Application Bulletin

CONTAMINATED GROUNDWATER CLEANED BY GRANULAR CARBON SYSTEM

Reprinted from PIMA Magazine. A Paper Industry Management Association publication.

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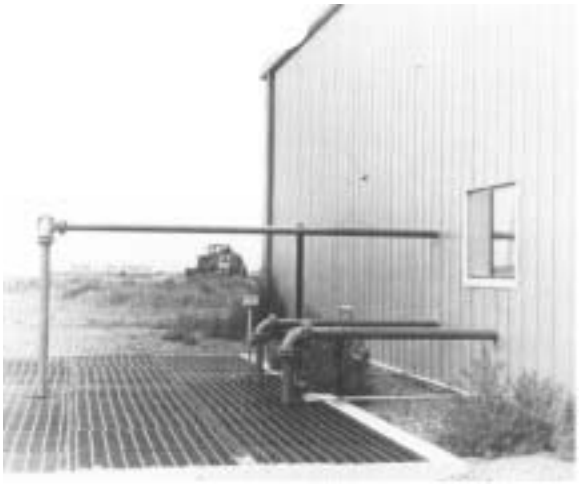

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However, stopping much of the flow of groundwater out of the arsenal also would effectively cut off the supply of water from individual shallow wells for homes and forms north of the military complex. So the Army is removing contaminated groundwater from a series of six wells upstream from the barrier, purifying it, and then returning the clean water to the table on the other side of the barrier through a dozen recharge wells. The recharge wells are less than a block away from a number of homes north of the arsenal property.

Concern for the migration of contaminated groundwater away from the arsenal began four years ago, when minute traces of DIMP (diisopropyl methyl phosphonate) were detected in surface water draining from a marshy bog on the arsenal's northern boundary. The chemical compound is produced in small quantities during the manufacture of GB nerve gas. A dike was constructed north of the bog to prevent off-post surface drainage.

Traces of another toxic compound, DCPD (dicyclopentadiene), were also found in the water. DCPD is used in the manufacture of pesticides. Part of the manufacturing facilities at the arsenal have been leased to private industry for chemical manufacturing since 1946. Government use of the arsenal during recent years has been mainly for the safe disposal of chemical warfare munitions.

For many years, industrial wastes from government and civilian production operations had been discharged into a natural basin in the center of the arsenal. The discovery of minute traces of DIMP (0.57 parts per billion) in a well near the city of Brighton, north of the arsenal, suggested that contaminated groundwater - possibly from the original wastewater basin - might be moving out of the arsenal. A detailed study of groundwater movement by the U.S. Geological Survey confirmed it and plotted the course of the underground flow.

On April 7, 1975, three Cease and Desist Orders were issued by the Colorado Department of Health to stop any discharge of DIMP and DCPD-contaminated surface and subsurface waters from the arsenal. Additional steps also were to be taken to preclude any future discharges of these compounds.

The army immediately initiated a program to contain and treat the contaminated water. A series of shallow wells were dug throughout the area to monitor the concentrations of toxic materials in the groundwater. Also, studies of the effects of DIMP and DCPD on plants and animals were undertaken at various government and civilian laboratories.

Since a natural channel in the bedrock concentrates the underground flow of contaminated water north through a particular area, it was practical to block it with an underground "dam". This structure was made by filling a 3-foot-wide trench, extending 25' into the clay shale bedrock, with a mixture of soil and impermeable bentonite clay.

A number of processes for removing the dissolved organic compounds from the contained groundwater were investigated. These included the use of activated carbon in powdered as well as in granular form to "adsorb" the toxic substances from the contaminated water on their extremely porous surfaces.

Extensive field evaluations at the arsenal showed that granular activated carbon had a higher DIMP removal capacity than powdered carbon over a wide range of influent concentrations. Therefore, it offered a substantial safety factor.

Another advantage of using granular activated carbon is that it doesn't produce any sludge. The contaminants trapped inside the granules are completely destroyed when the spent carbon is "reactivated" at high temperatures inside special furnaces. Calgon conducted tests to prove that neither DIMP nor DCPD are released to the atmosphere during the reactivation process, which takes place at a Calgon facility away from the arsenal.

A self-contained Calgon Carbon Service system was installed in a small building close to the underground barrier. Contaminated ground water from the dewatering wells on the other side of the barrier is pumped into a common sump next to the building. From there, it is filtered and pumped through the Calgon system, which contains approximately 20,000 pounds of granular activated carbon.

The system is capable of removing 99% of the DIMP and DCPD from the water at a rate of 10,000 gallons per hour, 24 hours per day, and 330 days per year. Only one, intermittent operator per shift is needed to monitor the operation.

When the carbon becomes saturated with dissolved organic contaminants, a specially designed Calgon truck removes it from the arsenal and replaces it with fresh activated carbon. Spent carbon granules can be economically reactivated and reused, with relatively little loss of material in the process.

As a part of its service, Calgon provided the equipment now in use at the arsenal, maintains it, and keeps the system supplied with carbon for an annual service charge of $ 125,000. The firm also trained the arsenal personnel who operate the system.

Tests performed in Calgon's advanced analytical laboratories in Pittsburgh, PA., enabled the company to recommend a treatment system for the arsenal which would meet the Colorado Health Department's water quality standards. Similar units are currently in use in potable water treatment applications throughout the U.S. They have established an enviable record of reliable performance, Calgon maintains.

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The system's modular design permits it to be easily expanded to handle higher flow rates and even more stringent water quality requirements in the future. Granular activated carbon's "broad spectrum" treatment capability provides additional protection against the possible appearance of other dissolved organic contaminants in the groundwater leaving the arsenal.

It has been estimated that the total flow of polluted water across the arsenal's northern boundary varies from 10,000 to 25,000 gallons per hour. Monitoring wells installed on both sides of the barrier will keep track of ground water quality and depth. Such factors as seasonal variations and the table's response to carefully controlled changes in the operation of the treatment system will be studied during the coming months.

Technical Fact Sheet

Calgon Carbon system at the Rocky Mountain Arsenal
Denver, Colorado

- Dual filter units, containing a total of 20,000 pounds of Calgon granular activated carbon, are used to remove toxic materials from contaminated ground water leaving the Arsenal through its North boundary.
- The System processes approximately 10,000 gallons of contaminated water per hour, 24 hours per day, 330 days per year.
- Annual service charge of $125,000 - no major capital investment on the Government's part, since the system is provided and maintained by Calgon.
- The Calgon Carbon System produces NO sludge or air pollution as a byproduct of the water treatment process.
- Except for pumping requirements, the Calgon Carbon System uses NO energy in its operation.
- Very little land is needed for the Calgon Carbon System.
- Only one intermittent operator per shift is needed, yet the system provides a wide margin of safety.
- The modular design of the Calgon Carbon System permits its easy expansion at the Arsenal, should this become necessary to meet more stringent water quality standards.
- The effectiveness of granular activated carbon treatment of contaminated ground water at the Arsenal has been established through thousands of hours of comprehensive laboratory and field testing.
- Similar Calgon Carbon Systems, now in operation throughout the United States, have established the high reliability and cost-effectiveness of this form of treatment in combating "tough" dissolved organic pollutants in water.

The pilot containment/treatment system will provide the data needed to design and construct a permanent solution to the problem of contaminated groundwater at the Rock Mountain Arsenal. The technology employed there represents a significant step forward in the development of practical techniques for combating ground water contamination. Industrial and municipal water pollution in many parts of the country goes much deeper than formerly believed.