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Abstract

Removing the R's in Groundwater Radon, Radium and aRsenic

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Culpeper County has developed a new infrastructure system to serve the Clevengers Village area of the County. One part of the system is a new water treatment plant. The plant will treat water from two existing wells and four new wells to meet the requirements of the U.S EPA Safe Drinking Water Act and the Virginia Department of Health, Office of Drinking Water. The wells contain iron, manganese, radon, radium and arsenic. The plant has been designed to remove all of these elements and is the first in the Commonwealth of Virginia designed to remove radon, radium and arsenic. The treatment system consists of a number of steps including chemical addition, filtration, and absorption. The raw well water enters the plant site through a common line from the wells. The combined flow stream passes through an aeration unit to remove radon present in the groundwater. Sodium hypochlorite is injected into the flow to provide preliminary disinfection of the raw water and to oxidize iron and manganese in the groundwater. Hydrous manganese oxide (HMO) solution is utilized to remove radium 226+228 present in the groundwater. The HMO solution facilitates the removal of radium 226+228 by filtering. Provisions are also included that allow the injection of polymer into the raw water flow stream upstream of the filters to enhance filter efficiency. Two vertical pressure sand filter (VPF) vessels are provided to remove radium 226+228 sequestered by the HMO solution, as well as oxidized iron and manganese. Following the VPFs, three vertical pressure absorption (ion exchange) vessels are provided to facilitate the removal of arsenic that may be present in the groundwater. Granular ferric hydroxide (GFH) media is utilized to absorb arsenic. Traditional treatment steps are also included for fluoridation, corrosion control, and final disinfection of the finished water.

