



Mobile camera systems monitor tank farms at Hanford.

Wireless Technology Advances Hanford Cleanup Safety

By Mike Berriochoa

Wireless technology is moving into the forefront of our lives on almost a daily basis. It has also moved into the forefront of worker safety and productivity for CH2M Hill, improving the company's ability to safely manage radioactive and chemical waste on the U.S. Department of Energy's Hanford Site. A wireless infrastructure—or "canopy"—has recently been activated over the center of this 560-square-mile windswept site, giving workers access to a wide range of technologies and communications

tools not previously available to them.

The Hanford Site is in a remote location in the arid section of eastern Washington State. Self-reliance has been a way of life since the site was established as part of the Manhattan Project, producing plutonium for atomic bombs. Production of plutonium continued into the 1980s, leaving a legacy of 53 million gallons of radioactive and chemical waste stored in 177 underground tanks.

In May 1989, the DOE entered into an agreement with the state of Washington and the U.S. Environmental Protection Agency to clean up Hanford Site waste, including

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the waste stored in the underground tanks. The tanks are grouped into 18 so-called farms with anywhere from 2 to 16 tanks in each farm. Up to 67 of the older single-shell tanks may have leaked as much as one million gallons of waste to the surrounding soil.

Today, it is CH2M Hill's responsibility to safely manage this waste until it can be prepared for disposal. A primary focus of this responsibility is the removal of waste from the 149 aging, leak-prone single-shell tanks and transferring it to 28 newer, safer double-shell tanks. Waste removal has been accomplished from seven tanks so far, and retrieval is under way in three others. This often hazardous work is performed under difficult circumstances in a variety of adverse weather conditions.

“Our highest priorities are the protection of our workers, the public, and the environment. Each new wireless technology we bring onto the site adds an additional measure of protection through improved monitoring and faster flow of information,” said CH2M Hill Chief Information Officer Ron Nelson.

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Quick to Adopt Wireless

Hanford was quick to adopt wireless technology as it became available. More than a decade ago, conditions began being monitored remotely in and around the 28 double-shell tanks. Devices were deployed that allowed continuous monitoring for changes inside the tanks that would signal problems, such as changes in the surface level of the waste in the tanks, changes in waste temperature,

and changes in conditions between the two tank walls as well as in the soil surrounding the tanks. Data from these sources are transmitted in real time to a central monitoring facility where operators are immediately alerted if conditions in the tanks change. Bringing this monitoring capability onto the site was a significant step forward; it provided instant information and ended the reliance on personnel having to conduct periodic readings by hand. It also reduced the potential for worker exposure to harmful radiation or chemicals and freed them up for other high-value work. Its application, however, was limited to the 28 newer, double-shell tanks. Unlike their single-shell tank counterparts, the double-shell tanks were designed to accommodate a variety of monitoring technologies.

A Local Area Network

The next big step was expanding the use of cell phone/personal digital assistants (PDAs) and other mobile technologies as they became available to improve the ability to promptly contact workers in the field to alert them to changing conditions that could impact their work. “These devices have served us well, and as features are added we are able to use them more widely, but no matter how good cell phone/PDAs have become, they don't meet all of the company's communications needs,” Nelson said. The solution, obviously, is “WiFi.” WiFi capabilities have become standard in most new laptops. Combine this with the development of wireless notebooks, and it was obvious that CH2M Hill needed a wireless infrastructure that would allow all of the various forms of wireless technology to talk to each other and link to the Hanford Local Area Network (HLAN).

“We are responsible for managing waste in two separate areas near the center of the Hanford Site, and our people are often spread out over 10 square miles. We needed a versatile wireless infrastructure that would allow us to use not only desktop computers, but also laptops, rugged

tablet personal computers, and other mobile devices to connect to HLAN. This canopy is now in place, giving us the ability to adapt a variety of hardware to improve worker safety and improve our waste management activities. The canopy also eliminates geography as a constraint to accessing informational resources to efficiently perform work, improves the timely flow of information among the workforce, and gives workers access to information in real time," said Nelson.

WiFi in the Field

The versatile wireless infrastructure has another advantage. Because cleanup work moves from one location to another across the Hanford Site, CH2M Hill is reluctant to install costly infrastructure that will be used for only a short while. "Much of our current focus is moving waste solids and sludges out of the single-shell tanks into the safer double-shell tanks, and wireless systems are perfect for us because we don't have to install expensive fixed infrastructure in areas where we will be working only for a few months or even a few years," Nelson said.

Mobile offices are set up in a number of locations to manage much of the work that takes place inside the tank farms. These offices can be brought to the site, set up at a reasonable cost, and moved almost at a moment's notice. They can easily be outfitted with wireless computer systems and other wireless services, giving them the same capability as a hard-wired system but at less cost.



Above: Movable camera systems monitor single-shell tank farms where no work is being done. These systems can be moved to any location in the tank farm complex.



Left: The control station for the tank farm cameras.

One such location is C Farm, where workers are using remotely operated equipment to remove waste from the underground tanks. Before workers can enter a tank farm to work, their training must be current and verifiable, and their records must be readily accessible. "It all comes down to safety. With our wireless systems we can instantly access databases to make sure workers have the required training before they enter the farm. This used to be done in a shift office several miles away. Now, we can do it in the field, which is faster and much more efficient," said C Farm Operations Manager Dave Saueres-

sig. In addition, the system tracks the entry and exit of every worker, providing an additional measure of safety if a need arises to quickly evacuate a tank farm.

