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TECHNOLOGY & PRACTICE

Missouri puts plug in radium problem

To a geologist, it made sense. If well water has a problem with radionuclides, the offensive water probably comes from a geologic zone bearing that kind of ore. Finding that zone and putting a plug in it would be a whole lot cheaper than pumping the water out and building a treatment plant.

The well drillers install the tremie pipe to plug the geologic zone that contributed water heavy in radionuclides. *Photos courtesy Boone County PWS #9*

In one case, it worked beautifully; in another, it didn't, reports Steve Sturgess, water protection program manager with the Public Drinking Water Branch of Missouri's Department of Natural Resources and a geologist by training.

The state was in a quandary two years ago, he said; it had more than 22 public water systems in violation of the federal Radionuclide Rule.

One of them was Boone County Public Water System No. 9, outside of Columbia, Mo., in the center of the state. Boone County's Harg Well was always high in radionuclides — 19 to 34 picocuries/L for gross alpha and 6–7 pCi/L for radium-226 and radium-228. In 2004, when the final maximum contaminant level (MCL) was agreed on as 15 pCi/L for gross alpha and 5 pCi/L for combination of radium 226 and radium 228, the Harg Well was on USEPA's radar.

District Manager Roger Ballew looked at numerous alternatives. He didn't really want to drill a new well because this one was positioned in the distribution system right where it needed to be and had a water tower on-site. The chances of finding land for sale nearby were slim.

Furthermore, all the wells in the area had radionuclides; a new well probably would, too. Blending wouldn't work, either, he said.

The best solution seemed to be building a hydrous manganese oxide treatment plant to clean up the water, he says — an expense of around $800,000 for a public water system that has only 4,500 customers. The plant would have been fairly automated, easing labor costs; chemicals would have cost only $20/day.

But the plans hit a snag when Ballew began to work out what to do with the radioactive sludge. The nearby city of Columbia almost agreed to take the backwash into its sanitary sewer system for treatment at its wastewater plant, but, as Ballew recalls, "people get paranoid real fast when you're talking about radiation." As the possible political fallout became apparent, Columbia refused to accept the sludge.

Costs began to climb astronomically when Ballew began investigating alternatives, such as trucking material to a landfill or bioreactor, dewatering sludge and getting a discharge permit from the DNR.

"About that time, the US Geological Survey agreed to do a study," Ballew said.

John Schumacher with USGS joined a team effort with Sturgess and Missouri's Geological Survey department. The DNR provided most of the funding through set-asides from the Drinking Water State Revolving Fund.

A simplified description of Schumacher's detailed

scientific guidance and strategy and an intense work effort is that the well was taken offline and the pump pulled.

A device called a "packer" was lowered into the well. A packer is able to isolate each geologic zone by inflating to seal the bore hole above and below the zone and taking a sample from the water flowing into the well from just that zone.

Luck was with Boone County PWS No. 9. Sturgess says, "We were able to find the offensive zones lower in the well, just above the pre-Cambrian base rock layer." Next, a tremie pipe carried neat cement to the bottom of the well, sealing off the offensive zone.

This packer inflates above and below geologic zones to sample water.

"The quality improved dramatically," says Sturgess. Ballew crows, "It completely eradicated the problem." The highest radionuclide readings after the well was put back in service — 4 pCi/L for gross alpha and 1.5 or 2 pCi/L for radium 226-228 — or "basically nil," as Ballew termed it.

The town of Farmington in southeast Missouri was not as lucky, Sturgess said. The Schumacher - Sturgess technique actually was tried there first as they were the largest community with a radionuclide problem.

"We were able to find the offensive zones," Sturgess says, "but the zones that produced the radionuclides were also the ones that produced the most water. Sealing them off would have rendered the well useless." Hence, Farmington is looking at $4 million in capital costs to treat their water.

Missouri doesn't plan on performing the tests for all the troubled PWSs, Sturgess says. Their intent is to investigate and demonstrate the technique so utilities can pursue it on their own.

However, he expects the state will agree to do one more test to prove the viability of the technique in a third set of geologic conditions in the state — this time in the southwest region. The town of Bronaugh has high levels of radionuclides and is considering drilling a new well, but would like to have the test performed before going to the expense of putting in the pump.

The total costs so far, Sturgess says, run around $250,000 to $300,000, with the DWSRF set-asides paying for most of it, while the utilities and USGS pay smaller sums. In Ballew and Sturgess's book, that is a "really good" way to put the taxpayer's dollars to work because the reduced costs over time will justify the up-front costs.

Additional AWWA Resources:

- AWWA References on Radioactivity
- *Opflow* article, May 2008, Radioactive: Treating Contaminated Water
- AWWA online professional and technical resources on Radiation Regulations

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