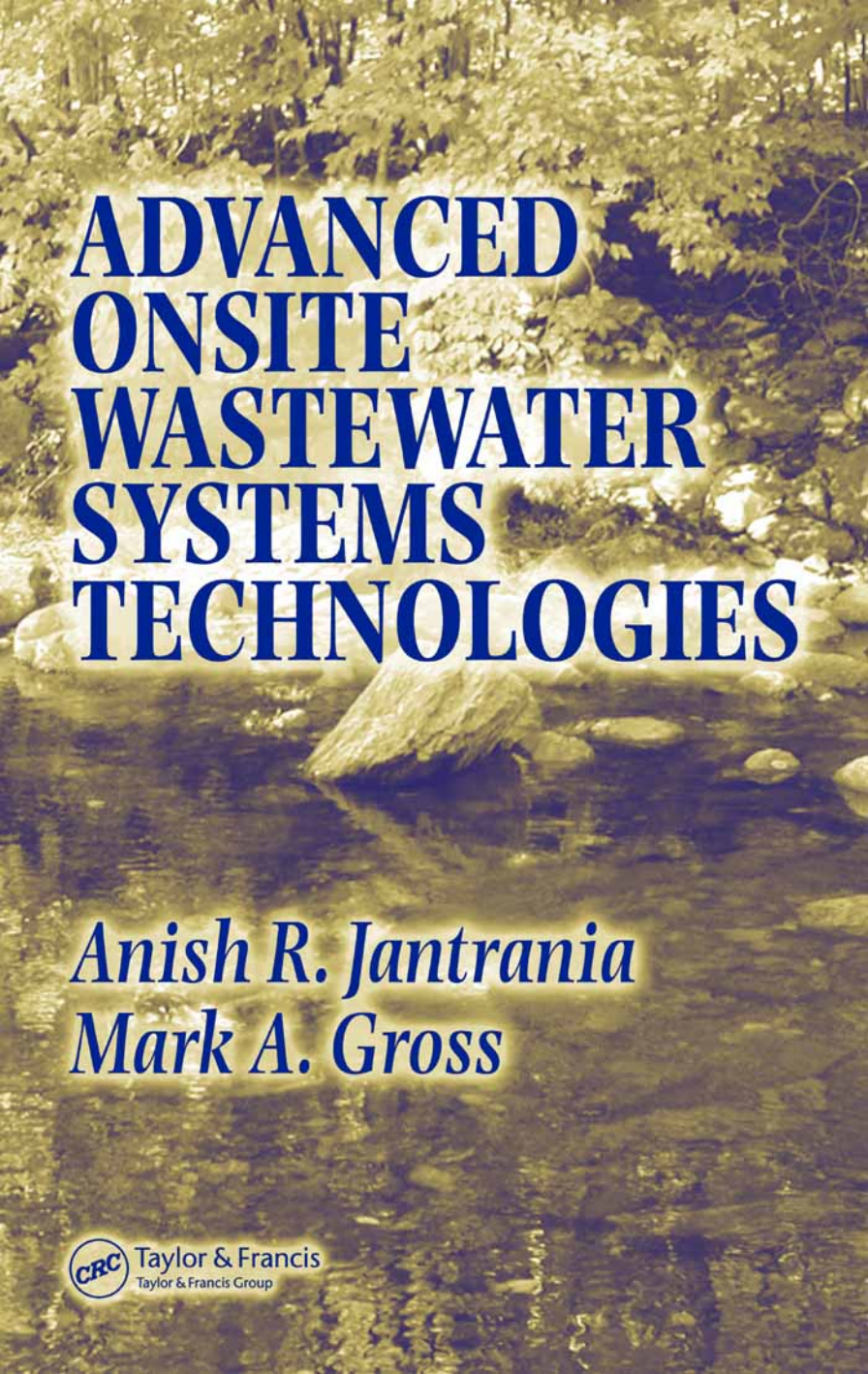
ADVANCED
ONSITE
WASTEWATER
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TECHNOLOGIES
Anish R. Jantrania
Mark A. Gross
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Anish R. Jantrania
Virginia Department of Health
Richmond, Virginia, U.S.A.

Mark A. Gross
University of Arkansas
Fayetteville, Arkansas, U.S.A.

