Radioactive waste surfaces at Texas gas sites

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Since '05, 140 Texas cleanups; experts uncertain of risks
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Blasted free by millions of gallons of fresh water and chemical soup sent miles below ground, some of earth's baddest geological actors – radioactive elements capable of scarring soil and scourging human health – are slowly rising to the surface along with the Barnett Shale's natural gas.

Once above ground, if they can stay afloat, they continue to travel suspended in the water produced from the well. Otherwise, they fall from their own weight and accumulate.

They crystallize as shiny, black scales on tubular steel. Or cake in layers of whitish-brown sludge at the bottom of tanks and separators. Eventually, they can crust over gas production fixtures like a rusted hot-water heater about to flood the house.

Yet licensed decontamination workers wait for the phone to ring.

Statewide, 140 such sites were decontaminated from January 2005 to the present, according to documents obtained from the Department of State Health Services, which oversees disposal of the state's hottest radioactive waste.

Moreover, 25 of those decontamination sites were in Denton, Tarrant and Wise counties, the core counties of the Barnett Shale. The cleanups signal that fracing – short for fracturing, the water-guzzling process that busts the gas out of the shale – could be pulling up much more than energy companies bargained for, experts say.

Known as technologically enhanced, naturally occurring radioactive material, or NORM, the residue can be the most toxic waste that oil and gas production generates. The risk to human health and the environment varies widely. Small concentrations of NORM provide less exposure than even a dental X-ray. But when allowed to accumulate in greater concentrations, especially with poor monitoring and containment practices, NORM can hurt people and the environment as any radioactive waste can.

Few researchers have traced the residue's radioactive trail. Pete Ramirez of the U.S. Fish and Wildlife Service in Wyoming found radium from drilling activities in the bones of ducks captured in contaminated wetlands there. He couldn't say what long-term implications that had for the ducks or how that translated to human health.

But, he said, "I wouldn't want to live next to it."

In Denton, Tarrant and Wise counties, all kinds of equipment – from pipes and separators to frac and brine-hauling tanks – were decontaminated of NORM – the most toxic waste the wells can generate.

Texas Railroad Commission rules allow the industry to self-monitor for NORM, and many operators are slow to decontaminate the radioactive residue because of the cost, industry insiders say. Furthermore, only two of nearly 200 operators registered with the commission in the Barnett's core counties – Key Energy Services and Devon Energy – have provided for such decontamination in the past two years.

Hot waste

In the Barnett Shale, everything from equipment to producing well sites is being decontaminated. At most area well sites, decontamination workers cleaned and disposed of 10 barrels of radioactive residue or fewer. (One barrel equals about 42 gallons.) However, in places where equipment has been stored, or production waste has accumulated, the cleanups have been much larger.

Based in Andrews and one of a dozen Texas firms licensed to decontaminate radioactive waste, Lotus disposed of 100

barrels of contaminated material from Devon's Bridgeport pipe yard in February 2006 in Lotus disposal facilities.

In October 2006, Lotus workers made an emergency cleanup around a leaking vessel at Devon's North Tarrant saltwater disposal well in Saginaw. They removed about 105 barrels of radioactive residue.

Doug Bridwell, an environmental and health specialist for Devon Energy's central division, said the tank involved in the spill was inside a secondary containment area, which is designed to prevent soil contamination.

"It [the NORM] was all picked up within that lined dike," Mr. Bridwell said. "But not all operators work like that."

The largest Barnett Shale decontamination to date occurred at Key Energy Services' Chico storage yard. Houston-based Soloco, another licensed decontamination firm, cleaned up more than 40 different tanks, including frac and brine-hauling tanks, hauling the hot waste for licensed underground disposal in Big Hill in November 2006.

Ken Houston, vice president of health, safety and environmental for Key Energy Services, said the cleanup and disposal contract cost $120,000, not counting labor and materials on Key's part.

Key has acquired more than 100 smaller companies in the last 15 years – a lot of them "as is," he said. "When we recognized an existing issue, we've taken an effort and expended the cost to clean it up."

The known number of decontaminated sites in the Barnett Shale exceeded those in Panola County, although the total amount of hot waste was less. Workers in Panola County have cleaned up several thousand barrels of hot waste from 24 different sites in the past two years. Meanwhile, the Environmental Protection Agency and Texas Railroad Commission continue to wrestle with large-scale contamination of the soil and drinking water there.

Not normal

Radium-226 and radium-228 are the two most common elements to travel up gas and oil wells. Both emit alpha particles and gamma radiation as they decay. Radon gas, the second-leading cause of lung cancer, is emitted as they decay.

Radium and other NORM often come up with oil, but typically not with natural gas, according to James Otton, a geologist with the U.S. Geological Survey who has studied radium contamination. However, the more water is used to mine the gas, the more likely operators are to bring up NORM.

Unlike most natural gas mining, which produces little water as a byproduct, Barnett Shale gas mining uses and produces about as much wastewater as oilfields do. A median 1,638 gallons of wastewater is produced per thousand cubic feet of Barnett Shale gas, according to U.S. Geological Survey data. Denton County gas wells produce 36 percent more wastewater, or a median 2,226 gallons, for every thousand cubic feet of gas.

Other factors also can predict whether concentrated levels of radium or other radioactive material will be produced along with the gas, Dr. Otton said.

Organic-rich shale such as the Barnett Shale has higher levels of uranium, for one. The high level of salt in the wastewater produced along with the gas is another predictor. As a gas well is producing, the variable pressure also helps free NORM from the shale, bond with other elements, such as barite and calcium carbonate, and travel to the surface along with the gas.

Operators should regularly survey their equipment for NORM, according to Gerri Cooley, a health physicist with Lotus. Typically, operators decontaminate production equipment that gets plugged with the residue if they need to use the equipment. Otherwise the pipes and tanks sit in storage until needed.

But because proper disposal is expensive, some operators put off dealing with it.

"They are somewhat slow to call [us]," said Kenny Ryan, operations manager for Soloco.

In addition to charges for cleaning up and hauling the waste, operators must pay upward of $300 a barrel for proper disposal, Mr. Ryan said. Both Soloco and Lotus have disposal facilities as well as cleanup crews.

Health experts are still learning about the long-term effects of low-level radiation exposure, said Evan Douple, director of radiation effects research at the National Academy of Science National Research Council. People are exposed to radiation every day in myriad different ways, some of it innocuous and some harmful.

Over the last 40 years, the council has published seven reports on the biological effects of ionizing radiation, much of it

learned from studying the survivors of the atomic bomb blasts in Hiroshima and Nagasaki 60 years ago.

A person can get a whole-body dose of radiation standing near a contaminated site that is emitting alpha particles or gamma rays. A person can also get a dose by ingesting or breathing in particulate, Dr. Douple said.

While risk of exposure can be highest for oilfield workers, that risk can be managed as long as workers' doses are measured, Dr. Douple said.

However, for the general public, exposure requirements are stricter because the circumstances are less controlled.

"The materials need to be handled and properly removed to keep people's exposure to a minimum," Dr. Douple said.