

## State Summary for Missouri

Information on population density, use of domestic-water supply, land use, and distribution of the 11 selected contaminants (arsenic, atrazine, benzene, deethylatrazine (CIAT), manganese, nitrate (data for nitrate consists of analyses for nitrite plus nitrate, as N, by the laboratory), perchloroethene (PCE), radon, strontium, trichloroethene (TCE), and uranium) for domestic well data for Missouri is shown in figures MO1–MO16. The percentage of samples greater than U.S. Environmental Protection Agency (USEPA) human-health benchmarks for National Water-Quality Assessment (NAWQA) Program major-aquifer studies that included Missouri and had at least 10 samples is given in table MO1. The areal extent of some NAWQA major-aquifer studies goes beyond the State boundary (fig. MO4). All data associated with a major-aquifer study are provided and are used in contaminant summaries even if the sampled well was located outside the State boundary. The “Selected References” section at the end of this summary lists previous Missouri studies that are relevant to the 11 contaminants.

In Missouri, the largest areas with the highest population density are located along the east-central and west-central parts of the State (fig. MO1). About 35 percent of the domestic (private) supply and public supply is obtained from ground water. The population (by census-block group for 1990) using a domestic-water supply from ground water was widespread throughout the State, with the exception of most of the northern part of the State and the two major population centers where less than 250 people per census block group were using ground water as a domestic water supply (fig. MO2). Most of the land use consists of agricultural and forested areas (fig. MO3).

Two major-aquifer studies with more than 10 samples in one principal aquifer (Ozark Plateaus aquifer system) were conducted in Missouri (fig. MO4). The Ozark Plateaus aquifer system is located in the southern part of Missouri (fig. MO4) and limestones and dolomites with some sandstones make up the majority of the aquifer rock types (Miller and Appel, 1997). Confining units within the aquifer system are shale or

dolomite, and the lithology of the aquifers and their hydraulic character are consistent over a large area.

Water-quality data for 11 selected contaminants (table 2) in samples from domestic-water supplies were compiled and summarized. The concentrations relative to USEPA human-health benchmarks (table 2, fig. MO5) and the number of major-aquifer studies with concentrations greater than human-health benchmarks were both considered in evaluating the potential concern to human health. This analysis assumes that current USEPA benchmarks (U.S. Environmental Protection Agency, 2006) are the most relevant and accurate measure of human-health risk.

Radon had the greatest potential human-health concern because it had the largest percentage of samples with concentrations greater than the human-health benchmark of 300 picocuries per liter (pCi/L). About 67 percent of the samples in the ozrksus3a major-aquifer study in the Ozark Plateaus aquifer system had radon concentrations greater than 300 pCi/L, which is the proposed Maximum Contaminant Level (MCL) for radon (table MO1). About 52 percent of samples in the ozrksus2a major-aquifer study in the Ozark Plateaus aquifer system had radon concentrations greater than the proposed MCL (table MO1). None of the radon concentrations were greater than the alternative proposed MCL of 4,000 pCi/L (table MO1). Radon-222 is a decay product of radium-226, and radon concentrations greater than the human-health benchmark are widespread and probably can be attributed to natural sources in the soil and rock material in Missouri.

NAWQA data showed arsenic concentrations to be greater than the human-health benchmark (MCL of 10 micrograms per liter (µg/L)) in one sample, and U.S. Geological Survey (USGS) State data showed concentrations of one additional sample greater than the human-health benchmark (fig. MO6). Manganese was not greater than the human-health benchmark (Lifetime Health Advisory (HA) of 300 µg/L) in any NAWQA samples; however, two manganese concentrations were greater than the human-health benchmark for USGS State data (fig. MO10).

**Table MO1.** Percentage of samples with concentrations greater than U.S. Environmental Protection Agency human-health benchmarks for National Water-Quality Assessment (NAWQA) Program major-aquifer studies that included Missouri and had at least 10 samples.

Study-Unit code for NAWQA major-aquifer study	Principal aquifer	Contaminant	Number of samples	Percentage of samples with concentrations greater than human-health benchmark
ozrksus3a	Ozark Plateau aquifer system	Radon	12	<sup>1</sup> 67/0.0
ozrksus2a	Ozark Plateau aquifer system	Radon	31	<sup>1</sup> 52/0.0

<sup>1</sup>First number is the percentage greater than 300 picocuries per liter (proposed Maximum Contaminant Level), and second number is the percentage greater than 4,000 picocuries per liter (alternate proposed Maximum Contaminant Level).

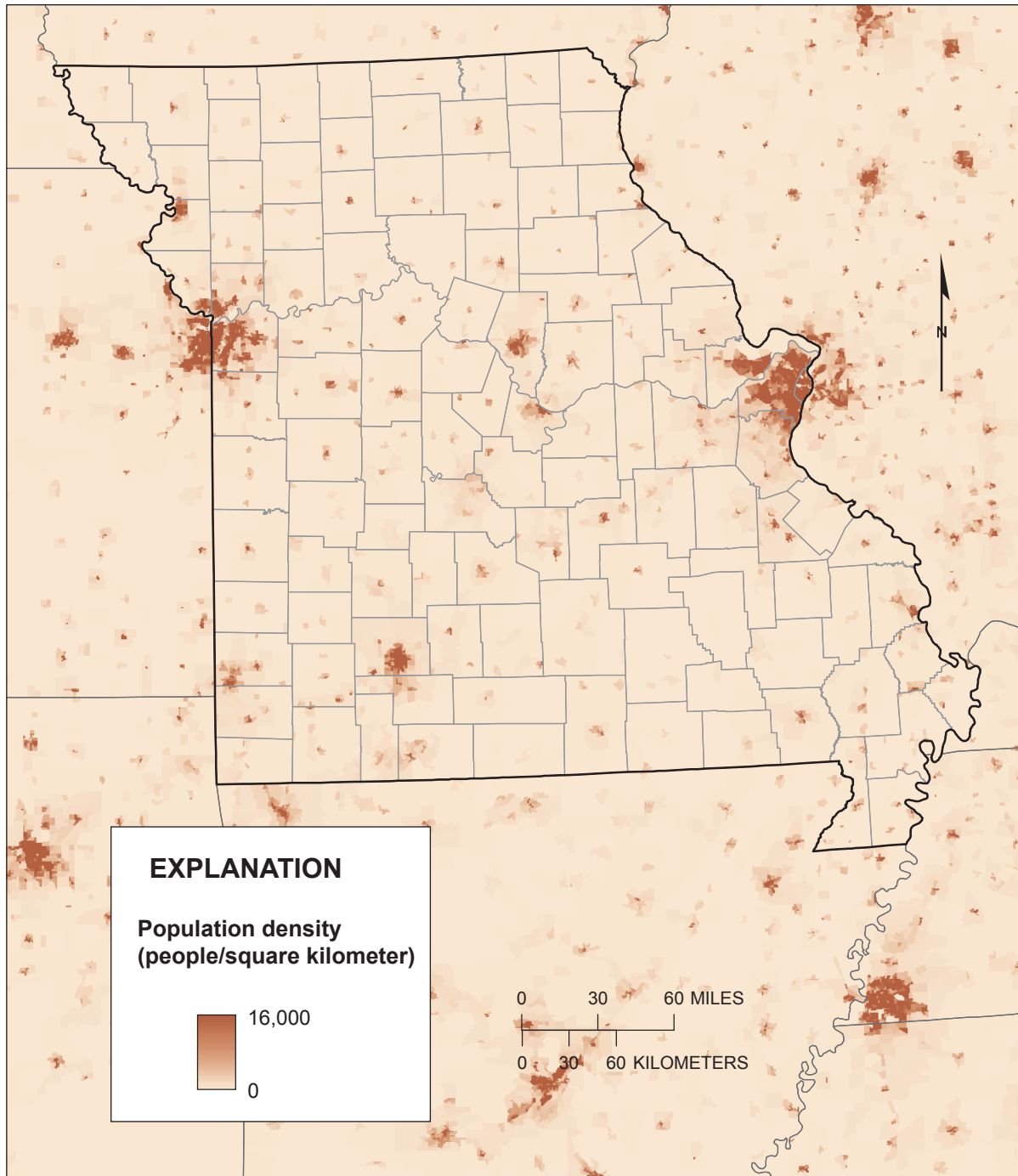
NAWQA data showed that nitrate concentrations were all less than the human-health benchmark (MCL of 10 milligrams per liter (mg/L) as N), but USGS State data showed several areas in the western part of Missouri to have nitrate concentrations greater than the human-health benchmark (fig. MO11). These nitrate concentrations appear coincident with agricultural land use, and some people could be using domestic-water supplies in these areas on the basis of water-use data.

For the entire Missouri data set, atrazine (fig. MO7), benzene (fig. MO8), CIAT (fig. MO9), PCE (fig. MO12), strontium (fig. MO14), TCE (fig. MO15), and uranium (fig. MO16) did not have concentrations greater than USEPA human-health benchmarks for either NAWQA or USGS State data. No NAWQA data were collected for strontium. CIAT is a degradation product of atrazine and does not have a human-health benchmark; however, for this report, the MCL for atrazine is used as a benchmark for CIAT because their toxicities are considered equivalent.

