

## ON-SITE REMEDIATION TECHNOLOGY CONTINUES TO EVOLVE FOR R&D-FOCUSED SOIL-THERM

*Q&A with Mark L. Sujata, MS, President, SOIL-THERM Equipment, Inc. (Agoura Hills, CA). Since 1990, SOIL-THERM has been an industry leader in developing cleaner technologies for environmental and site cleanup applications. SOIL-THERM's latest technology uses a Jet-THERM combustion process for gas-fired soil heating, allowing low cleanup costs for In-Situ Thermal Remediation (ISTR) applications. SOIL-THERM also offers a complete line of industrial thermal oxidizers, storage tank degassing equipment, remediation equipment, emissions control, and custom equipment solutions for industry, refineries, and all types of environmental and site cleanups.*

**EBJ:** Generally, how have you seen the evolution of off-site treatment to on-site treatment over the past 10 years?

**Mark Sujata:** It appears to us that major oil, State Underground Storage Tank Fund, and other projects are pushing for simpler and faster Soil Vapor Extraction (SVE) and Dual-phase extraction (DPE) cleanups over the last 10 years. And we've been getting the impression that remediation contractors are more likely to automatically select simple SVE extraction blowers with Granulated Activated Carbon (GAC) as their preferred method of emissions control for Volatile Organic Compounds (VOCs) and Chlorinated Volatile Organic Compounds (CVOCs). GAC offers a fast, simple, and effective means of capturing VOCs for small projects where capital costs aren't in the budget.

Our view is that the selection of GAC for emissions control can result in overly expensive cleanups when VOC extracted concentrations are higher than expected. GAC also provides risks to owners and operators: (1) where is the waste GAC really

going and is the treatment facility at future risk, (2) Cradle to Grave responsibility risks and future possibility of liability, (3) multiple truck trips through communities, and (4) large space may be required for barrels or tanks stored at a site.

We review and often apply the **Interstate Technology and Regulatory Council (ITRC)** documents and recommendations for setting future guidelines for Green and Sustainable Remediation (GSR). We're seeing there will be a bigger push towards on-site treatment and permanent destruction, greater energy efficiency, energy recovery, minimized waste generation, and lowering greenhouse gas (GHG) emissions.

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The development of better technologies has been the key factor in the evolution from off-site to on-site treatment. For over 25 years, SOIL-THERM'S in-house burner technologies have played a role in this evolution. While many other remediation equipment suppliers are simply component assemblers, SOIL-THERM has always designed and created new technology remediation equipment solutions for our customers. We've never stopped our R&D efforts. We have been able to apply our unique burner technology successfully to a variety of the toughest sites. We will do our best to see this evolution continue. In our opinion, off-site treatment is a waste

of time and money when onsite treatment is feasible. Transport of contaminants is risky and expensive. Why move pollution around when you can completely destroy it forever right where it is?

**EBJ:** How have consultants changed their approach to remediation projects over time and how do you interact with firms at the front-end of remediation?

**Sujata:** We are seeing that in oil and gas station remediation sites, simple and inexpensive blower packages are being installed more often, with greater use of Granulated Activated Carbon (GAC) for emissions control. This represents a shift to lowering capital costs for these types of projects, at the expense of creating GAC wastes that require transport and treatment/recycling offsite. Thermal/catalytic oxidizers are not being installed as frequently as in the past, probably because consultants have been scared away by higher equipment capital costs, expensive and time consuming utility installation, and permitting and community considerations.

SOIL-THERM is looking to change this perspective with lower cost and smaller thermal equipment that can be quickly installed with lower GHG emissions, permanent destruction of contaminants, and improved processing performance over prior thermal and catalytic oxidizers used in the past. Most consulting firms seem to stay in their comfort zone, and often times it's difficult to promote new products or processes to those accustomed to using the 'some old' vendors and products using 20 year technology. In many cases, the consulting engineers do not take the time to explore more efficient technologies for their projects. We would like to see them utilize ITRC guidelines for GSR wherever possible during remediation projects.

**EBJ:** Please provide some specific examples of recent successful applications.

**Sujata:** Often SOIL-THERM is contacted by consultants or service companies

that require specific equipment solutions with guaranteed performance results. A large environmental company required a single trailer refinery tank degassing oxidizer with generator power, twin jet burners, 4500 cfm flows, and the ability to destroy up to 1200 lbs/hr VOCs from refinery tanks. This was a system they knew was impossible for others to design and build on a 25-ft trailer. This project was a success.

In another case, for a treatability study for a TCH project in New Jersey, SOIL-THERM was asked to design and build a single trailer 1200 scfm thermal oxidizer and scrubber system for a limited space location and tight schedule which also required a guarantee of >99.99% destruction of Benzene and H2S with retention times <0.19 seconds. Another success.

These projects required careful communication and interface with our customers to meet their exact site and performance requirements, something that SOIL-THERM has been doing for over 25 years.

