

# **An Industry Perspective on Environmental Technologies**

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I really appreciate the opportunity to address this conference. In the next few minutes, I would like to tell you a little bit about who TerraTherm is, what our technology is, and about some of our experiences in marketing what I think is very innovative technology.

TerraTherm is only about a year old, so we have a pretty unique perspective on how to get technology into the marketplace. The company was started by Shell Oil Company just about a year ago to develop a thermal technology, which had been used to get heavy oil out of the California oil patch, for use in the environmental industry. This technology has been worked on for about 25 years, but it was actually first tried on an environmental problem in 1988.

Shell had decided to get some of their lab-developed technologies out into industry, not only environmental industry but also energy and other industry sectors. TerraTherm was the first company to come out of that decision. Our parent company, Shell Technology Ventures, is about 3 months older than TerraTherm, and its job is to launch more new companies in addition to TerraTherm — primarily in the energy and industrial efficiency markets — once again, using Shell-developed technologies. We are also open to bringing in technologies developed by some of the national labs, and we've actually looked into that.

So, what is our thermal adsorption technology? Quite simply, it is a matter of putting heat, just plain thermal heat, into the soil and at the same time putting suction on that heated soil and vacuuming the contaminated vapors out of the soil. We typically get the soil to the boiling point of the contamination, for example, for Aerochlor, where we've had a lot of experience, we got the soil to about 800 °F while we vacuum the soil. We get extremely good results. There are three ways in which the technology is employed: thermal blankets, thermal wells, and an ex-situ form of our technology.

This is a cartoon of how our process works. There are usually three 40-foot trailers that we bring on site. In the processing trailer, we take the vapors that we've cooked out of the ground and continue to process them. We also have a control trailer and a power trailer. Typically, employment of the technology takes about 2 megawatts of energy for 3,200 ft<sup>2</sup>. Normally, we don't use both blankets and thermal wells at the same time. This is a picture of a thermal blanket, which is about an 8- x 20-ft steel frame that sits on top of the contaminated soil.

It works down to about 24 inches of contamination below the surface. The bottom of the thermal blanket looks like this: you can see that there are normal elements, the same type of heating elements used on your stove top. We heat these up to about 1,700 °F and the heat is actually carried over by the stainless steel furnace blanket and is conducted downward to about the maximum of 24 inches. At the same time, we place a silicon rubber blanket over the thermal blanket and provide a suction on the blanket. So, we essentially boil the contaminants and vacuum them out.

The second technology is a thermal well. This is actually the first technology developed by Shell Oil. This was developed to go down about 2,000 feet to get heavy oil out of the diatomite around Bakersfield, California. What we do is we deploy these thermal wells down to the depth of the contaminant, and we use anywhere from 2- to 10-foot spacing on the wells. Each well itself has both a heating element and a suction element. Heat is conducted outward from the well and at the same time, the contaminants are drawn into it. So, contaminants are actually destroyed as they are drawn into this ever increasing heat field.

**Question:** What is the range of volume in yards using your technology, and what is the cost per yard?

**Response:** We'll do as many yards as you want, the bigger the better. Our costs are anywhere from \$150 to \$350 per ton of contaminated soil, depending on the size and type of container, and the depth. Note that we have no DOE demonstration jobs. (I'll discuss this more in a minute.) The California job is DoD, and the others are commercial or other Government agencies. We found out that the market is very competitive, and it is price sensitive. There are lots of competitors, lots of people who have been in the market for some time. There's a lot of technology out there, but we have to try and convince people that we have the better technology. It is a rather mature market. Even with that kind of background, I think we've had pretty good success.

We've done a couple of private-sector well projects successfully. We did a private-sector well and blanket project, which you saw in the superfund well demonstration, where we did 12 wells, a blanket, and the ex-situ demonstration. The initial contaminant level exceeded 20,000 ppm PCBs. Following our treatment, they all came out with non-detectable levels of PCB by EPA Method 8080. The EPA was extremely pleased with our results as was the Missouri Department of Natural Resources. The Corps of Engineers project is in progress. I think that is fairly significant work. Here we are — a new company — and we have a job with the Corps of Engineers within a year of starting up. We're doing a job for the Bay Area Defense Coordination Action Team in San Francisco, and that's going quite well. In fact, we got some very good press about the job in the *San Francisco Chronicle*.

