power.

Preservation of Natural Resources and Maximization of Land Reuse to Preserve Underdeveloped Areas

Undeveloped lands play an important role in mitigating the effects of greenhouse gas emissions. In the effort to preserve such lands, time is of the essence. Among the most efficient ways to prevent undeveloped lands from being committed to industrial use is to revitalize and clean Brownfields for reuse in a timely and predictable manner. The rapid and predictable results of ISTR ensure the redevelopment of Brownfields on a fixed timeline, thereby preserving Greenfields. No other technology achieves this sustainability goal as quickly, or completely, as ISTR.

Permanent Elimination of Contamination

ISTR is proven uniquely effective in the elimination and stabilization of contaminants. Results consistently demonstrate the achievement of site cleanup goals, even to drinking water standards (where applicable). Through carefully engineered and controlled processes, permanent remediation is measurable and ensured through in situ destruction, desorption, stabilization, and/or extraction of offending materials. In addition, these processes prevent mobilization of contaminants ensuring the safety of adjacent water supplies. No other remediation technology has proven more effective in the permanent elimination of contaminants.
Public Contractor Safety and Health During and After the Project

TerraTherm has maintained an impeccable safety record throughout its history. Further, it can be said that in situ thermal remediation is inherently safer than other methods because of little or no dust, heavy vehicle movement, chemical use, harmful emissions, or noise are consequential to the process. In this way, threats to public and contractor health that are common to excavation, chemical treatment, and some other purportedly “green” methods are eliminated or greatly reduced.

Recycling of Materials

TerraTherm endeavors to reuse, refurbish, and recycle materials to the fullest extent possible. We have found that refurbishing process equipment to fully restore it to useful life is both economical and safe. It also provides reductions in ancillary life cycle costs (resource extraction, manufacturing, shipping, etc.). Our aim is to exemplify the principal of “waste not, want not.”
Appendix D: TerraTherm’s Online Presence

You can now keep up-to-date with all things thermal and follow TerraTherm through various social media networks. View, Follow, and “Like” us on LinkedIn, Facebook and Twitter, as well as our very own blog titled “Think Thermal-The Blog.”

Our goal is to provide our audience with value-added posts to educate about what we do, and explain why TerraTherm, continues to be the “Thought Leader” in our industry.

If you have any questions about our process, we would be happy to organize an educational webinar on the topic of your choice. Email marketing@terratherm.com.

Also make sure that you sign up for our Quarterly Newsletter through the button below, for project updates and other important news from TerraTherm.