Wireless systems are also used to monitor equipment in C Farm, such as the filtered ventilation system that provides air flow through the underground tanks. "The ventilation systems are essential to worker safety because they help prevent worker exposure to potentially harmful chemical vapors coming from inside the tanks. They also prevent the buildup of flammable gases inside the tanks. With wireless sensors we can monitor the performance of the ventilation systems and quickly spot and correct maintenance problems before they compromise worker safety," Sauereissig said.

Off-the-Shelf Technologies

One of the keys to the success of the CH2M Hill wireless program has been the use of commercially available technology wherever possible. At times it has to be adapted to the company's special needs, but buying it off the shelf saves time, speeds delivery, and cuts costs.

A recent example of addition to Hanford wireless capability is the acquisition of wireless, wind, and solar-powered portable platforms (WWASPP) to monitor the single-shell tank farms where no work is taking place. Each remotely operated WWASPP system is on a trailer-mounted retractable mast, allowing it to be moved anywhere within the tank farm complex. More than a dozen of these units have been deployed. By connecting them to the wireless canopy, CH2M Hill can provide real-time monitoring of conditions inside tank farms and eliminate the need for workers to enter the farms on a daily or weekly basis as they once did to perform their routine surveillance rounds.

"Rounds reductions are important changes in our single-shell tank farm operations. They eliminate frequent entries for operational and radiological surveillance and significantly reduce the potential for workers to be exposed to workplace hazards," said CH2M Hill's Rounds Reduction Project Lead Dave Brown. With the WWASPP units in place, worker entry into the farms takes place only once every three months. This capability allows the company to schedule personnel entries for surveillance to coincide with other work taking place in tank farms, resulting in improved efficiency. It also frees up workers to perform other tasks. Another advantage of the WWASPP units is providing instant visual information during emergencies.

What's New?

Just entering service at Hanford are tablet personal computers (PCs), small devices similar to laptops that allow workers to write on them like a tablet to take notes and transfer the information over the network. "We started using tablet PCs for inspecting inventories of waste packages

and regulated containers to document their location and condition," said Cindy Stratman, CH2M Hill manager of Technical Waste Services. Although the learning curve for tablet PCs is steeper than that of other wireless technologies, the advantages of tablet PCs are greater. Workers can use them to take notes and download procedures, forms, and records information (which would otherwise have to be taken into the field in hard copy). Supervisors can sign forms and dump them back into the paperless records system. Workers can also search the company records management system for documents by topic, which speeds the process and saves money by avoiding having to retrieve documents from the federal records repository in Seattle, some 200 miles away. "Using the tablet PC in the field makes our workers more efficient, but the real gain is in records availability. Records are now available to our workers at the touch of a button," Stratman said.

There is another practical reason to use tablet PCs. "Papers get damaged by everything from rain to coffee spills, while digital files aren't as susceptible. Digital records will have a longer life than paper," Stratman noted.

The tablet PCs are very robust and stand up well to the harsh Hanford climate. "Our biggest problem with any new technology in the field has been the pervasive wind



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and dust, which can raise havoc with electronics. These units are robust and operate well. In addition, they are extremely rugged, which is what you need at an industrial site,” Stratman said.

One of the newest applications of wireless technology is remote radiation monitors, which can be put in places where it would be dangerous to send workers. These innovative monitors are housed in a heavy-duty plastic case and a foam liner, along with flashlight batteries for power. The units were field-tested along a tank waste transfer line running down a steep, gravel-covered slope between two tanks. The slope created a hazard for workers who had to take periodic readings along the line by hand several times a day to verify radiological conditions. The remote units can fulfill this requirement and provide continuous data to a computer in a nearby trailer where the data can be continuously monitored.

“The whole purpose of developing this monitoring unit is safety. We want to protect our workers who would have to negotiate that slope to obtain radiological data during retrieval operations,” said CH2M Hill Health Physicist Bob Brown.

A big issue facing CH2M Hill when it comes to wireless technology is the same one facing any other company: security. “Security of our network is a high priority, and we are implementing the necessary physical and cyber technologies to ensure we have a secure network that will continue to serve the needs of our workforce well into the future,” Nelson said.

So Where Does This Wireless Network Go from Here?

“We will constantly be reconfiguring our system with newer and upgraded technologies as they become available. We will mobilize and demobilize our projects, remove facilities, and add others. We have designed our

wireless infrastructure to meet these changing needs,” Nelson said.

With most of the major changes and upgrades now in place, the next step will be to automate additional work processes to accelerate mission work and expand the wireless capabilities. “This will provide greater opportunities for projects to use wireless systems to mobilize and demobilize, selecting from a wide array of tools available in the marketplace,” said Nelson.

It’s clear that wireless capabilities offer nearly endless possibilities. At Hanford, they improve safety, improve productivity, enhance emergency response capabilities, improve property tracking, and offer selective notification capabilities, e-mail, network access, and much more. The architecture of the CH2M Hill system was designed to accommodate increased demand and expansion of services and the addition of new technologies.

“Now that our infrastructure is in place, the next challenge is deciding how best to use it as new technologies come along,” Nelson said. A few of these technologies include the use of Voice over Internet Protocol (VoIP), Radio Frequency Identification (RFID), and Global Positioning System technologies. RFID tags, for example, can be incorporated into a product for the purpose of identification; some tags can be read from several meters away, well beyond the sight of the reader, and could be useful for tracking supplies, equipment, property, waste inventories, and possibly personnel accountability. VoIP will allow the use of telephones from remote locations using the wireless infrastructure.

“Wireless technology presents a bright and interesting future, and we’re working hard to stay ahead of the curve,” Nelson said. ■

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