Flexible Grout Restores Reservoirs to Service

Many potable water reservoirs, both above and below grade, are made of poured-in-place concrete or poured-in-place combined with precast concrete. Stresses imposed by the forces of nature eventually cause development of cracks in walls, floors, and ceilings, and voids appear where the walls meet floor or ceiling.

The result is that groundwater can leak in and drinking water can leak out. The reservoir must be repaired to prevent possible contamination of the drinking water supply by untreated groundwater and to prevent the loss of valuable treated water. In New Berlin, Wis., a hydrophobic polyurethane product* the city had used successfully in the past proved once again to be the solution when repairs were necessary to an in-ground concrete reservoir.

New Berlin has eight 1-mgd reservoirs—six underground and two standing. When utility superintendent Bob Lamourex emptied an in-ground reservoir for annual inspection, the expected cracks and voids were evident. The reservoir's floor had been raised by the earth's heaving, which created many lineal feet of cracks. At the juncture of wall and floor, an actively leaking void extended around the structure's perimeter. Infiltration was also occurring at the juncture of wall and ceiling. The ceiling was built of precast panels supported by the poured walls. These panels averaged 5 ft of ground cover above them.

Previously, in a similar situation, New Berlin had used epoxy with only limited success. The epoxy didn't fail, but movement of the structure broke the concrete in other locations. However, another past repair, when the city used the more flexible hydrophobic polyurethane product, had been successful. Inspection of that reservoir revealed the repair to be holding at 100 percent, so the decision was made to use the same product and contractor* for the current project.

Liquid grout injected into cracked concrete reservoirs keeps the drinking water in and the groundwater out.

WHEN THE GROUT MEETS MOISTURE, IT EXPANDS WITH AN OUTWARD PRESSURE OF UP TO 7 PSI AND FINDS ITS WAY INTO THE SMALLEST CRACK.

Holes drilled in strategic locations

After the damaged tank was empty, a two-man crew drilled 5/8-in.-diameter holes at strategic locations at angles so they intercepted cracks or joints deep below or behind the surface of the concrete. Injection packers were then inserted into the drilled holes, and liquid grout was pumped through the packers and down the drilled holes. When the grout meets water or moisture, it begins to expand with an outward pressure of up to 7 psi and find its way into or behind the smallest crack.

The grout attains initial set and becomes an impermeable closed-cell plastic within just a few minutes. On the job site, the contractor uses a substance called an accelerator to control the actual reaction and set times of the grout. A reaction time of less than 3 seconds can be obtained if enough accelerator is mixed with the base resin.

Another reservoir then received this treatment, an eight-year-old structure that had been shut down in 1976 by the Wisconsin Department of Natural Resources because of bacteriological contamination. Previous attempts at repair had failed, and the tank had remained out of service. Inspectors found groundwater pouring into the tank through the juncture between floor and walls and through a crack that ran entirely across the middle of the floor. The crack had been caused by the hydrostatic head pressure.

As floor cracks and joints were repaired, water started coming in through the lower walls; as these were injected, the water found higher access points as the outside water table rose. This process continued until the leaking water was "chased" to the top of the walls, where it poured in at the juncture with the precast panels that served as the reservoir's ceiling. After a last series of injections, the infiltration was entirely stopped and the potable water reservoir was dry and ready to be put back into operation. ♦