## Selected References

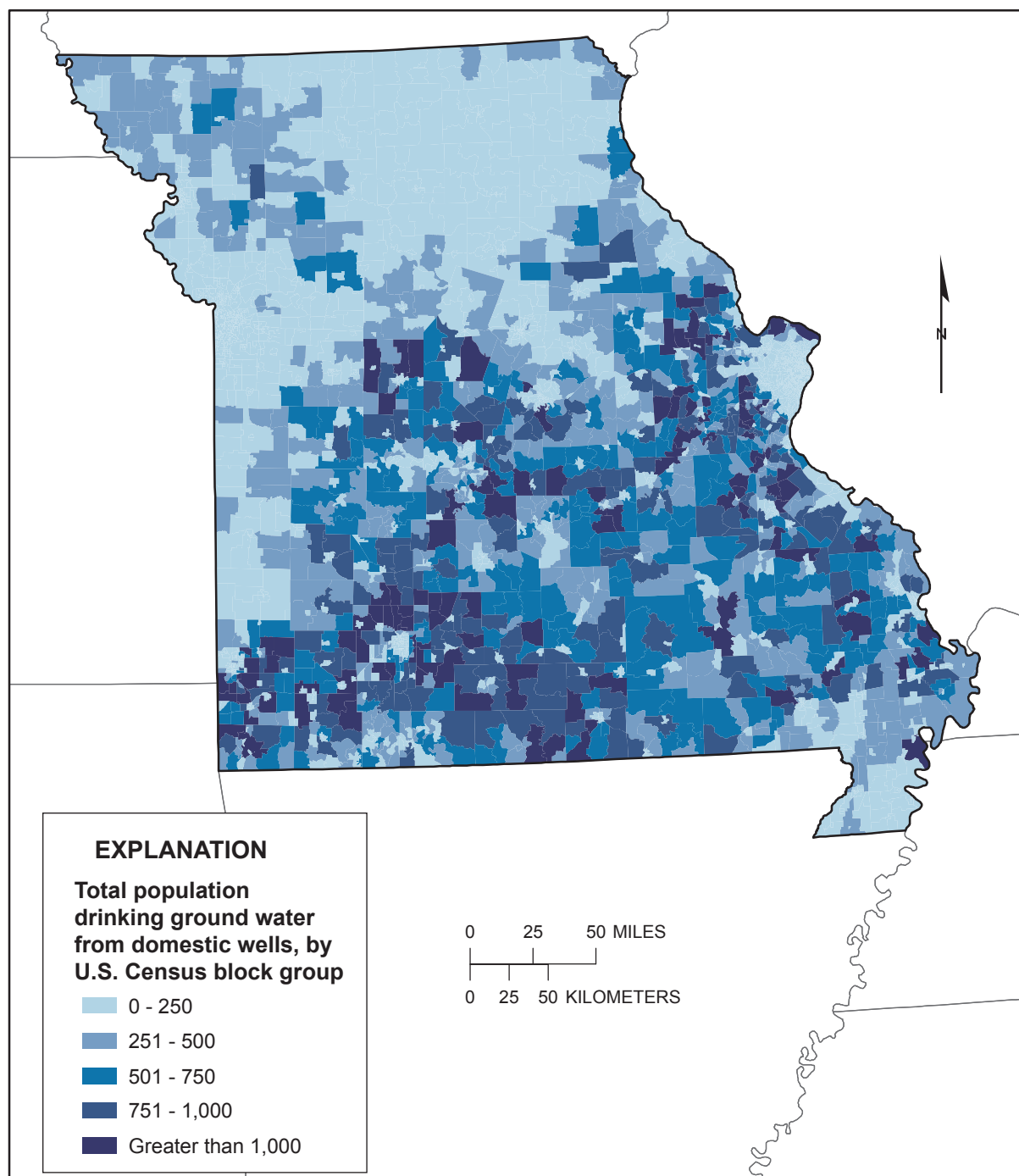
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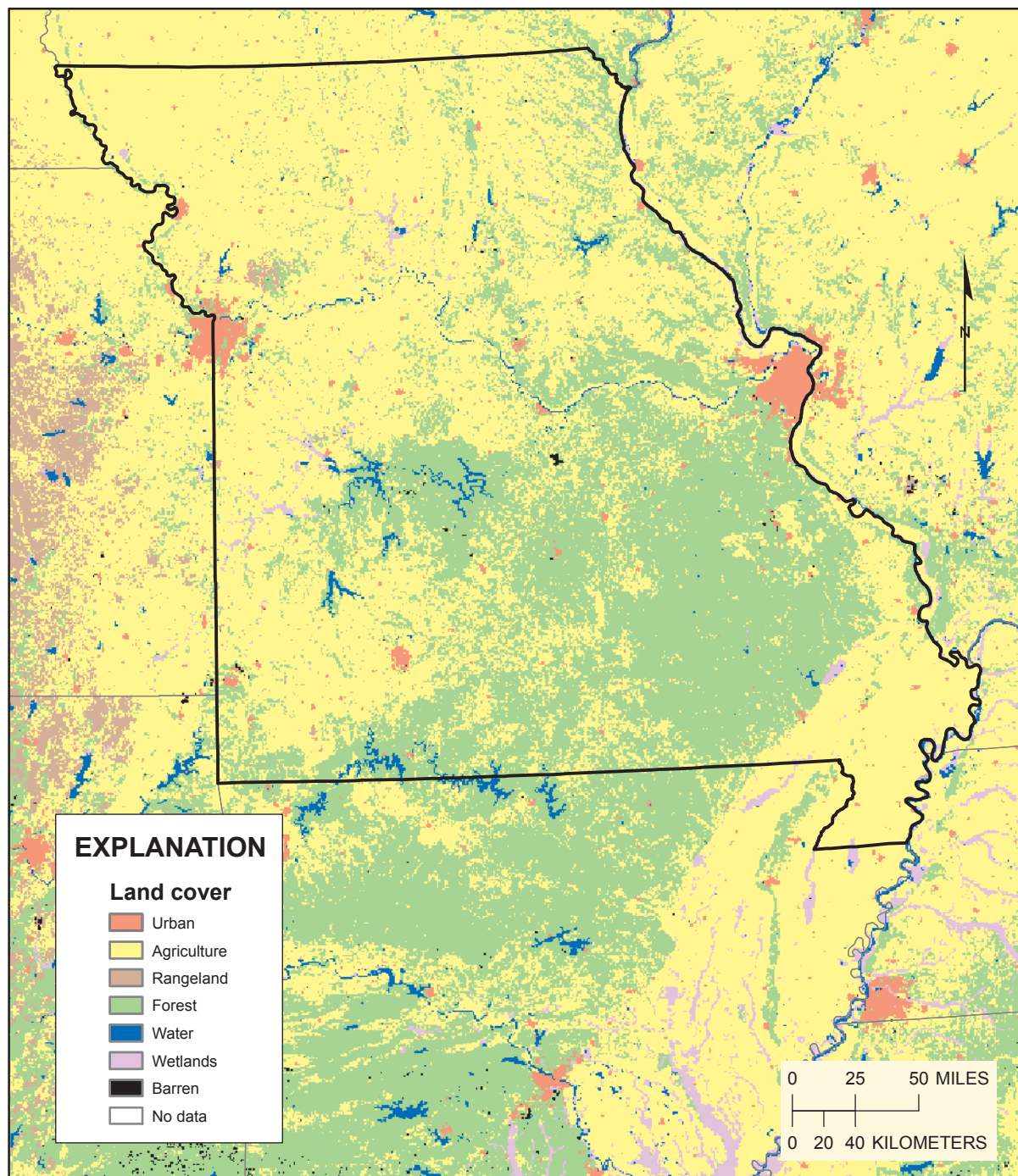
**Figure M01.** Population density for Missouri and nearby States. (Data from Hitt, 2003.)



