National Environmental Health Association

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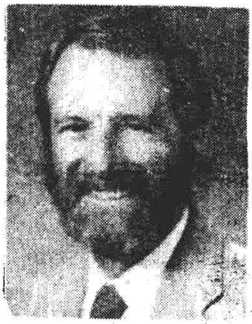

Richard J. Perkins is a Water Resources Specialist with the New Mexico State Environmental Improvement Division in Santa Fe. Dr. Perkins received his PhD in Ecology from the University of Georgia in 1971. He also holds a BA in Biology from the University of California and an MS in Zoology from the University of Georgia. In 1972, Dr. Perkins joined the faculty of the University of Kansas, where he taught courses on ecology and environmental quality, was instrumental in the development of an environmental studies major program, and became chair of that program.

In 1978, he moved to New Mexico and began working to increase the effectiveness of that state's septic tank control program. Dr. Perkins worked with septic tank installers in developing and implementing environmentally protective system designs for use in areas not suitable for standard systems, and developed a number of guidance manuals along with a training program for installers and enforcement personnel. He has initiated research on the effects of septic tanks on ground water and has published on that topic. Since 1984, he has expanded his interests and activities to include development of a broader range of ground water quality protection policies and programs.

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Preface

About one in every four new houses being constructed makes use of an onsite septic system to treat and dispose of household wastewater. Too many of these systems do not do the job they are built to do. Failure takes the form of unpleasant and health-threatening sewage on the surface of the ground. It takes the form of sewage backing up into the plumbing fixtures inside the house. It takes the form of polluting the ground water destined to enter someone's well.

Failed onsite household wastewater disposal systems are becoming an increasing problem over much of the country as homes are constructed in rural areas unsuitable for conventional onsite systems. Two-thirds of the nation's land area is unsuitable for septic system installation and use. The septic tank installer who constructs a septic system inadequate for these sites may be asking for a critical review of his contractor's license. The homeowner who puts in an expensive but "environmentally responsible" system may be throwing money down the drain. The land developer who sells lots in these areas without providing a warning to consumers may spend some time in court. The governmental regulator who approves inadequate systems may spend some unpleasant time in his or her supervisor's office. The information herein is presented to prevent these sorts of problems as well as to expand the land area which can be safely developed through the use of modern septic system technology.

Even the most experienced installer of septic systems may not be able to put in a functional system which is significantly different in form and substance from those he has been installing all his life, particularly if he is provided only an explanation of the theories underlying the new technology. Installers must consider siting, design, construction, installation, operation, and maintenance. This book provides easy-to-understand methods of proper septic system practices suited to a broad range of site conditions, and the reasons for using them. Potential problems, both with the system components and the people who regulate septic systems, are described and potential solutions provided.

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Introduction

In nature, all living things use resources and produce wastes. The wastes of each group of organisms represent resources for another group of organisms, so that materials are recycled and reassimilated. We are now learning that our health is totally dependent on the health of the environment and its cycles, that accumulations of wastes can cause severe environmental pollution, and that wastes should be recycled whenever possible.

It used to be said that a stream would cleanse itself in 10 miles of flow. This distance generally was maintained between settlements along rivers so that the waste from an upstream settlement would not be consumed by those downstream. But, as population densities grew, the capacity of rivers and streams to assimilate the wastes and cleanse the water was exceeded, resulting in the accumulation of wastes in a deteriorating environment. Now communities using rivers and streams for water supplies must treat the water extensively because chances are that some proportion of the flow entered the water channel as waste discharged from an upstream community.

In many areas of the country, septic wastes from rural onsite liquid waste disposal systems constitute a major source of ground water recharge. Septic tanks and cesspools rank highest among all wastewater systems in total volume of wastewater discharged directly to ground water (more than a trillion gallons per year) and are the most frequently reported sources of fecal bacteria and toxic chemical contamination. It is said that a few feet of soil between the disposal excavation and the ground water table are sufficient to cleanse the sewage effluent. However, the cumulative effects of inadequately treated sewage on local and regional ground water quality are potentially much more serious than the effects of surface water pollution. The goal of proper onsite liquid waste disposal practices is both to prevent disease and to provide future generations with ground water that can be used without extensive and expensive treatment.