When we started the company, we thought we'd go in three directions: DOE, DoD, and commercial. We've had fairly good success in two of these directions, but not with DOE. We have just not been able to make progress in gaining DOE business. In our experience, it seems that the DOE is pretty content with maybe a 3- to 5-year cycle to get into the actual remediation.

There are multiple approaches and scopes to the remediation market. We have met with a number of DOE folks and typically, we get three or four telephone numbers to call someone else — so we've been on kind of a wild goose chase through the DOE, talking to any number of people. Everyone we talk to likes the technology and says, "Well you ought to call so-and-so." We call them up, and go visit them, and then they say, "We like the technology, but you have to go through so-and-so." That's been our experience.

Even with our successes in the commercial market and for DoD, DOE seems to want to do their own testing. I don't think the M&O contractors want to see us on the scene at this point. They really haven't been banging on our door, and we've been trying to see them. Why? Because there may be some conflict of interest, or they may not have time, or there are a lot of projects going on at different sites. There is a lot of work being done; we just may not be hitting the right people at the right time. Although there is something of a not-been-here attitude, in our case, the company was invented or developed by Shell. We've spent a lot of money to try to take advantage of that.

I'm saying that if there were a well-known and organized methodology for bringing a new technology into DOE, I think that would be very helpful. We're a company that puts out its own money to do demonstrations for other companies or other parts of the Government — and that ought to be taken very seriously. There may be other companies like Shell who are very interested in getting into the environmental market, and spend a lot of money to develop the technology, or have a technology that's been developed for a specific purpose like, for example, our ex-situ thermal desorption process that was developed for the oil patch. A lot of money was spent in that developmental process, and now another \$12 million was spent by Shell to bring it to the environmental market. I think that kind of investment from an industry should get the attention of DOE.

**Question:** Do you remember 8 years ago when there was a tremendous explosion of market potential and everybody was getting excited, and the big guys were all running around trying to find out what's going on? How were you successful in convincing your management of your ideas?

**Response:** The reason why that worked was that the market has matured in the U.S. Shell has developed some tremendous technologies, and it became very apparent to Shell's management that they would like to get into the market with some of this technological development and commercialize it. And the fact that the timing was perfect for environmental technology really wasn't too much concern.

**Question:** But still, you have to have had some friends, you'd have to have had some arguments, financial arguments?

**Response:** As to the financial market, there still is a lot of environmental cleanup going on. Shell management felt that, quite frankly, this technology was so superior that we would overwhelm the competition. And we're trying, we haven't quite overwhelmed them yet, but we're giving it a good try.

**Question:** How many of those proposals did you submit to DOE?

**Response:** Four.

**Comment:** That's not very many.

**Question:** One point you mentioned was that this is a mature market, where cost is the driver. Yet DOE is not using any of this....So, did I miss something there?

**Response:** I am saying, really, that the mature market is what we found just in the environmental arena in general.

**Question:** But you deployed your technology in a variety of places?

**Response:** Well, through superior salesmanship or something. We've done a couple to three demonstrations. Our DoD success has been the most surprising — how we were able to get into DoD quite rapidly. But with DOE, we've spent a lot of time trying to figure out a way to get looked at by DOE and haven't had a lot of success.

**Question:** You've got to prove the point where cost-effective technology is concerned. Another question is do you have permits that you have to go through, or do you have a portable permit, or do you have removal action authority, or what?

**Response:** Our first PCB job was in Glen Falls, New York. We were working in conjunction with the local community and the TSCA Headquarters branch of the EPA. From that job we got a draft permit for PCBs, and when we went to Missouri, we got an expansion of that draft permit. So we have a draft permit, and we hope it becomes final pretty soon. The air emissions are well below any state's standards.

In closing, I again want to express my appreciation for the opportunity to talk to you about my company and our successes and problems. I'll be available at the break if there are any more questions. Thank you.