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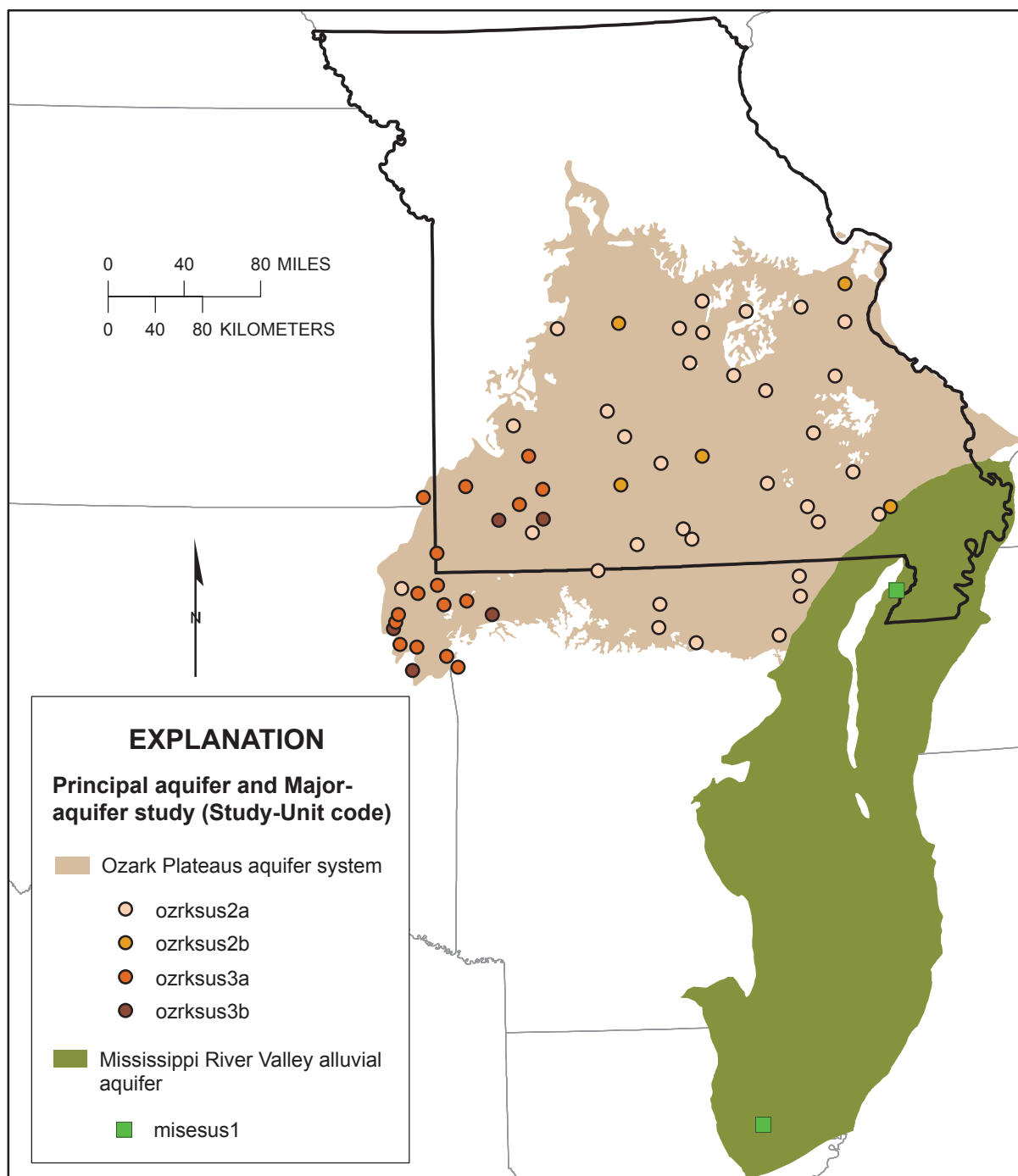
**Figure M02.** Population using domestic-water supply (from ground water) for Missouri. (Data from 1990 U.S. Census block group, Kerie Hitt, U.S. Geological Survey, written commun., 1997.)





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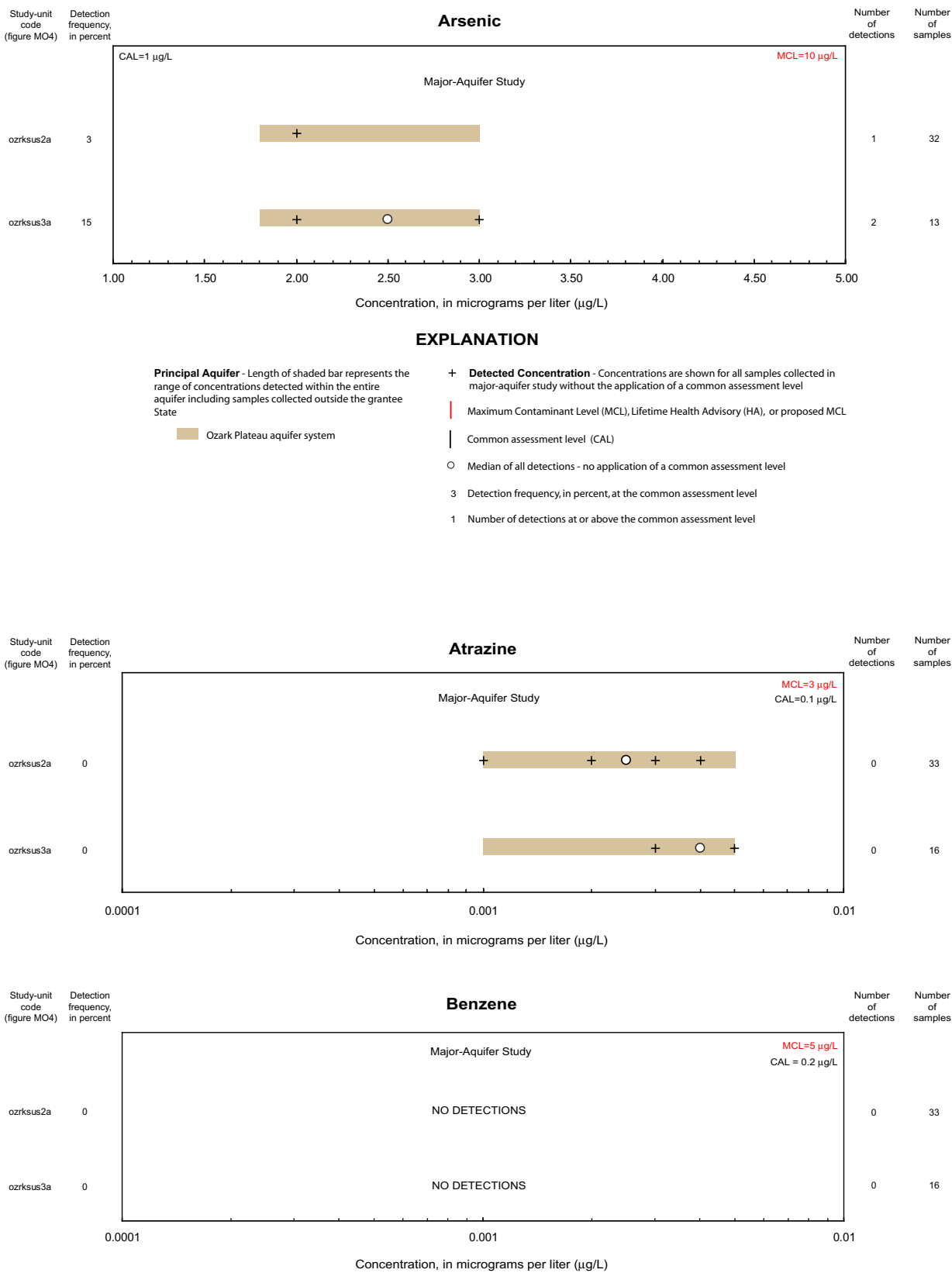
**Figure M03.** Land use/land cover for Missouri and nearby States. (Data from Naomi Nakagaki, U.S. Geological Survey, written commun., 2005.)



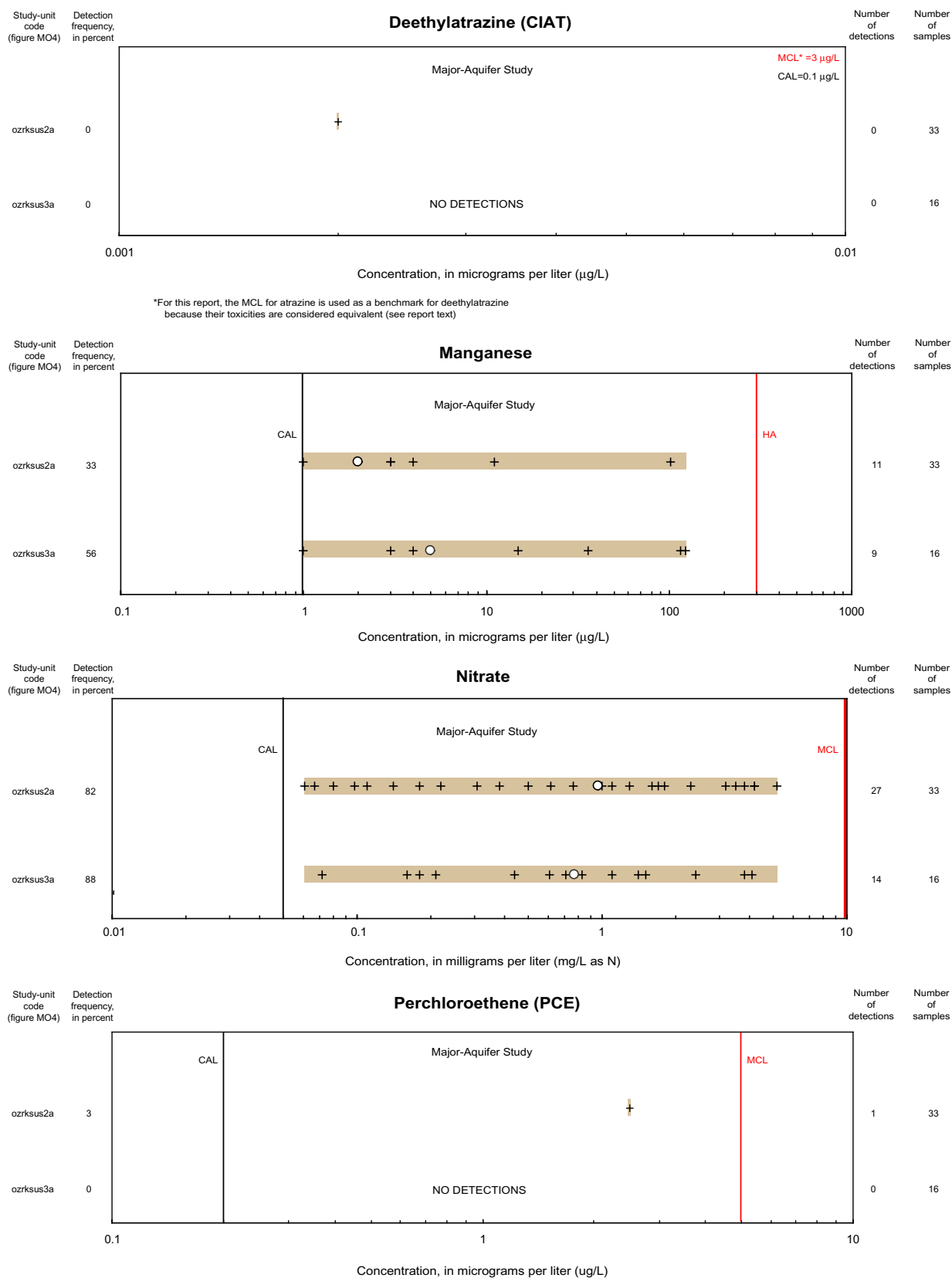
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Principal aquifer data from U.S. Geological Survey, 2003