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Foreword

Issues associated with management of human waste have plagued societies throughout history. Ancient texts refer to a variety of methods to mange human waste and in the generations since societies began to develop we have developed a better understanding of the public health, environmental quality and economic impacts of waste management programs and processes. As communities developed into cities, the need to treat and manage waste became critical and when water carrying plumbing developed, the need to find effective solutions to the issues associated with waste management was amplified tremendously.

Professions developed to address these issues. Here in the United States, the Public Health Service evolved to address issues of waste management. With passage of the Clean Water Act in the late 1960's, environmental health practice and wastewater engineering practice diverged. Since the Clean Water Act, tremendous federal resource has been allocated for proliferation of the large collection and treatment systems and there has been a perception that the onsite and decentralized efforts have waned.

In truth, much of the support for the onsite and decentralized effort has come from state and local government. The research and technology development associated with the onsite and decentralized system demonstrates that these are viable options for all areas of the country. Applications of these appropriate technologies and associated management programs are evident in urban, sub-urban, and rural areas. The USEPA and state agencies recognize the value of appropriate wastewater solutions.

This text addresses planning, design operations and maintenance issues associated with those technologies required as part of a comprehensive preapplication treatment. It discusses the variety of dispersal options available to distribute treated or reclaimed water into receiving environments and describes the opportunities available for recycling and reuse. Finally, this text discusses the importance of a comprehensive planning and management approach to dealing with wastewater management issues.

Drs. Anish Jantrania and Mark Gross have many years of valuable experience and they have synthesized and assembled that experience to provide this tremendously valuable reference for all environmental health and wastewater engineering practitioners. This text provides a well developed and comprehensive assessment of technology and management

solutions available to address a variety of waste management challenges. This text is an indispensable reference for all professionals involved in the planning, design, installation, operation, maintenance and management of wastewater systems.

Robert A. Rubin, Ed.D.
Professor Emeritus and Senior Environmental Specialist
North Carolina State University and McKim & Creed
Raleigh, North Carolina, USA
brubin@mckimcreed.com

Preface

Onsite treatment of wastewater and onsite dispersal of treated wastewater is not a new concept. Throughout the history of civilization in this country and other places in the world, onsite wastewater systems have been and will be an integral part of the overall wastewater management infrastructure. Onsite wastewater systems are here to stay and the U.S. Environmental Protection Agency (EPA) views adequately managed onsite systems as a cost-effective and long-term option for meeting public health and water quality goals, particularly in less densely populated areas. For one out of every four homes in the U.S. wastewater is treated onsite, typically using a septic tank and a drain field system. A septic system was, and with some modifications still is, the most common method for onsite wastewater treatment. However, just like any other field, significant advances have been achieved in onsite wastewater treatment and effluent dispersal technologies. A septic tank is now viewed only as a level one treatment system, while a variety of technologies such as packed bed media filters and flow-through or sequencing batch reactor treatment system are now considered as level two, three, or even level four treatment systems. These advanced systems can treat wastewater onsite from a single home or a cluster of homes, to effluent standards similar to those achieved by large centralized treatment plants. Highly treated wastewater can now be dispersed onsite using a conventional drain field or any one of the advanced technologies such as drip, spray, filter bed, evapo-transpiration bed, and greenhouse system, on land that is typically rejected for use of septic systems, i.e., on land that doesn't *perc*.

This book has three goals: introducing readers to advanced onsite wastewater systems technologies, suggesting regulatory and management frameworks for effective use of such technologies, and proposing vocabulary to better understand the benefits of such technologies. The advanced systems can meet demands for onsite wastewater management on two main fronts—new growth that is occurring in areas not served by centralized collection and treatment plants (sewer systems), and existing homes and businesses with failing or inadequate septic systems. The advanced systems' operations can be managed using monitoring devices that send signals to a central location, allowing a trained operator to ensure treatment performance of multiple systems by offering scheduled and emergency

services. Centralized management of onsite systems is now a reality and a necessity for all onsite systems. The five management models proposed by the U.S. Environmental Protection Agency (EPA) offer a good framework for initiating a global movement to bring all onsite wastewater systems into some form of recognizable management program so that their impact on public health and water quality can be measured and improved. Advanced onsite wastewater systems put more emphasis on treatment before discharge compared to conventional septic systems, thus requiring a higher degree of operational monitoring and ensuring measurable performance on a long-term basis. The onsite stakeholders are home and business owners, land developers, builders, planners, regulators, educators, trainers, consultants, designers, engineers, manufacturers, and service providers. They are intimately familiar with the use of septic systems and soil and site issues related to the *perc* test. To them, this book offers a new vocabulary of terms such as pollution scale, treatment scale, wastewater treatability, treatment levels, overall treatment levels, treatment before and after discharge, soil and site credits, performance standards, and performance matrix. The new vocabulary will improve communication among the onsite stakeholders for discussing advanced onsite wastewater systems technologies.

