



CDC Looks at Links Between Wastewater and Disease

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Drinking water contaminated by sewage has been cited as the principal cause for most outbreaks of waterborne illnesses in the U.S. Many of these outbreaks can be traced to individual wells or small community drinking water systems. Local health departments have been seeking ways to prevent these outbreaks, and the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, has offered its help.



CDC Creates New Branch

In 1999, the National Center for Environmental Health (NCEH), a division of the CDC, formed the Environmental Health Services Branch (EHSB) and charged it with improving the practice of environmental health at state, local, and tribal health departments throughout the U.S. "EHSB is involved in many projects that promote advances in the environmental health sciences and the system by which environmental health services are delivered," said Richard Gelting, Ph.D., environmental engineer, EHSB. "These projects the EHSB is involved in include, but are not limited to, work in food safety, onsite wastewater systems, drinking water safety, recreational water safety, vector control, and environmental health workforce development."

The EHSB comprises three teams: technical assistance, research and evaluation, and education and training. Many of the activities of the EHSB are based upon a document that was developed by the NCEH and numerous partners titled *A National Strategy to Revitalize Environmental Public Health Services*. The strategy, which can be found at www.cdc.gov/nceh/ehs/default.htm, has six major goals:

- build capacity,
- support research,
- foster leadership,
- communicate and market,
- develop the workforce, and
- create strategic partnerships.

EHSB Studies Onsite Systems

"Local-level environmental health officials were asking us about the public health issues involved in onsite wastewater," Gelting said. "We didn't have much information on the subject, so we began to investigate to see what the issues were."

In October 2003, the EHSB began a three-year project titled *Public Health Impact of Onsite Wastewater Disposal*

Systems to determine if there is a definitive link between outbreaks of waterborne diseases and onsite systems. The project is administered as a cooperative agreement with the University of New Mexico.

"There really isn't a lot of evidence showing that this is a problem or showing that this is not a problem," Gelting said. "The University of New Mexico is doing a case-control study in which it is looking at areas with onsite disposal and private wells versus areas with public water supplies to see if there are apparent differences in water quality and health."

Gelting and Michael Herring, senior environmental health scientist, EHSB, have teamed together to work with local health departments on onsite systems. "Several years ago, we hired a contractor to search for case studies that showed a connection between human illness and onsite wastewater practices," Herring said. "The contractor confirmed what we had found—there just isn't much documented information about this subject."

"We know that untreated sewage is a factor in illnesses, but trying to make a strong link with onsite wastewater is difficult. We are trying to better define the problem."

Herring's search for documented cases led him to several Canadian studies indicating that illness had not resulted from a possible widespread exposure to wastewater pathogens from onsite systems. "This raises the question: are we protecting public health if people are exposed to these pathogens?" Gelting said. "One of the theories the authors posed in these studies was that the residents who were exposed to wastewater pathogens might have developed immunity to them. However, visitors to the locale would not have that immunity."

Harmful Wastewater Pathogens

Some of the types of pathogens found in wastewater that are hazardous to humans include bacteria, viruses, and parasites (including protozoa, worms, and rotifers). Scientists believe that there may be hun-

dreds more disease-causing organisms in wastewater that have not yet been identified.

"Whether or not someone will get sick after being exposed to untreated wastewater is hard to predict," according to "Onsite Wastewater Disposal and Public Health," an article published in the 1996 Summer issue of *Pipeline*, (Volume 7, Number 3). The article continues: "There are enough disease causing organisms in wastewater, however, to make contact with it always very risky."

Many people who are infected with pathogens or pollutants in water never even develop symptoms. How healthy you are to begin with, whether or not you have built up a resistance to a specific disease, how the organism or substance enters your body, how potent or toxic it is, and the size of the dose all contribute to how severely you will be affected.

People who have suppressed immune systems because of HIV/Aids, chronic disease, chemotherapy, or other conditions are especially at risk from wastewater-related diseases. Children, the elderly, and the urban and rural poor are also significantly more at risk than the general population.

Water from Private Wells in Ohio Found Tainted

Although there are few documented case studies in the U.S., a recent outbreak in Ohio may provide the EHSB with data. In September 2004, the Ottawa County Health Department in Ohio documented 1,455 cases of gastrointestinal illness in South Bass Island residents and visitors. Symptoms included diarrhea, abdominal cramps, chills, and vomiting. Officials believed groundwater contamination to be the likely cause for this outbreak and took steps to test and shut down wells that might have bacterial contamination.