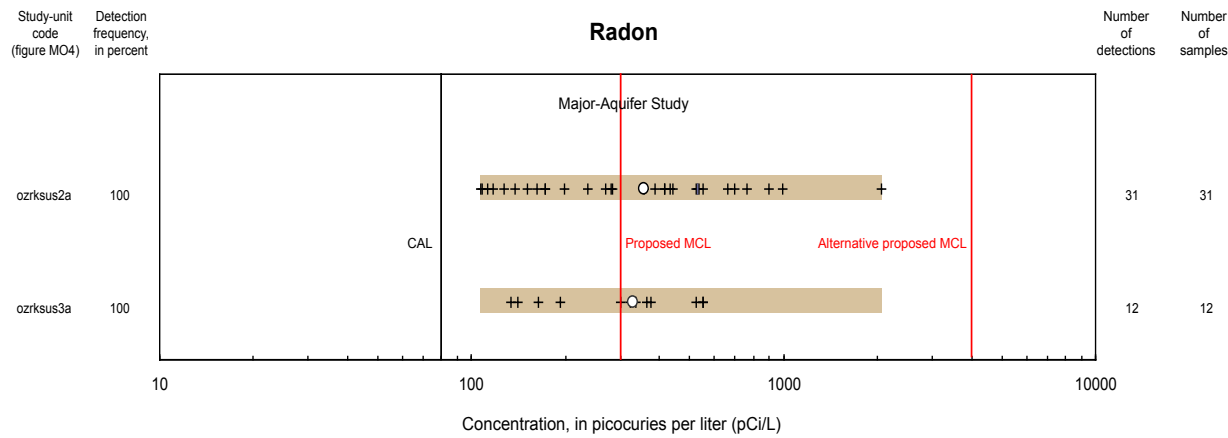
**Figure M04.** Location of domestic wells sampled for National Water-Quality Assessment (NAWQA) major-aquifer studies that included Missouri.



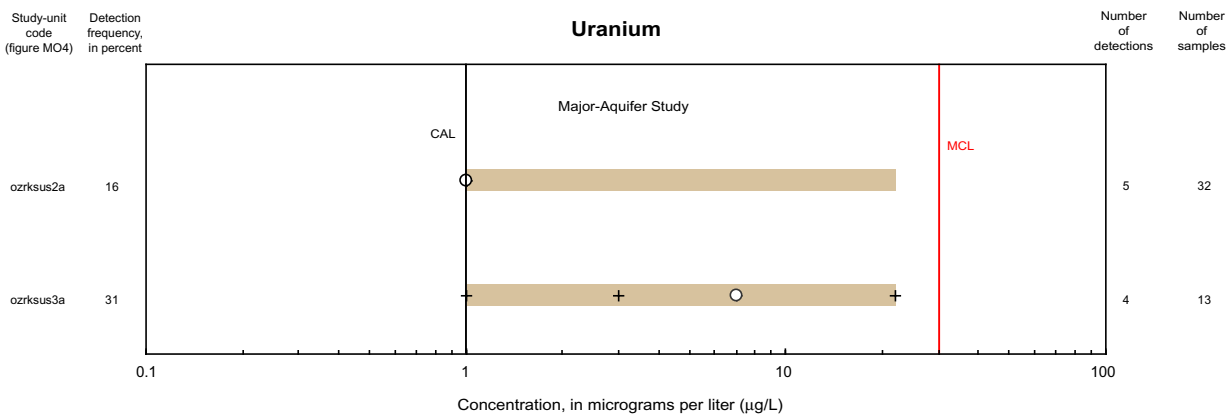
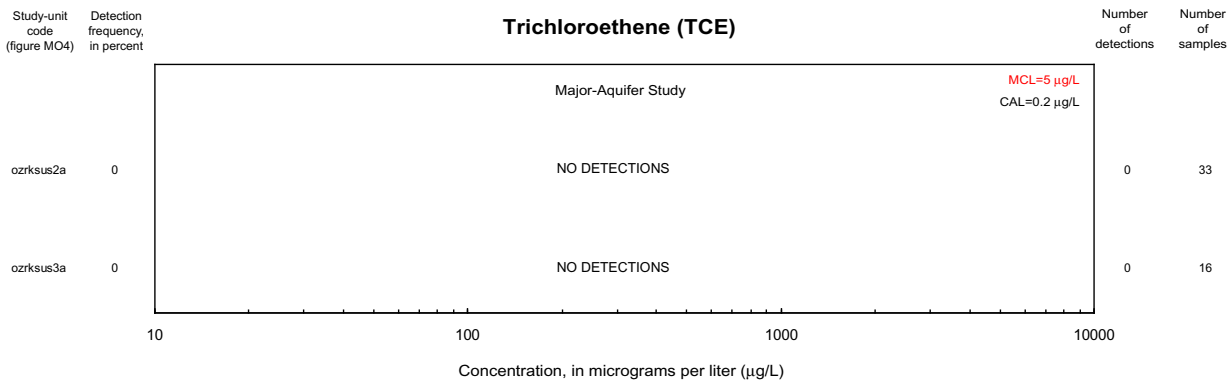




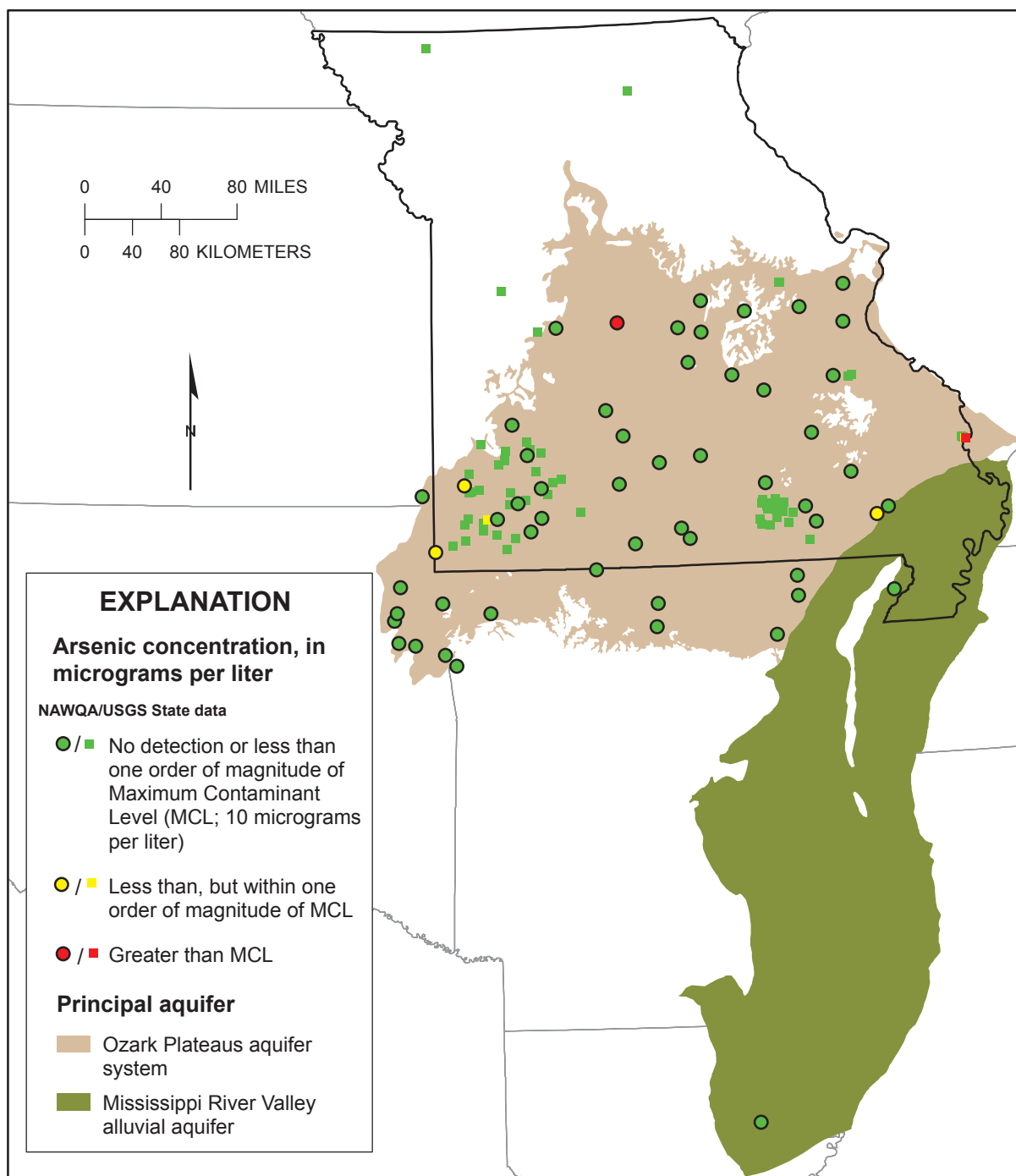
**Figure M05.** Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for Missouri (includes studies for which at least 10 analyses were available).—Continued



There are no strontium data for Missouri.



