DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES BRANCH

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Contributions to Enhancing the Public Health Perspective on Onsite Wastewater Management

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 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*.

In this column, EHSB and guest authors from across CDC will highlight a variety of concerns, opportunities, challenges, and successes that we all share in environmental public health. EHSB's objective is to strengthen the role of state, local, tribal, 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 conclusions in this article are those of the author(s) and do not necessarily represent the views of CDC.

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Introduction

Onsite wastewater systems (onsite systems) treat and dispose of wastewater (effluent) near the point of generation (U.S. Environmental Protection Agency [U.S. EPA], 2002). Onsite systems are classified as septic or advanced systems. Septic systems may be conventional and enhanced treatment units or alternative onsite systems (New York State Department of Health, 2012; North Carolina Health and Human Services, 2013). Components of septic systems are the septic tank, distribution box, drain field, and soil. Wastewater flows by gravity or is pumped from the septic tank to the soil.

Enhanced treatment units control the wastewater flow to the drain field, while others may need an alternative drain field unit if the soil is unsuitable for effluent discharge or the water table is high. Wastewater treatment stages are defined as follows:

- Primary treatment is the removal of solids (those that float and those that settle).
- Secondary treatment is the removal of dissolved organic matter.
- Tertiary treatment is the removal of nutrients (nitrogen and phosphorus compounds).

Septic systems are designed to perform primary treatment (in the septic tank) and to some extent tertiary treatment (nitrate removal in suitable and aerated soils). Advanced onsite systems are designed to perform primary and secondary treatment. Most advanced onsite systems are small versions of conventional activated sludge systems that include an aerobic treatment unit.

Currently, most of the onsite systems operating in the U.S. are conventional septic systems. The U.S. Environmental Protection Agency (U.S. EPA) estimates that 25% of American households have an onsite system (U.S. EPA, 2013). Using the U.S. Census Bureau (2014) statistics for the period 2008–2012, an estimated 75.18 million people use onsite systems in the U.S. (28,806,700 households with 2.61 persons per household). Assuming that each person produces 50–80 gallons of wastewater per day, daily effluent discharges from onsite systems range from 4,000 to 6,000 million gallons. Also, the estimated rate of malfunctioning onsite systems is 10%–20% each year (U.S. EPA, 2013). Therefore, the lack of data on the quality of effluents discharged to the environment creates a public health concern.

Monitoring the Performance of Onsite Wastewater Systems

Because we lack data on the performance of onsite systems, the impact of effluents from these systems on the environment and human health has yet to be determined. Monitoring the performance of onsite systems and conducting epidemiologic studies in areas where these systems are prevalent have been recommended to determine the impact of onsite systems on the environment and human health (Zarate-Bermudez, 2009). Monitoring the performance of conventional onsite systems

is challenging, however, because their components are underground, which makes sampling difficult. The Center for Disease Control and Prevention's (CDC's) Environmental Health Services Branch sponsored a two-year collaborative study (2009–2011) to learn more about onsite systems' performance. Researchers from East Carolina University, North Carolina State University Extension Program, North Carolina Health and Human Services, and CDC collaborated in that study to determine the fate of contaminants from conventional onsite systems in a coastal setting of North Carolina. Although sampling was difficult, the sampling methodology designed and implemented in the study helped determine the fate of pollutants from the systems involved. This methodology can serve as the basis to develop programs for monitoring performance of onsite systems in similar coastal or other geographic settings. Study findings on the nitrogen fate (Humphrey et al., 2013) and the phosphorus fate (Humphrey, O'Driscoll, Deal, & Lindbo, 2014) were published. These publications include a description of the sampling methodology. Publications of findings on the microbial fate, the meteorological influences on nitrogen speciation, and the overall perspective of that study are pending.

Enhance the Public Health Perspective on Onsite Systems

Findings of the CDC-sponsored study can also help enhance the public health perspective on onsite systems. Onsite systems are not currently thought of as proven systems to protect public health, but they are designed to treat smaller wastewater flows at or near the point of generation, resulting in smaller environmental footprints (U.S. EPA, 2002). Due to the large number of onsite systems that currently discharge effluents of unknown quality into the subsurface, however, we still need to learn more about their performance. Thus, it is timely that stakeholders discuss onsite systems issues and plan viable interventions to enhance the management of these systems in the U.S.

Promising Aspects of Enhanced Onsite Wastewater Management

Discerning the extent to which onsite systems may impact the environment and human health remains a challenge, but learning more about their performance can enhance onsite wastewater management. Therefore, the following aspects of the CDC-sponsored study seem promising:

- Sampling methodology: The methodology designed for and implemented during the study may be the basis for developing programs to monitor onsite systems.
- Fate of pollutants in the environment and onsite rules: Study findings on the nitrogen fate may challenge existing required setback distances in coastal settings of North Carolina and other states.
- Building partnerships and local capacity: The partnerships developed during the study provide a model for building further partnerships and improving capacity in other localities.

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