"Three wells at the Island Club tested positive for *E.coli*, an indicator of the possible presence of feces, and for total coliform, which can point to contamination by more serious bacteria or pathogens," according to a September 4, 2004, news report written by *Toledo Blade* staff writer Steve Murphy. "An auxiliary well at a local inn also tested positive for total coliform, bringing the number of public wells under no-use orders to 15. Last month, the Ottawa County Health Department found total coliform in 32 of 42 residential wells tested, including 11 wells that also tested positive for *E.coli*."

The CDC has begun a detailed study that will compare 100 island visitors who became ill to 100 companions who weren't affected, according to Jay Carey, spokesman for the Ohio Department of Health.

Case Studies

Other incidents have indicated the link between sewage and waterborne disease. In September 1999, more than 600 people at the county fair in Albany, New York, were stricken with an infectious strain of *E.coli* bacteria that washed into the groundwater from a local barn and contaminated the wells the fair used for its drinking water. Fifty-eight people were hospitalized with bloody diarrhea, abdominal cramping, and fevers, and a 79-year

old man and a 3-year old girl died from kidney failure caused by the bacteria.

In May 2000, in Walkerton, Ontario,

more than 1,000 people became ill from *E.coli*, and seven died from this deadly strain of intestinal bacterium. The cause for this outbreak is believed to be the town's well water. Manure had washed into the wells during a time when the disinfection system was broken.

In February 2001, the Wyoming Department of Health reported cases of acute gastroenteritis from vacationers at a snowmobile lodge. A study showed that there was a significant association between water consumption and illness. "Norwalk-like virus (NLV) was found in eight of 13 stool samples and one well," according to "A Waterborne Outbreak of Norwalk-Like Virus among Snowmobilers," published in the *Journal of Infectious Diseases*, volume 187, 2003. The three wells that served the lodge were located within 92 to 115 feet of a septic tank or outhouse.

"Contamination of the water supply is attributed to the geological conditions of the area and to an overloaded sewage disposal system. The sandy, porous soil present at the lodge has poor adsorption qualities and permitted rapid water percolation, decreasing the soil's ability to filter and remove viruses. Any viruses reaching the fractured granite bedrock below could then be easily pulled into the groundwater well source by the well's pumping action. The lodge owner remodeled the facilities in November 2000, and the increased sewage load was not matched with a larger septic system, which caused more effluent to pass through the leach fields at a faster rate. The site of this outbreak is illustrative of the need to carefully consider local geology and not simply distance siting requirements for septic systems and wells to ensure safe drinking water."

Process of Investigation

For outbreaks of waterborne illnesses, the EHSB conducts investigations to determine the infectious agent, examine exposures, and identify the mode of transmission. This process can be illustrated by reviewing





Infants, young children, the elderly, and the urban and rural poor are significantly more at risk for contracting waterborne illnesses than the general population. These illnesses are the leading cause of infant mortality worldwide.

Photo by Julie Black

the investigation into the outbreak at the snowmobile lodge in Wyoming.

CDC investigators performed a retrospective cohort study that compared symptoms, dates of illness, water and ice consumption, and a complete list of menu items served at the lodge where guests were affected to guests who were unaffected at a nearby lodge. Investigators analyzed the collected data using CDC software.

CDC investigators also collected bulk stool samples from 13 guests who had become ill and tested the samples for NLV, *Salmonella*, *Shigella*, *Campylobacter*, and *Escherichia coli*. Samples of well water from one of the three onsite wells at the lodge were tested for NLVs and fecal coliform. Well water from two nearby lodges was also tested for fecal coliform.

The investigators questioned food handlers about recent illnesses and procedures they used in preparing food. They then conducted an assessment of the lodge's water supply system and sewage disposal system.

Outbreaks from Waterborne Illnesses in 2002–2003

It is impossible to determine how many cases of waterborne illnesses occur in people each year because illnesses can be misdiagnosed or easily go unreported.

But according to the latest statistics from the CDC, an estimated 1,020 Americans became ill and seven died from 31 outbreaks associated with drinking water during 2001 and 2002. "It should be kept in mind that these publications summarize reported outbreaks," Gelting said. "There is currently no national estimate of the total number of illnesses from waterborne agents in drinking water."

When the Public Health Impact of Onsite Wastewater Disposal Systems project is completed, Gelting and Herring will provide state and local health departments with public health guidance. "The type of guidance we will provide will depend upon the findings from the study," Gelting said.

Until then, there are some steps communities and individuals can take to protect public health. Some communities have developed onsite wastewater treatment management programs. These programs help homeowners by centrally monitoring and managing onsite systems to ensure that they are functioning correctly. Another safety measure is to educate homeowners about testing their well water for harmful microorganisms and contaminants and steps to take to prevent contamination.

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