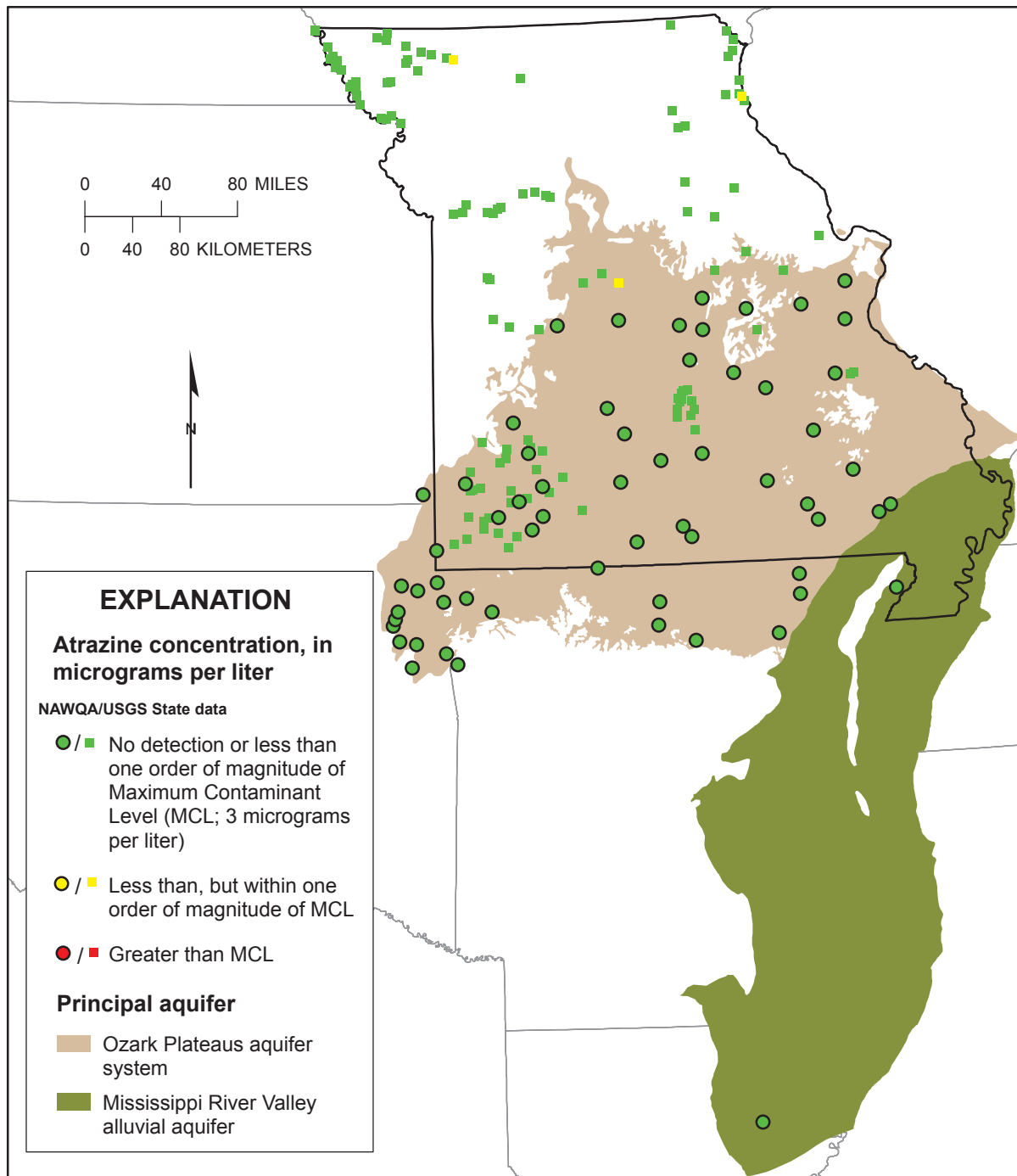
**Figure M05.** Statistical summary for 11 selected contaminants by major-aquifer study using domestic-well data from National Water-Quality Assessment (NAWQA) studies for Missouri (includes studies for which at least 10 analyses were available).— Continued



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Principal aquifer data from U.S. Geological Survey, 2003

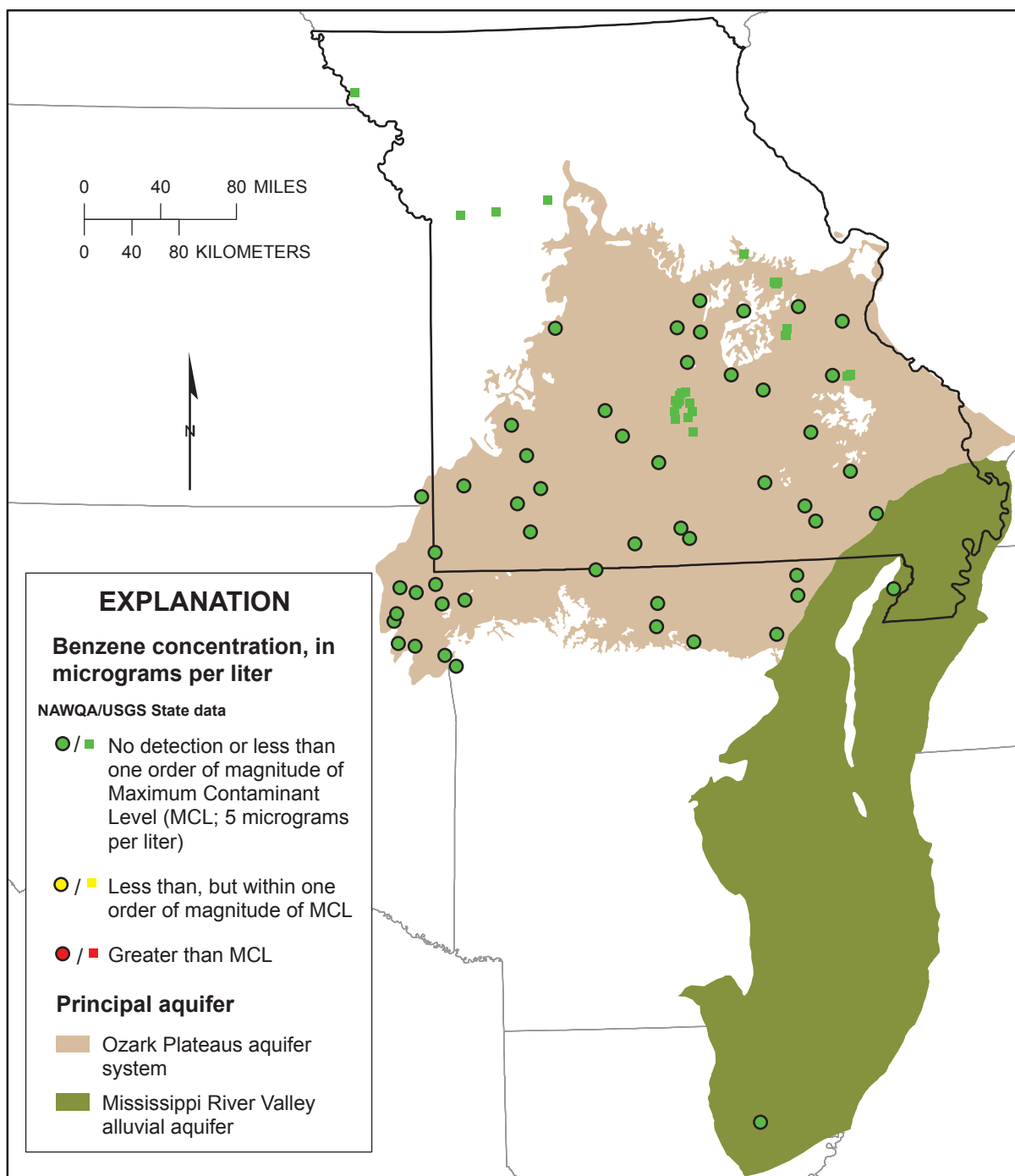
**Figure M06.** Concentration of arsenic in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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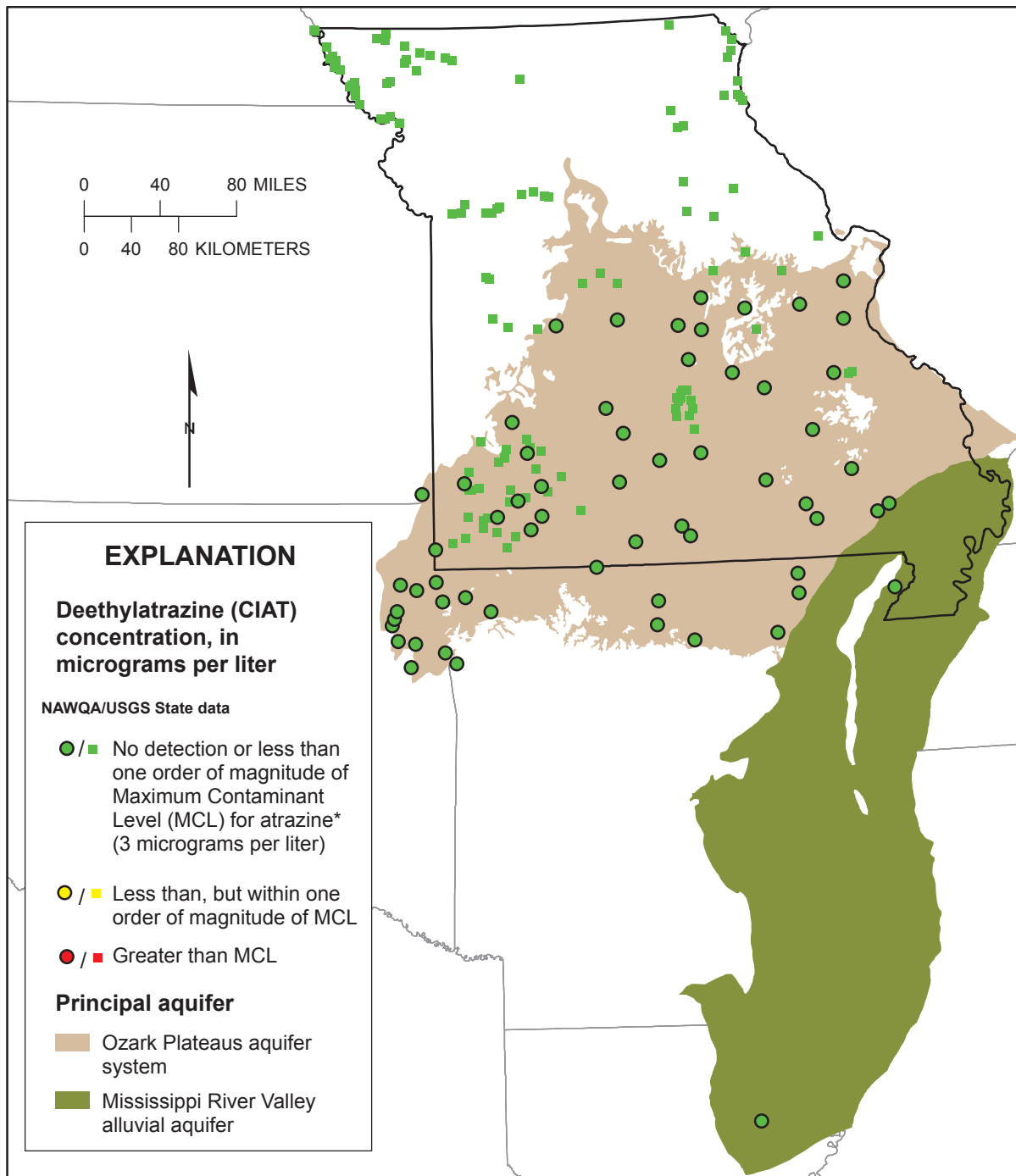
**Figure M07.** Concentration of atrazine in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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Principal aquifer data from U.S. Geological Survey, 2003

