Ground-Water Quality Atlas of Oakland County, Michigan

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ABSTRACT

The U.S. Geological Survey (USGS), in cooperation with Oakland County Health Division (OCHD), collected 140 water samples from 38 wells in Oakland County during 1998 to better understand ground-water quality. OCHD had observed temporal variations in concentrations of various constituents, so two additional sets of samples were collected to evaluate potential short-term variability related to sample collection procedures and long-term seasonal variability. Replicate samples from 28 wells were analyzed in the Michigan Department of Environmental Quality (MDEQ) Drinking Water Laboratory to compare MDEQ's analytical results to those obtained from the USGS National Water Quality Laboratory. Several additional databases describing population, land use, water supply, soils, geology, and flows of ground water and surface water are presented in the first part of the report to assist in interpreting the water-quality data. Maps created from these databases are provided in the first portion of the report as an extension of the study-area description.

The U.S. Environmental Protection Agency (USEPA) has established Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant Levels (SMCL) for which samples were analyzed in this study. Water from the 38 wells sampled by the USGS did not exceed the SMCL or MCL for sulfate, fluoride, or nitrite. However, water from 26 wells exceeded the SMCL for iron, water from 12 wells exceeded the SMCL for manganese, and water from 12 wells exceeded the SMCL for dissolved solids. Water from two wells exceeded the MCL for nitrate, although nitrate concentrations in water from most wells was below the detection limit. Water from seven wells exceeded the SMCL for chloride, and water from all wells contained detectable concentrations of chloride. Water from five wells exceeded the MCL for arsenic, and most of the wells sampled contained detectable concentrations of arsenic. These five wells were identified from previous MDEQ analyses to have elevated arsenic concentrations, and were sampled to obtain additional chemistry information. Replicate samples were collected from 26 of the 38 wells for analysis at the MDEQ Drinking-Water Laboratory to compare the results with the USGS National Water Quality Laboratory. The results of the replicate analyses indicate close agreement between the laboratories, with mean differences for nitrate, chloride, and arsenic of 0.10 milligrams per liter (mg/L) as nitrogen, 6.8 mg/L, and 0.0008 mg/L, respectively between the USGS and MDEQ analyses. Potential health effects associated with ingesting nitrate, chloride, and arsenic are provided with the water-quality data, along with references for further information.

INTRODUCTION

In 1996, the U.S. Geological Survey (USGS), in cooperation with the Michigan Department of Environmental Quality (MDEQ), the University of Michigan, and nine counties in southeastern Michigan, began a

study of the occurrence and distribution of arsenic in ground water in southeastern Michigan. The early results of this study raised broader concerns in Oakland County about the quality of ground water used for drinking water. In response to these concerns, the USGS, in cooperation with the Oakland County Health Division (OCHD) initiated a study of distributions of arsenic, nitrate, and chloride in ground water in Oakland County. A series of USGS Fact Sheets were produced in December 1998 to present maps and information to residents of Oakland County about the distribution and potential health effects of these chemicals in ground water.

Understanding the distribution of these chemicals required the compilation of several supporting data sets describing the geologic and hydrologic setting of Oakland County. These data sets are presented in the first part of this report. Water samples from 38 wells across Oakland County were analyzed for arsenic, nitrate, chloride, and more than 20 additional physical and chemical characteristics. Complete analytical results are provided in Appendix 1. A comparison of analytical results from the USGS National Water-Quality Laboratory (NWQL) and the MDEQ Drinking Water Laboratory is presented in Appendix 2.

Purpose and Scope

This report provides information on the distribution of arsenic, nitrate and chloride in ground water in Oakland County and the potential health effects of each chemical. Analytical results are presented for water samples collected by the USGS in Oakland County in 1998, as well as several supporting spatial databases describing the demographic, geologic, and hydrologic context of Oakland County. This report also provides several maps, generated by the Center for Applied Environmental Research at the University of Michigan-Flint (CAER) from information in MDEQ databases, to describe the occurrence of arsenic, nitrate, and chloride in ground water.

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STUDY-AREA DESCRIPTION – OAKLAND COUNTY, MICHIGAN

A variety of spatial databases were generated or modified for use in this study, and are presented in the next several pages to provide a context for the study. Included are descriptions of the glacial geology, soils, surface- and ground-water resources, as well as summary information about water-use, population growth, and land-use change in Oakland County. Oakland County, with a land area of 900 square miles, contains 25 survey townships and is the largest county in the Lower Peninsula of Michigan. With more than 1.2 million residents, Oakland County is the second most populous county in Michigan.