Advanced onsite systems should be viewed not just as an alternative to septic systems or centralized systems, but as an integral part of any wastewater infrastructure. Information in this book will complement the educational and training efforts undertaken by national organizations such as NOWRA, NEHA, NAWT, NSF, ASAE, WEF, NSFC, and regional/state associations, representing interests of onsite stakeholders. Improved knowledge and understanding of this subject matter will allow millions of home and business owners to have better access to the advanced onsite wastewater systems to meet their current and future wastewater needs. Education and training of wastewater professionals must parallel regulatory reform in order to adequately justify the newly developed professionalism and responsibilities undertaken by the certified and licensed professionals. Regulatory programs that were designed and developed for using conventional septic systems are no longer valid as the technology, management, and overall understanding of advanced onsite systems develop. Thus, there is a need for thorough evaluation and restructuring of state and local regulatory programs for onsite systems. This book offers suggestions on management and regulatory frameworks necessary for allowing the new generation of professionals to offer their services using advanced onsite wastewater systems that are currently available in the market.

Onsite systems must not be used as the tool for controlling growth in areas that are not served by centralized collection and treatment systems. Advanced onsite wastewater systems, just like technologies such as satellite television or wireless phone, neither require centralized networks of hardware nor special type of soil or site conditions for adequate onsite wastewater treatment and effluent dispersal. With the right regulatory attitude towards

public health and water quality protection goals, and with the right attitude from the products and service providers, it is now possible for adequately trained and appropriately licensed onsite wastewater professionals to offer onsite wastewater services to home and business owners on a permanent basis.

We would like to thank our friends, colleagues, and mentors in the wastewater technologies field who have contributed to moving away from status quo. We are thankful to our editor and publisher for the help and support they have provided. We would like to express our heartfelt gratitude to our families for their patience, encouragement, love, and support during the entire process of getting this book ready for publication.

Views expressed in this book are our own and they do not reflect views of our past, current, and future employers.

Anish R. Jantrainia, Ph.D., P.E.
Technical Services Engineer
Virginia Department of Health
Richmond, Virginia, U.S.A.
anish@advancedonsitesystems.com

Mark A. Gross, Ph.D., P.E.
Professor
University of Arkansas
Fayetteville, Arkansas, U.S.A.
mark@advancedonsitesystems.com

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Dedication

We dedicate this book to our family members, friends, and peers who constantly provided much needed support and the push for starting this project and getting it to completion.

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About the Authors

Anish R. Jantrania
Anish R. Jantrania is a Technical Services Engineer at the Virginia Department of Health in the Onsite Sewage and Water Program. Prior to joining the state health department in 1996, he worked for two years as an Engineering Consultant for the city of Gloucester, Massachusetts on the first national onsite demonstration projects funded by the U.S. EPA. Before that he worked as a Technical Program Coordinator at the National Small Flows Clearinghouse for four years. He received his B.E. in Agricultural Engineering from the College of Technology and Agricultural Engineering, Udaipur, India in 1982, M.S. in Agricultural Engineering from the Ohio State University in 1985 and Ph.D. in Agricultural Engineering with specialization in Environmental Systems Engineering from Clemson University in 1989. He has also received M.B.A. from West Virginia University in 1994 and is a registered professional engineer in Virginia, Massachusetts, and West Virginia. He has served on the board of directors for the National Onsite Wastewater Recycling Association (NOWRA) and has served on the technical review committee for revising the U.S. EPA Onsite Design Manual and is currently serving on the NOWRA Model Performance Code primary committee and evaluation committee.

Mark A. Gross
Mark Gross is a professor of Civil Engineering at the University of Arkansas in Fayetteville, Arkansas. He has a B.S. in Civil Engineering, M.S. in Civil Engineering, and a Ph.D. in Engineering. Dr. Gross has 20 years of experience in the decentralized wastewater field both as a teacher and as a designer. He has authored or co-authored over 75 articles in the field. His research is in the area of decentralized wastewater, currently working on phosphorus removal in soil-based systems. He maintains an active consulting practice in addition to his university duties, and is a registered professional engineer in Arkansas, Tennessee, Mississippi, Missouri, and Virginia.

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