Periodic publications such as the *Journal of the American Water Works Association* and the *Journal of Environmental Health* have described a number of disease incidents associated with onsite waste disposal systems. In Richmond Heights, Florida, a church and day-care center septic tank contaminated a drinking water well 150 ft away. Twelve hundred people contracted gastroenteritis. In Polk County, Arkansas, the well of a general store became contaminated by septic tank effluent. Ice made from the well water transmitted viral hepatitis. In Yakima, Washington, typhoid fever was spread by wells contaminated by the septic system of a typhoid carrier. There are other instances throughout Europe and America where long-term biological and chemical contamination of ground water has resulted from onsite wastewater disposal.

People tend to dispose of their wastes into their neighbor's drinking water supply, whether surface or subsurface. Since the dilution factor is often relatively small for discharges into surface waters—some streams consist *only* of sewage—surface water supplies require expensive treatment. In terms of numbers of systems supplying water, wells are the most common and to date, very few water supplies from wells need treatment to make the water safe to drink. Prevention of contamination is much less expensive than paying to remove contaminants, particularly when treatment must be done by the homeowner instead of the community as a whole.

For many years, it was assumed that connection to public sewers should be the goal of every household. Only recently have the federal government and a few engineers, city councils, and county commissioners come to the realization that in many areas, onsite disposal is far more cost-effective than a collection system and a central treatment unit. Many of the sophisticated treatment plants built in rural communities have posed significant problems to those communities that could not afford the maintenance costs, paying skilled operators to manage the facilities, or paying the pollution fines resulting from improperly operated facilities.

Onsite disposal is a viable alternative to sewerage. It often provides a greater degree of protection to public and environmental health than a public facility, and at far less expense to the homeowner and the taxpayer. Given the fact that nonmetropolitan areas have been growing faster than cities, the future will bring an increasing concern for the health and environmental effects of onsite sewage disposal, as well as an increasing emphasis on the proper design, installation, operation, and maintenance of these onsite systems.

Onsite disposal systems can provide adequate ground and surface water protection for present and future generations, or they can make water totally unfit for consumption. Proper design, location, installation, and maintenance make the difference between these two scenarios. The one-half million new onsite systems being built each year have significant potential to impact ground water quality over large areas of the country. Many of these systems will be installed in areas of scenic beauty, suburban tranquillity, and environmental vulnerability. Where homesites are not amenable to standard onsite disposal practices, the protection of human health and environmental quality demands the use of systems designed to overcome particular limitations of the site. Areas of high flooding potential, steep slopes, thin topsoil, high ground water tables, and clay soils can present problems which, if not solved by design, can result in angry neighbors, paranoid public health officials, and resentful grandchildren.

The technology of onsite liquid waste disposal has rapidly advanced during the last decade. In addition to the rediscovery of very old and very satisfactory methods of disposal, new methods have been developed for application on difficult sites. These new methods have been in use long enough that some performance data are available. It is now possible to present design criteria, construction methods, and maintenance requirements, as well as to identify potential problems for each of these systems. The designs presented in Part II of this book are tested and proven, are addressed by many states in their regulations, and are suitable for use both by persons living an isolated existence far removed from neighbors and by developers planning waste disposal systems for subdivisions. However, each site has its own climatic and physical characteristics, each installer has his own techniques, and each user has his own habits. None of these designs can be guaranteed to function properly under all conditions. On the other hand, the designs are proven as presented, and any change in design to conform to local conditions should be made with a clear understanding of the effect of that change.

The purpose of this book is to provide information sufficient to allow a homeowner, potential homeowner, contractor, septic system installer, or consulting engineer to evaluate the future site of a