**Figure M08.** Concentration of benzene in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).

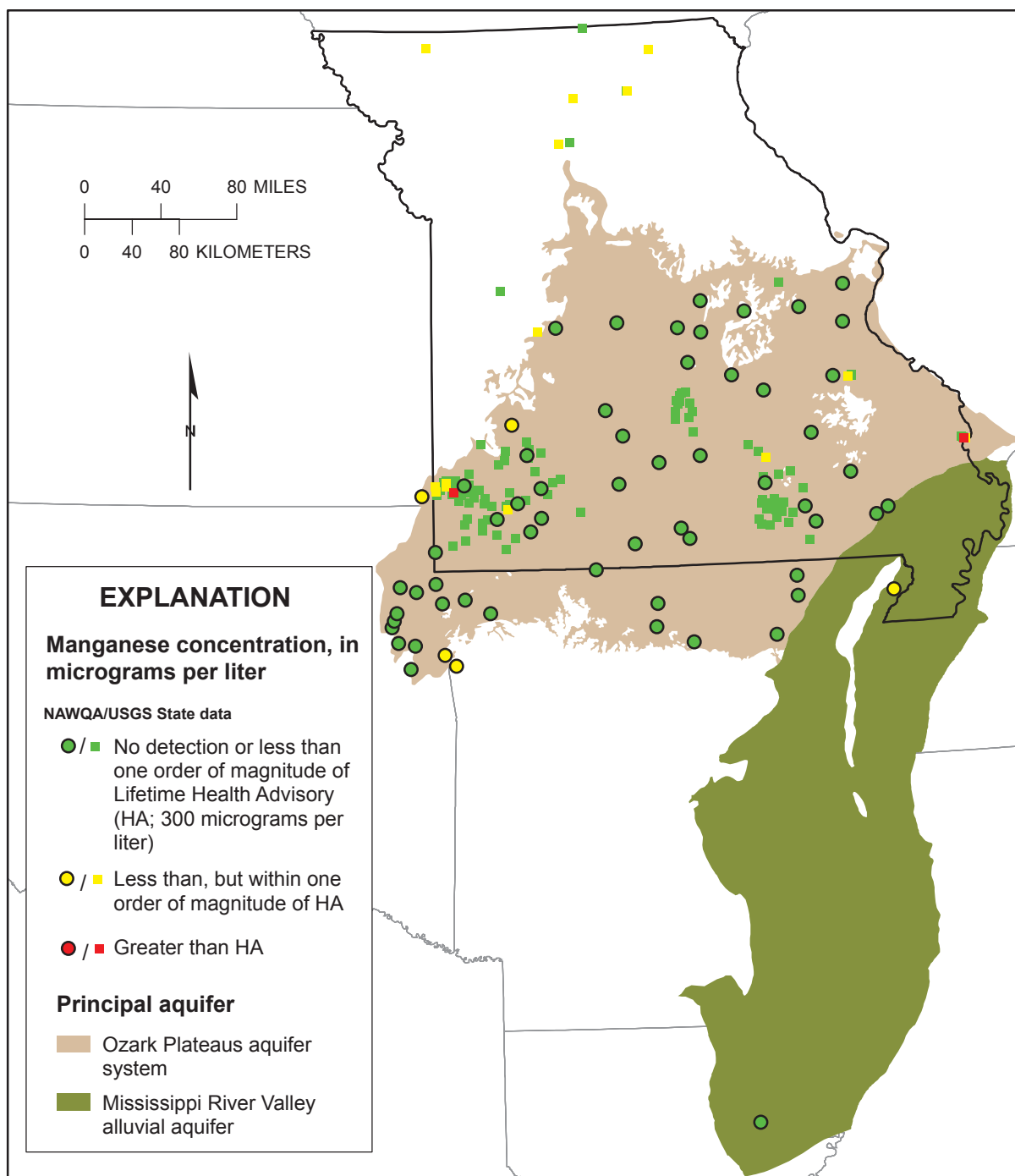


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Principal aquifer data from U.S. Geological Survey, 2003  
 \* For this report, the MCL for atrazine is used as benchmark for deethylatrazine because their toxicities are considered equivalent (see report text).