**EBJ: As a business, how do you decide which works best for SOIL-THERM: to partner on projects and manage site implementation; to license the technology; or to manufacture and sell units.**

Sujata: SOIL-THERM gets good feedback from our customers, both remediation services providers and site owners. In the past consultants used to be doing more front-loaded projects: By that, I mean they mostly seemed to make equipment deci-

sions based solely on initial price tag and often did not look at the big picture or lifecycle costs.

Our objective is to discuss each project thoroughly with our customers. The more we know about the site, and the pollutants at that site, the better the equipment will meet their needs. Having a background in chemical sciences together with manufacturing expertise means that we can design the best equipment for their project. Our equipment is modular, so components can be added or subtracted as the characteristics of the site changes. SOIL-THERM is currently exploring the possibility of licensing technologies for a variety of applications, especially several currently in R&D. Over the last 25 years, we've traditionally built custom remediation and thermal systems for sale, and had some equipment for local rent. We believe this is an exciting time for SOIL-THERM, even though many consider remediation cleanups and equipment to be a mature industry.

**EBJ: What's the typical profile of a site where first, on-site thermal systems apply most efficiently, and second where gas-fired technology is most cost-effective?**

SOIL-THERM's goal is to provide a single piece of equipment that will clean the site cost effectively as the cleanup goes from high to lower concentrations of VOCs. By improving gas-fired burner technologies through our in-house R&D, we've been able to demonstrate equal performance in a small sized, powerful, energy

efficient gas-fired thermal oxidizer that can save thousands of dollars over other technologies. And by utilizing the exhaust heat from the thermal/catalytic oxidizer, SOIL-THERM has employed additional site heat recovery capabilities of evaporating waste groundwater, saving thousands from offsite disposal. We're finding more and more of our customers are looking to reduce their remediation costs and carbon footprint wherever possible. Onsite treatment means permanent destruction and no future 'cradle to grave' responsibilities from shipping wastewater or waste GAC offsite.

**EBJ: What other environmental applications do you as a scientist see as future opportunities in remediation and the environmental industry?**

Sujata: As mentioned earlier, we believe on-site, permanent destruction of contaminants in the most energy responsible and GSR manner is the future. We also believe that gas-fired In-Situ Thermal Remediation (ISTR) will continue to grow in acceptance and applications. Simply, it offers complete soil remediation in much shorter time periods and permanent cleanup of the toughest sites.

Unfortunately, the current costs of ISTR are still perceived by the consultants we have talked to as completely impractical due to the very high costs of design, implementation, and energy requirements to heat the soil. I believe we are in the process of seeing a change in this area. A number of current sites are using established electric soil heating technologies to drive the VOCs from the soil, which seems impractical when natural gas offers as much as seven times lower energy costs at today's prices.

If we take an example of a 10,000 cubic yard (y3) site where it is generally understood that cleaning requires ~300 kilowatts per y3 soil cleaned, the clean-up will require 3.0 MM kilowatts (kW) of electrical power. At \$0.14 per kWh, the cost of electrical power alone will be \$420,000 plus special utility power hook up costs that can exceed \$100,000.

Alternatively, natural gas generates the same amount of heat for \$60,000,

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resulting in an overall energy savings of \$460,000 and typically lower equivalent GHG emissions. That's a huge project savings in energy alone, and we see gas-fired ISTR technologies to be an attractive alternative for heating soil in the future.

These are the two main areas we are basing our current business around and we still believe have significant potential for the future:

***New Gas-Fired In-Situ Thermal Remediation Technologies:*** For ISTR applications, SOIL-THERM looks beyond just the energy efficiency and high heat output benefits of our gas-fired burner process. It's extremely important that a properly designed network of below ground piping be installed to disperse the heat throughout the source and contaminated areas. With a combination of horizontal, vertical, and below ground conveyance piping with a powerful pressure burner and exhaust heat recovery, we've found the heat transfer to the soil can surpass electric TCH heating by 3-5 times.

Taking it a step further, SOIL-THERM recently demonstrated a downwell burner designed for soil heating was converted to operate as a Thermal Oxidizer of Perchloroethylene (PCE) at a dry cleaner site—demonstrating that in-situ thermal destruction of >99.9% of PCE could take place while heating the soil with no above ground oxidizer for emissions control required. Gas-fired ISTR makes sense at gas stations, dry cleaners, Superfund sites, and industrial sites and we are making big strides in reducing the cost of ISTR cleanups, especially for the smaller sites such as dry cleaners and gas stations.

***Lower Cost Small Site Oxidizers for Permanent Destruction:*** We have spent several years developing very small burners with an wide range of process capabilities. SOIL-THERM is currently beta testing our smallest catalytic oxidizer SVE remediation system ever, with a footprint the size of a Coke machine and a full 200 scfm extraction and processing rates for remediation and dry cleaner applications.

All vapors are extracted and destroyed through this 'nano' sized machine, which uses less than 0.2 gallons per hour pro-

pane during operation at only 100 ppmv vapors. Its size allows users to quickly roll this system off the back of a truck, plug it into a standard 'washing machine' type wall plug, and install a 100-gallon propane tank nearby to keep it operating for 20 days without refilling. This means minimal utility company hassles and much lower installation costs. ■

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