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# FOREWORD

GROUNDWATER IS A precious resource for the United States. Nearly half of the population of this country, and over 90 percent of the population in rural areas, depend on groundwater as their primary source of water. We all expect that groundwater will be clean and pure, and, in particular, free from the contaminants that threaten our health. The frightening reality is, however, that groundwater is not safe from contamination.

Groundwater contamination is a national problem and the sources of potential groundwater contamination are everywhere. In this country, there are over 100,000 landfills, many of which contain hazardous materials, and many of which leak directly into groundwater. As many as 10 million underground storage tanks for petroleum and industrial chemicals threaten groundwater quality. Already, 41 states report groundwater contamination from such tanks. Wells are used to inject hundreds of millions of tons of toxic, hazardous, and other liquid wastes into the ground every year. Twenty-five states report groundwater contamination from pesticides that are applied in this country at a rate of 700 million pounds a year. Even the average American household uses about 25 gallons of hazardous chemical products each year to clean, paint, repair, and weed the garden. Many of these products end up down the drain or in the garbage and, eventually, in the groundwater.

The challenge for all of us is to act to protect the groundwater we all need from the contamination sources in all our communities. In Congress, we are responding with new legislation. In the 100th Congress, I introduced several significant bills that would strengthen federal laws protecting groundwater. The legislation I proposed would create a comprehensive structure to provide the same kind of protection to groundwater that we provide today to our nation's lakes and rivers under the Clean Water Act, I also introduced bills to expand research into the problem of groundwater contamination and to protect groundwater from pesticide contamination. Many of my colleagues in the Senate and in the House of Representatives support these efforts and some have introduced similar legislation. I hope and expect that groundwater protection legislation will be a high priority for Congress in the coming year.

Groundwater contamination is not, however, a problem that can be solved on the federal level alone. It will require strong and effective action in state legislatures and city councils, too. And, perhaps most of all, protection of our vulnerable groundwater resource will require that alert and concerned people around the country take action to protect the groundwater they and their neighbors use every day. Governments will not be able to solve this problem without the help and prodding of local citizen groups.

I strongly support the efforts of these groups to organize and educate their neighbors about groundwater and I encourage citizens to learn about and get involved in federal, state, and local groundwater programs. This kind of citizen action is what *The Poisoned Well* is all about. The book discusses in a practical way how to use the laws and regulations that are in place to stop ongoing contamination and get effective cleanup response from polluters and government agencies and to prevent contamination in the future. *The Poisoned Well* will help concerned people become active and effective advocates for groundwater protection.

Protecting our groundwater for our children is a challenge we all must accept and struggle with together if we are to succeed. The time for action is now.

David F. Durenberger  
United States Senator from Minnesota

# INTRODUCTION

RESIDENTS OF COLUMBIA, Mississippi, learned that barrels of benzene left at an abandoned chemical plant were leaking and had contaminated the groundwater supplying their town with drinking water. Faced with this serious health threat, the citizens of the town pressured the Environmental Protection Agency (EPA) into initiating a cleanup action.

In Lake Charles, Louisiana, people discovered that hazardous wastes were being injected into deep wells outside their town. Toxic contaminants were found in the regional drinking water aquifer. Citizens organized and forced some action at the site, but their fight to complete the cleanup continues.

In Massachusetts, an abandoned chemical pesticide plant caused the contamination of groundwater 60 feet below the surface, leading the town to close several drinking water wells. Local residents formed a citizens' group, spread information about the problem, and with the assistance of a national group, worked with EPA to develop a long-term cleanup plan.

These are just a few examples of the countless stories from around the United States about groundwater contamination. Groundwater contamination is no longer an isolated problem limited to a few heavy-industry states. Groundwater contamination is everywhere—cases range from pesticides polluting groundwater in farm states like Iowa to solvents from storage tanks leaking into aquifers in California's Silicon Valley. And because groundwater is such an important source of drinking and other water supplies—over 90 percent of the water used in rural areas, for example, comes from groundwater—contamination of groundwater can be a serious threat to human health. Pollutants commonly found in groundwater have been linked to illnesses ranging from bacterial infections to cancer. Individuals and citizen groups around the country are waking up to news stories about groundwater contamination in their own community and are beginning to worry about their health and their children's health. The question is, what can people do to protect their families from groundwater contamination?

This book is designed to help citizens to help themselves. This book is based on the idea that the best way for citizens to protect their health is to go out and wage their own fight against groundwater contamination. People can make a difference if they know how to use the legal and other

tools that are available to them. The primary focus of this book is advice about how to use the various federal laws and programs that can affect groundwater quality. There is no comprehensive federal groundwater protection scheme, but there are many laws and programs that can be used to protect groundwater quality. The discussion of these programs is directed toward the citizen who is neither a lawyer nor a scientist and it communicates the information about these programs that anyone who wants to use them needs to know.