**Figure M09.** Concentration of deethylatrazine (CIAT) in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).

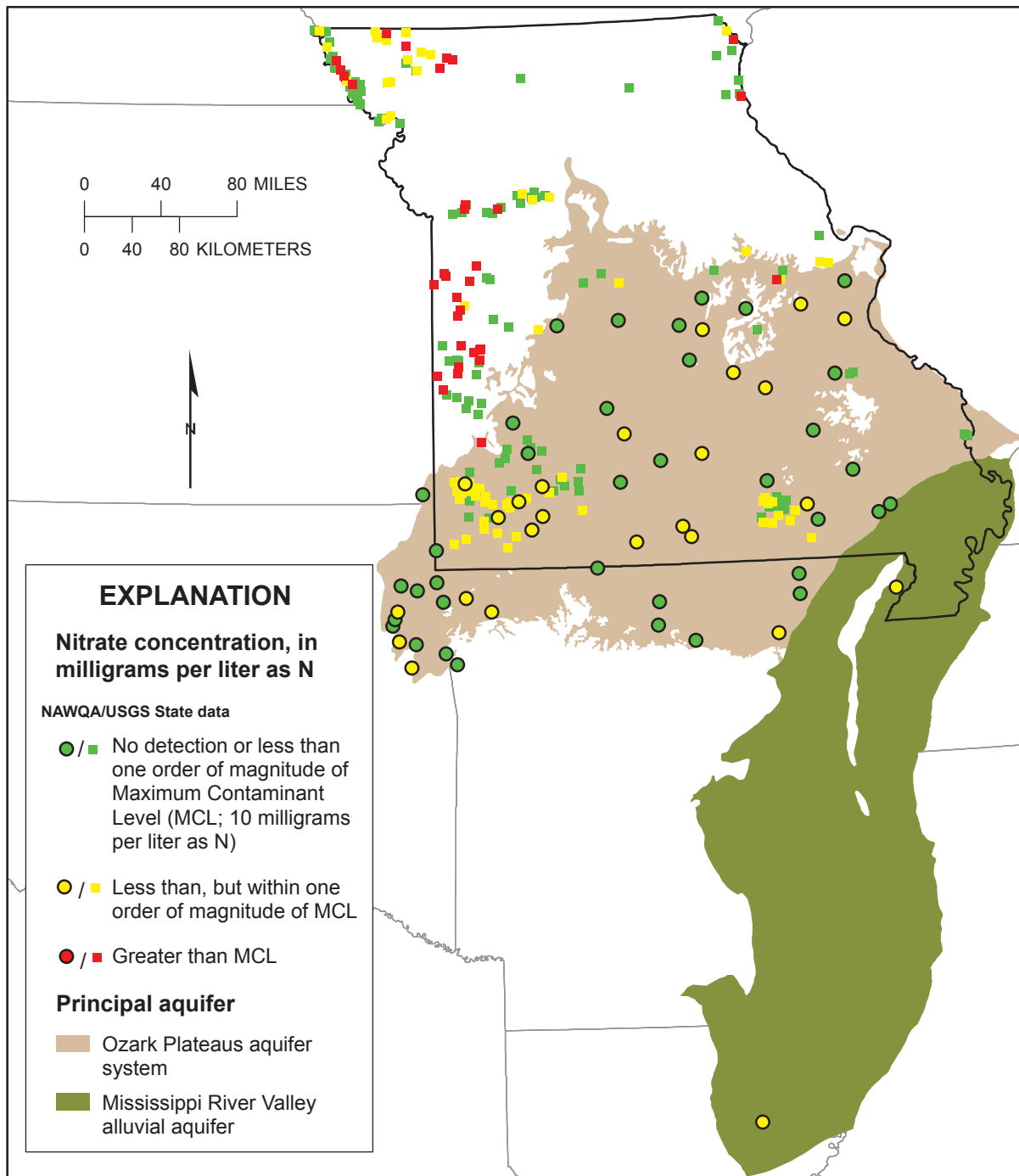




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Principal aquifer data from U.S. Geological Survey, 2003

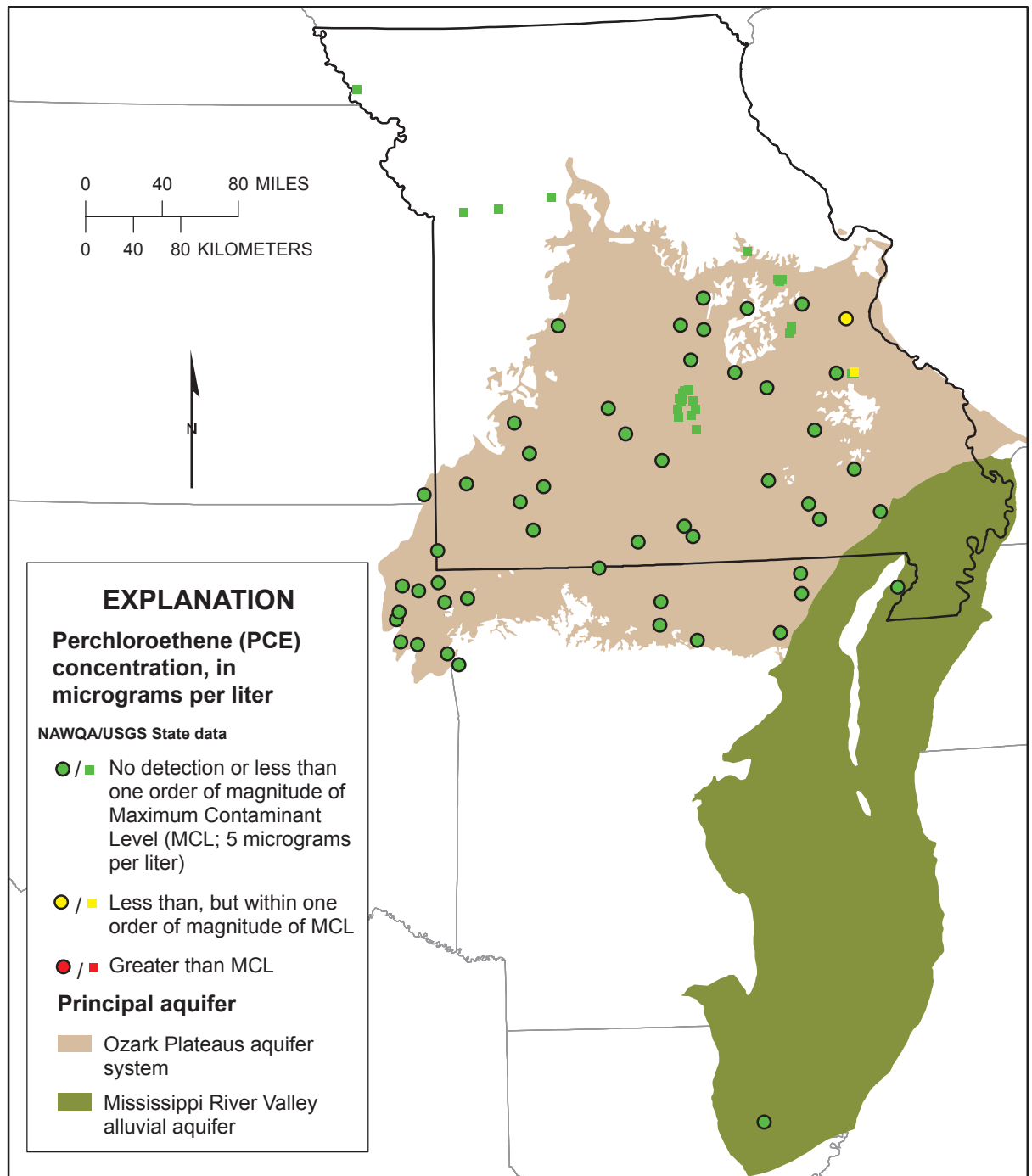
**Figure M010.** Concentration of manganese in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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Principal aquifer data from U.S. Geological Survey, 2003

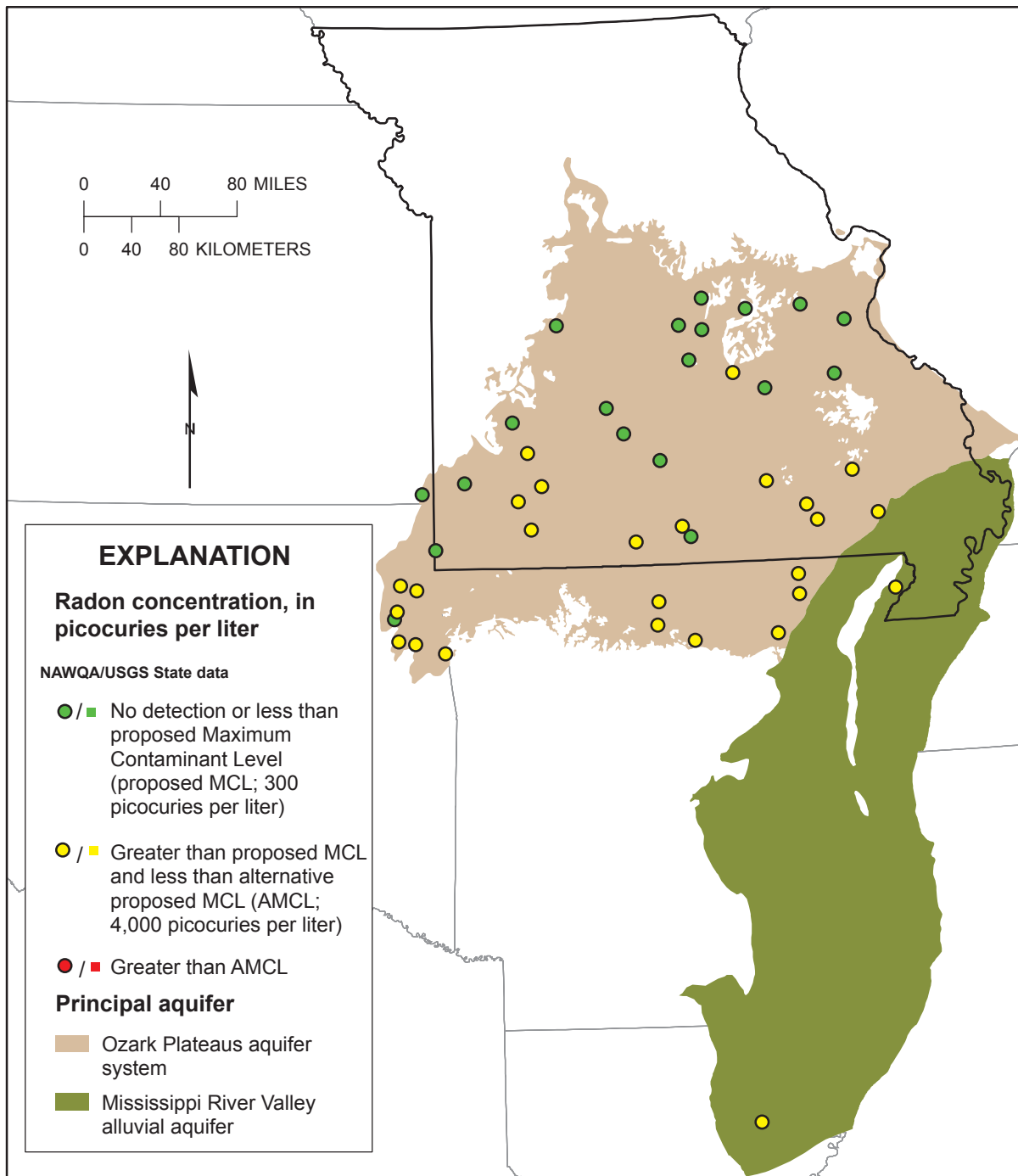
**Figure M011.** Concentration of nitrate in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



