

New technology cleans up Visalia Superfund 100 years ahead of schedule

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Lawrence Livermore National Laboratory's technology was instrumental in cleaning up Southern California Edison's Visalia Pole Yard, which is scheduled to be taken off the Environmental Protection Agency's Superfund list this week.

LLNL, a National Nuclear Security Administration laboratory, used dynamic underground stripping (DUS), a Lab-developed steam-cleaning technology that not only cleaned the site more than 100 years sooner than originally estimated, but also saved millions of dollars.

Southern California Edison had used the Visalia site for 80 years to treat utility poles by dipping them into creosote or pentachlorophenol, which by the 1970s, had seeped into the subsurface soil and groundwater to depths of approximately 100 feet (30 meters). The Visalia pole yard bore the distinction of being one of the original Superfund sites. Twenty years later, Southern California Edison was looking for a faster and more efficient way to treat the soil and groundwater.

And that's where Livermore geophysicists Robin Newmark and Roger Aines entered the scene. The duo, along with LLNL and UC Berkeley colleagues, had developed DUS, which was first successfully used in the cleanup of an underground gasoline spill at Livermore Lab in 1993.

They found that contaminants were removed 50 times faster than with the pump-and-treat process. The cleanup at the Livermore site, estimated to take 30 to 60 years with pump-and-treat, was completed in about one

year. In 1996, regulators declared that no further remedial action was required. It served as a proof of concept to use the same method at other contaminated sites.

"It cleaned it up in no time," Aines said. "We thought the same method could be used at other sites."

Later, Livermore scientists developed hydrous pyrolysis/oxidation (HPO), a process that converts contaminants in the ground to benign products such as carbon dioxide, [chloride ions](#) and water. By introducing both heat and oxygen, this process has effectively destroyed all petroleum and solvent contaminants that have been subjected to laboratory tests. Beginning in summer 1997, both processes were used for cleanup of the four-acre Visalia site. Southern California Edison and SteamTech Environmental Services of Bakersfield (the first commercial site licensee of the dynamic underground stripping technology), cleaned up the Visalia site, with Livermore staff periodically on hand making scientific measurements of the effectiveness, as well as operational consultants.

During the first six weeks of operation, between June and August 1997, the team removed or destroyed approximately 300,000 pounds (135 metric tons) of contaminants, a rate of about 46,000 pounds (22 metric tons) per week. For nearly 20 years, Southern California Edison had been removing contaminants from the subsurface using the standard cleanup method -- pump-and-treat -- at a rate of just 10 pounds (0.03 metric ton) per week. In contrast, the amount of hydrocarbons removed or destroyed in place in those six weeks was equivalent to 600 years of pump-and-treat, about 5,000 times the previous removal rate. Over the course of the next two years, more than 1 million pounds of contaminant were removed.

The EPA's National Priorities List (Superfund) identifies sites that may

present a significant risk to public health. A site may be deleted if environmental testing reveals that the site is not a health concern.

In DUS, the contaminants are vaporized and vacuumed out of the ground, leaving them to be destroyed. The groundwater then has to be treated and the contaminated material that is brought to the surface needs to be hauled away and disposed.

But HPO takes the cleanup one step further by eliminating the treatment, handling and disposal requirements and destroying the contamination in the ground. This "polishing" aspect of thermal remediation allowed the complete cleanup of the Visalia site, using the remaining heat in the soil to clean the groundwater to drinking water standards.

DUS and HPO were developed at LLNL through the Laboratory Directed Research and Development program.

"We thought about how you could speed up the cleanup process," Newmark said. "When we added energy in the form of heat, we came up with thermal remediation. This combined with HPO was a perfect way to clean up the soil and break down the contaminants into nontoxic material."

The Visalia site was considered to be essentially uncleanable. Estimates at the time suggested an essentially permanent pump-and-treat operation at the site would be required to prevent migration of the contaminated water, at a cost greater than \$100 million. Using the new process shortened the total cleanup time to 10 years, at a cost of \$14 million, and showed that one of the most difficult types of Superfund sites can, in fact, be cleaned and closed.

Source: Lawrence Livermore National Laboratory

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