U.S. Geological Survey
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News Release

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Water Supply at Greater Risk than Expected

Scientists from the U.S. Geological Survey have concluded that the drinking water from the Miami-Dade Northwest Well Field (NWWF) is at risk of contamination due to the close proximity of existing lakes created from limestone rock mining activities. Scientists conducted experiments to show how chemical contaminants and pathogens would move through the Biscayne aquifer. Approximately 2 million residents in southeastern Florida rely on the Biscayne aquifer for drinking water.

The U.S. Geological Survey first studied the movement of groundwater in the Biscayne aquifer in April 2003 when they injected a harmless red dye into the limestone of the Biscayne aquifer, which was then pulled into the public water supply system by wells at the NWWF. The results of this test revealed that groundwater traveled through the limestone aquifer at rates much faster than anticipated.

These studies were conducted because of the potential contamination of a drinking water supply in areas where shallow karst limestone systems, such as the Biscayne aquifer, are the source of drinking water. Of particular concern is the potential movement of pathogens in the groundwater, such as *Cryptosporidium parvum,* from limestone-rock mine lakes to the production wells. *Cryptosporidium parvum* is commonly recognized as a pathogen of concern because of its resistance to chemical disinfection. *Cryptosporidium* has been known to survive the normal chlorination process that a drinking water facility uses. Current treatment of water drawn from NWWF production wells is not completely effective in removing these pathogens from the drinking water. In other parts of the country, *Cryptosporidium* outbreaks have been associated with drinking water. This organism causes severe intestinal infections and can be a significant health concern.

Fluorescent microscopic particles were used to mimic the transport behavior of *Cryptosporidium parvum* in the aquifer. They traveled through the aquifer about three times faster than predicted. USGS research microbiologist Dr. Ronald Harvey explained that “The fast transport of these particles, their low removal in the aquifer and the extensive nature of the highly porous zones of limestone suggest that chlorine-resistant, surface-water pathogens pose potential threats to the drinking water withdrawn from the Biscayne aquifer.”

In response to the red dye test, the Miami-Dade County Department of Environmental Resources Management and the Miami-Dade Water and Sewer Department requested the USGS conduct additional studies that included a complex series of tracer tests conducted in February 2004. The analyses and results of these tests, published in three articles in the scientific journal, *Water Resources Research,* show that the potential movement of chemical contaminants and pathogens within the Biscayne aquifer can occur very quickly, primarily through highly porous limestone. A complementary study by USGS and university scientists provides additional insight to the broad continuity of these highly porous flow zones. It is published in the journal *Geological Society of America Bulletin*.

Robert Renken, USGS hydrologist and one of the lead investigators of the study said, "The highly porous nature of the Biscayne aquifer presents significant water-management implications, especially as

it relates to the inadvertent release of contaminants within or immediately outside the well field protection area."

Tests were conducted by injecting a tracer solution into the aquifer for a period of one hour. However, the tracer solution was still detected 160 hours later (about one week) at the NWWF production well. “This indicates that if a contamination event occurs in the Biscayne aquifer that continues for days, weeks, or months it has the potential to degrade water quality and could persist from years to decades,” said Dr. Allen Shapiro, USGS research hydrologist involved in the study.

Public-supply wells in the Miami-Dade area are required to have a designated distance or well-head protection zone around them to protect against contamination. Currently, the well-field protection zones are determined by numerical models that simulate groundwater travel-times. The tracer test results indicate that the numerical models are based on an oversimplified understanding of how groundwater moves through the Biscayne aquifer. Current protection zones are not sufficient to protect water supply wells from possible contamination from borrow-pit lakes (artificial lakes created by the mining activities) associated with nearby rock mining activities.

The risk of contamination to groundwater increases when groundwater is located close enough to surface water such that it receives direct surface-water recharge. Some borrow-pit mines are located as close as 800 ft from a municipal supply well. The Northwest Well Field is located in the Lake Belt area where open-pit rock mining activities excavate limestone from the Biscayne aquifer intersecting the same porous aquifer units as NWWF supply wells. The Lake Belt area is located between high-density urban development to the east and freshwater wetlands and water-conservation areas of the Everglades to the west.

The tracer tests demonstrate that existing and proposed rock mines near the NWWF in Miami-Dade County, Florida likely increase the risk of contaminating public drinking water sources. Miami-Dade County Department of Environmental Resources Management and the Miami-Dade Water and Sewer Department requested the study in response to County and public concern that rock mining activities near the NWWF presented much greater contamination risks than previously recognized. These findings will be used to support future water-management and land-use decisions.

The articles published in the journal ***Water Resources Research*** can be viewed at:
http://www.agu.org/pubs/crossref/2008/2007WR006058.shtml
http://www.agu.org/pubs/crossref/2008/2007WR006059.shtml
http://www.agu.org/pubs/crossref/2008/2007WR006060.shtml

The article published in the journal ***The Geological Society of America Bulletin*** can be viewed at:
http://www.gsajournals.org/perlserv/?request=get-abstract&doi=10.1130%2FB26392.1

Follow the path of water on a virtual 3-D tour traveling through a piece of limestone from the Biscayne aquifer. This animation was created using CAT-scan technology.
http://sofia.usgs.gov/people/cunningham.html

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