

Direct from CDC's Environmental Health Services Branch

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A Public Health Perspective on Onsite Wastewater Systems

Editor's note: NEHA strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, we will feature a column from the Environmental Health Services Branch (EHSB) of the Centers for Disease Control and Prevention (CDC) in every issue of the Journal.

EHSB's objective is to strengthen the role of state, local, and national environmental health programs and professionals to anticipate, identify, and respond to adverse environmental exposures and the consequences of these exposures for human health. The services being developed through EHSB include access to topical, relevant, and scientific information; consultation; and assistance to environmental health specialists, sanitarians, and environmental health professionals and practitioners.

EHSB appreciates NEHA's invitation to provide monthly columns for the Journal. EHSB staff will be highlighting a variety of concerns, opportunities, challenges, and successes that we all share in environmental public health.

Issues related to onsite wastewater systems are frequently among the top concerns of environmental health practitioners. Demographic, infrastructure, and land use trends show a likely continuation of this concern in the near future. Although the proportion of housing units with onsite systems has remained relatively constant in the United States over the last 30 years, at approximately 25 percent, about one-third of new homes are connected to onsite systems.

Rapid growth of rural and suburban fringe areas in some regions has led to more construction using onsite systems in higher-density areas. Although sewers may be feasible in some of these areas, onsite systems are often installed for new homes because infrastructure cannot always keep up with housing demand. Although the issue has not been specifically studied, concerns have been raised that a shift in the built environment from centralized sewer systems to onsite systems could potentially increase population exposure to wastewater contaminants.

In fact, although many of the practitioners who deal with onsite wastewater issues on a daily basis are in the field of public health, the body of literature on the public health effects of onsite systems is relatively small. Much of the literature about onsite systems is based in environmental engineering and soil science because these fields are closely involved in the design and construction of these systems. Health issues may arise, however, if onsite systems are improperly sited, designed, in-

stalled, or operated. A recent literature review by CDC found a limited number of outbreak investigations and epidemiological studies implicating problematic onsite systems as causes of disease. Although the relatively small number of studies limits analysis, some emerging trends indicate that the following factors have been associated with outbreaks related to onsite systems:

- intermittent use of drinking-water and wastewater systems, as in recreational settings or large temporary gatherings (e.g., fairs);
- installation of onsite systems in soil and geologic environments that are unsuitable (e.g., installation associated with a recent gastroenteritis outbreak in Ohio—see www.cdc.gov/nceh/ehs/Docs/NCEH_South_Bass_Island_Final_Report.pdf); and
- extreme precipitation events such as those linked to hurricanes or other large storms.

These results suggest that design criteria for onsite systems should include factors such as intermittent use and extreme storm events. The existing published literature is insufficient to allow this conclusion to be stated with certainty, but further investigation appears worthwhile.

In addition, the public health effects from onsite systems may not be limited to actual illness but probably also include exposure to wastewater pathogens. An epidemiologic study in Canada found that people whose septic systems were sited closer to their wells ex-

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perienced less gastrointestinal illness (Raina et al., 1999). The authors suggest that these residents might have acquired greater immunity to wastewater pathogens. Strauss and co-authors (2001) found that elderly individuals in rural areas who had relied on private wells for long periods of time showed lower rates of gastrointestinal-illness symptoms than did newer residents, possibly as a result of increased tolerance or resistance to enteric pathogens. Thus, exposure to wastewater pathogens may be more widespread than is commonly assumed, because such exposures do not always result in illness.

These results raise interesting questions that cut to the very core of how we conceive of public health. If people are being exposed to wastewater pathogens but do not get sick because of acquired immunity, are we protecting public health? What about newly emerging or re-emerging waterborne pathogens to which few or no individuals have built up immunity, or visitors to an area who have not acquired the immunity that long-term residents have? With more than 60 million people living in homes served by onsite wastewater systems in the United States, these questions surely deserve attention.

As a start, the Environmental Health Services Branch (EHSB) of CDC's National Center for Environmental Health (NCEH) has funded an external research study to further investigate potential links among onsite systems, exposure to wastewater pathogens, and health outcomes. Serologic responses to selected wastewater pathogens are being measured in study participants in an attempt to differentiate between exposures and actual health effects such as gastrointestinal illness. Results from this pilot project are expected within the next year. Additional work will be necessary, however, to further explore the possible public health effects of onsite systems, including potential effects from properly functioning systems. Such work is needed especially because some epidemiologic studies that have investigated health effects of onsite systems have not found any association between such systems and increased incidence or prevalence of wastewater-related illnesses.

To promote better awareness of issues related to onsite wastewater systems among local policy makers, CDC's Environmental Health Services Branch (EHSB) has also worked with the National Association of Local Boards of Health (NALBOH) to develop a guidance document titled *Local Board of Health Guide to On-*

Site Wastewater Treatment Systems (available at www.cdc.gov/nceh/ehs/Docs/Onsite_Wastewater_NALBOH.pdf). However, more work is needed to characterize the public health effects from onsite wastewater systems and to continue disseminating this information to the public and to policy makers. 🐸

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References

- Raina, P.S., Pollari, F.L., Teare, G.F., Goss, M.J., Barry, D.A., & Wilson, J.B. (1990). The relationship between *E. coli* indicator bacteria in well-water and gastrointestinal illnesses in rural families. *Canadian Journal of Public Health*, 90(3), 172-5.
- Strauss, B., King, W., Ley, A., & Hoey, J.R. (2001). A prospective study of rural drinking water quality and acute gastrointestinal illness. *BMC Public Health*, 1, 8.

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