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Project Summary

Institutional Responses to Contamination of Ground Water Used for Public Water Supplies: Implications for EPA R&D Programs

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The objectives of this ground-water assessment were threefold: (1) to improve the U.S. Environmental Protection Agency's (EPA's) understanding of problems faced by the states and municipalities in ensuring that ground-water is safe for drinking; (2) to provide guidance to EPA in setting research and development priorities in ground water and drinking water areas; and (3) to present data on the original and final sets of ground-water contamination cases examined, with source lists for contacts at each organization dealing with the problem.

The scope of this assessment includes public water systems with confirmed drinking water contamination from synthetic organic chemicals in ground water. From a preliminary list of municipalities with ground-water contamination problems, a group of cases was selected for in-depth analysis. These select cases, chosen with the assistance of regional EPA and state officials, were studied through site visits and extensive telephone interviews.

This Project Summary was developed by EPA's Office of Exploratory Research, Washington, DC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Ground water is a vast but vulnerable natural resource. About 25 percent of all fresh water used in this country comes from ground water sources, and somewhat over 50 percent of the U.S. population relies on ground water, often untreated, as a primary source of drinking water. Ground-water use is proportionately higher for small water utilities and in rural areas, where over 90 percent of the population is dependent upon public or, more often, private wells for drinking water. Although more than 20 trillion gallons of ground water are withdrawn annually, the nation is not facing a problem with the quantity of ground water, because natural recharge is usually ten times as large as withdrawal.

The current problem associated with ground-water supplies is with quality rather than quantity. In many instances, organic chemicals are associated with ground-water contamination. Even though national organics monitoring programs earlier focused attention on trihalomethanes in surface water systems, as recently as five years ago, ground water was still thought to be relatively secure from organics contamination.

Several major national studies by EPA from 1975 through 1979 showed that a number of volatile chlorinated hydrocarbons (besides trihalomethanes) were frequently found in ground water. More recent studies confirmed earlier reports that several organic chemicals associated with solvents, especially trichloroethylene and tetrachloroethylene, were present in a significant number of water systems using ground water.

A recent survey showed that EPA drinking water research and development

assistance was the highest priority request from the States. The largest areas of concern in the drinking water field are related to the measurement, assessment, chronic health effects, and treatment of trace organics in ground water. This study was initiated to investigate trends in cases of ground-water contamination and to comment on the needs of States and municipalities in studying and resolving local cases of drinking water problems caused by contaminated ground water. The final report is organized into sections addressing the methodology employed, characteristics of the cases analyzed, research and development needs, and conclusions on trends in organic contamination of ground water. Included as appendices in the final report are: the results of the initial survey of water systems, complete case studies, and a list of contacts at every agency involved in each case.

Technical Discussion

In the course of this study, several distinct patterns of ground-water problems became apparent. Eighty percent of the cases involved trichloroethylene, detected at levels as high as 5,700 ppb in public wells. Tetrachloroethylene, trichloroethane, and other volatile halogenated organic compounds were detected less frequently and at lower levels. The major sources of these organic solvents were military contractors or airports, followed closely by plating industries, electronics industries, and chemical waste handlers. The most common point sources of pollution were leaking underground tanks or improper disposal of solvents. Several patterns of institutional response became apparent during the study. When organic-contaminated drinking water was identified, the local water utility would close the contaminated wells immediately and invoke conservation measures or purchase water to replace lost capacity. State and technical consultants would then determine the source of contamination and restore long-term water supplies. In the majority of cases, new or recompleted wells were selected over water treatment or aquifer rehabilitation as a long-term water source.

Typically, local water authorities would be working with the county health or environmental department, the state health department and environmental agency, and regional U.S. Environmental Protection Agency (EPA) officials. The capabilities of state agencies, which often took the lead in resolving ground-water contamination cases, varied widely. The State of New York, for example, has studied organics in ground water extensively, while the State of Washington has barely enough staff or funding to conduct any investigations at all. Several states, such as Arizona, have set up their own versions of Superfund (CERCLA) to attempt to respond to hazardous waste problems. The Department of Defense also has become involved in a significant number of cases through programs such as the Air Force's Installation Restoration Program.

The major technical deficiency encountered was a paucity of information on the health effects of organics in drinking water and a lack of consistent health guidelines. Evaluating the hazards of keeping contaminated wells in service, informing the public, and designing treatment techniques were all made difficult by weaknesses in health data and inconsistencies in recommended allowable levels of contamination.

Tracing the sources of organics in ground water was a serious problem. Several investigations were limited by costly drilling techniques, by complicated data requirements for ground-water modeling, or by an overall lack of institutional coordination. Many regions face a shortage of qualified hydro/geological personnel to carry out extensive subsurface studies.

The state-of-the-art of treatment techniques to remove organics from drinking water was not a limiting factor; either EPA personnel or engineering consultants were able to design effective treatment plants. Aeration techniques were usually employed, although little is known about the levels of air contamination due to aeration. The major constraints in designing treatment methods were the uncertainties in specifications for allowable effluent levels of organics. Most municipalities examined in this study handled the problem of organic chemicals in their ground-water fairly well, but more work is needed to improve several areas of response. The most critical research and development need for states and municipalities is in health effects research, followed by establishment of consistent guidelines or standards for organics in drinking water. The dissemination of technical information on detection, analysis, and engineering control techniques is also necessary to help local and state officials to make informed decisions on resolving problems with organic contaminants in ground water.

In most cases, testing and monitoring techniques were adequate; however, development of more comprehensive and less expensive methods of analysis and development of standardized monitoring protocols would improve the detection and resolution of organic contamination problems.

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The complete report, entitled "Institutional Responses to Contamination of Ground Water Used for Public Water Supplies: Implications for EPA R&D Programs," (Order No. PB 84-140 326; Cost: $19.00, subject to change) will be available only from:

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