We also recognize that often citizens can be most effective in dealing with local groundwater problems by working at the local level. As a result, we have included a substantial discussion of programs that are being tried by state and local governments and used by citizen groups to combat groundwater contamination. Because of the number and variety of such programs around the country we cannot cover them all, nor can we provide the sort of step-by-step advice that we offer in our presentation of federal programs. Instead, the state and local programs section of the book highlights some of the approaches in use and provides general suggestions for citizen action. It is up to the reader to take the ideas we present and investigate similar options wherever he or she may live.

All of the programs discussed in this book are similar in one respect. They provide only a framework for action. The laws themselves do not protect groundwater. It takes aggressive and effective enforcement action to ensure that the law is translated into clean groundwater.

Many people assume that government agencies alone are responsible for enforcing the law and providing the protection the law envisions; but all too often agencies do not fulfill their role. This inaction may happen for a variety of reasons ranging from budget shortfalls and meager staffs to agency policies or personnel opposed to aggressive enforcement.

Whatever the reason, when agencies do not do their job, citizens have to step in and do the work themselves. In the end, the laws and programs discussed in this book work only as well as you make them work.

### HOW TO USE THIS BOOK

This book is split into four parts, each with a different purpose. To make the best use of this book, you need to know how it is organized. Part I contains basic information about groundwater, how it is contaminated, how you might be affected, and how to find out whether your groundwater is polluted. Read Part I to lay the foundation for the suggestions for action made in later chapters.

Part II describes in a general way the nuts and bolts of using the laws. It explains how to obtain information from the government, how to work

with administrative agencies, and how to use the courts. It also provides some basic advice about organizing and using nonlegal political tools as part of an overall strategy.

Part III gives step-by-step advice about using specific federal programs. It is organized primarily by the potential sources of groundwater contamination, such as underground storage tanks or injection wells, but it also describes the programs generally applicable to a variety of potential sources. This part is the heart of the book and is designed to provide specific suggestions for action.

Part IV summarizes state and local programs. It is organized to parallel the structure of Part III, but it provides more general information about the types of state and local programs in existence and how citizens can use them.

To use the book, then, most readers will want to study Part I to gain an understanding of the basic problem and read Part II to learn about the basic processes they will become involved in and use. Parts III and IV can be read more selectively depending on the contamination problem in a particular locality. A reader concerned primarily about underground storage tanks, for example, should read the chapters devoted particularly to regulation of underground storage tanks under federal and state law (Chapters 19 and 30). Material describing general federal and state programs may also be helpful and should be reviewed (see Chapters 10 to 15 and Chapters 23 to 26). The other source-specific chapters, however, need not be studied, unless of course the reader discovers that the problem is broader or deeper than storage tanks.

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PART I

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**GROUNDWATER  
AND  
CONTAMINATION**

This part of *The Poisoned Well* provides the background information a citizen needs to implement the specific suggestions for action discussed in later chapters of the manual. This part begins with a brief introduction to groundwater—what it is and how it moves. Chapter 2 then explains how contaminants found in groundwater can affect your health, how those effects are measured, and how legal limits on contamination are established. Chapter 3 summarizes basic information about all of the major sources of groundwater contamination—what they are, what contaminants they produce, and how big a problem they create.

This part concludes with two chapters that will help citizens gather more basic information about the problem in their area. Chapter 4 explains how groundwater is monitored and tested, including how citizens can test their own water. Chapter 5 discusses techniques that can identify problem areas through the use of maps of groundwater and contamination sources.

Becoming an activist for groundwater protection means starting a continuing process of learning. The information contained in Part I will give the reader a solid foundation from which to begin taking concrete steps to preserve groundwater quality.

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## CHAPTER 1

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# Groundwater Basics

### HYDROLOGIC CYCLE

WATER IS ALWAYS on the move. The sun evaporates it from oceans, lakes, ponds, streams, and the leaves of plants. It falls to earth as rain, snow, sleet, and hail. Gravity pulls it down to rivers and into the ground. Hydrologists call the total system the hydrologic cycle. (See Figure 1.1.) Groundwater is one of the less visible components of the cycle, but the global volume of groundwater is second only to the oceans and polar ice caps, and of all available fresh water in the United States, 96 percent is groundwater.

Groundwater is basically precipitation that has percolated down into soil and filled the spaces in the rock below in the same way that water fills a sponge. The first water entering soil from rainfall or snowmelt replaces water previously evaporated or used by plants during dryer periods. Some of this new water quickly repeats the hydrologic cycle: it evaporates, is taken up and transpired by plants, or runs off into streams. (See Figure 1.2.) Any remaining precipitation, or water that leaches from surface water bodies into the soil, travels through an upper portion of soil and rock that hydrologists call the unsaturated zone. While the degree of saturation varies with the amount of precipitation, the unsaturated zone is generally characterized as containing water and air in the smaller pores or spaces of rocks and soil. Any water in this area that is not left clinging to soil due to molecular attraction will drain from the unsaturated zone down to the water table. The water table is a seasonally fluctuating boundary between the unsaturated zone and the saturated zone. In the saturated zone the pores and cracks in rocks and soils are filled only with water.

### AQUIFERS

Underground saturated rock formations that yield usable water are called aquifers. The minimum water content necessary to qualify a rock formation as an aquifer is a relative concept depending on the availability of