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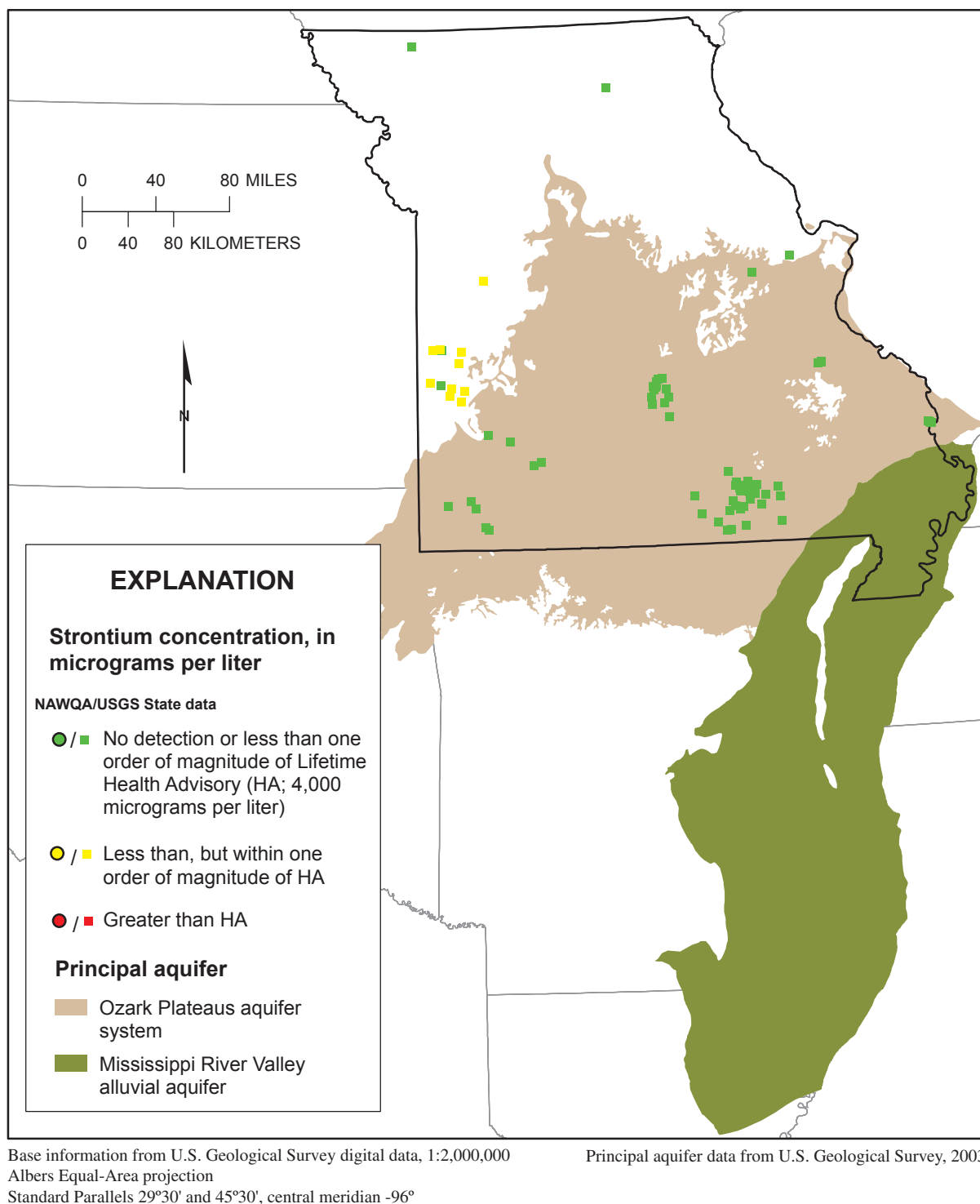
**Figure M012.** Concentration of perchloroethene (PCE) in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



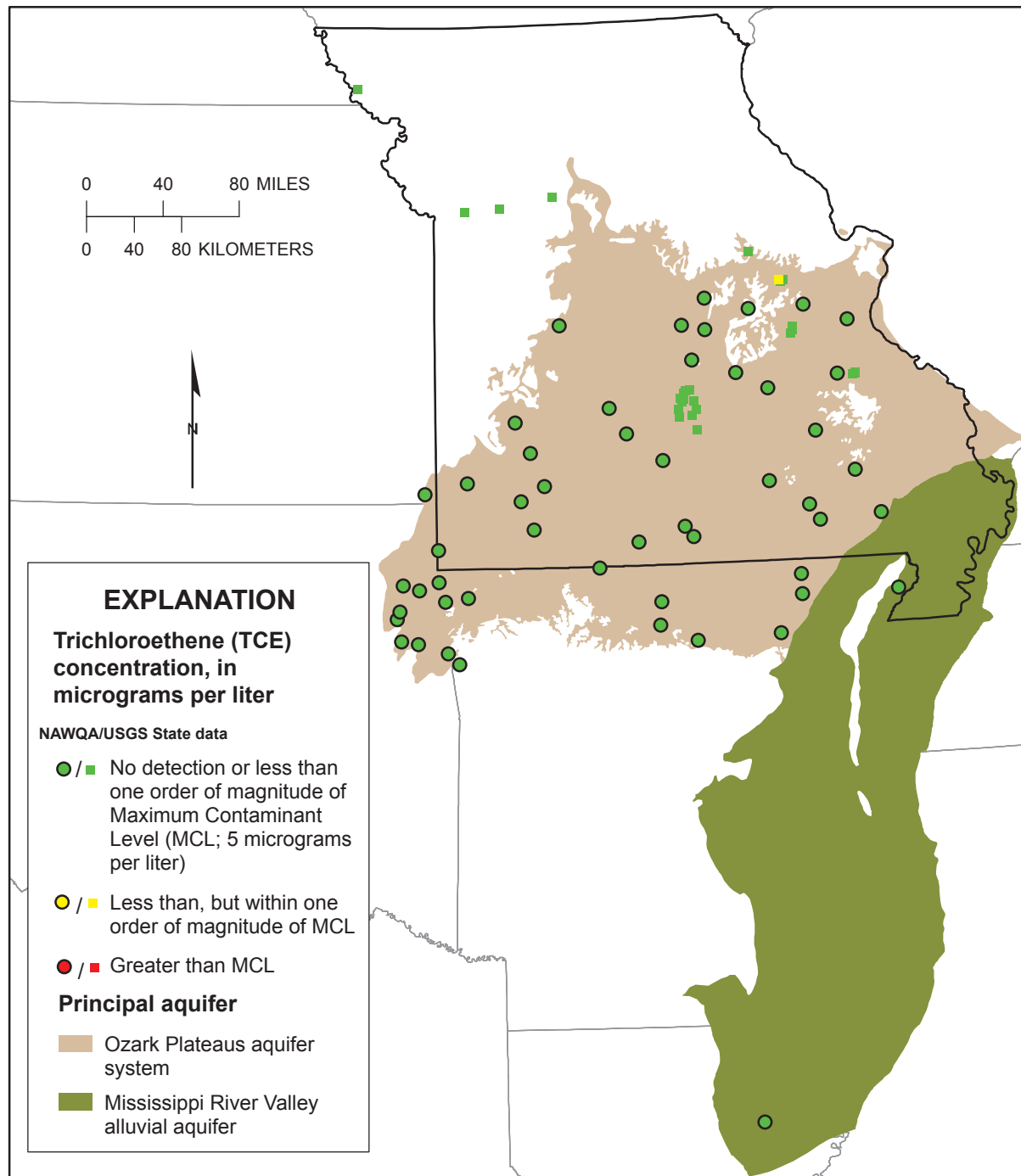
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Principal aquifer data from U.S. Geological Survey, 2003

**Figure M013.** Concentration of radon in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies. No additional data were available from U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).



**Figure M014.** Concentration of strontium in samples from domestic wells in Missouri (from U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS). No additional data were available from National Water-Quality Assessment (NAWQA) studies.

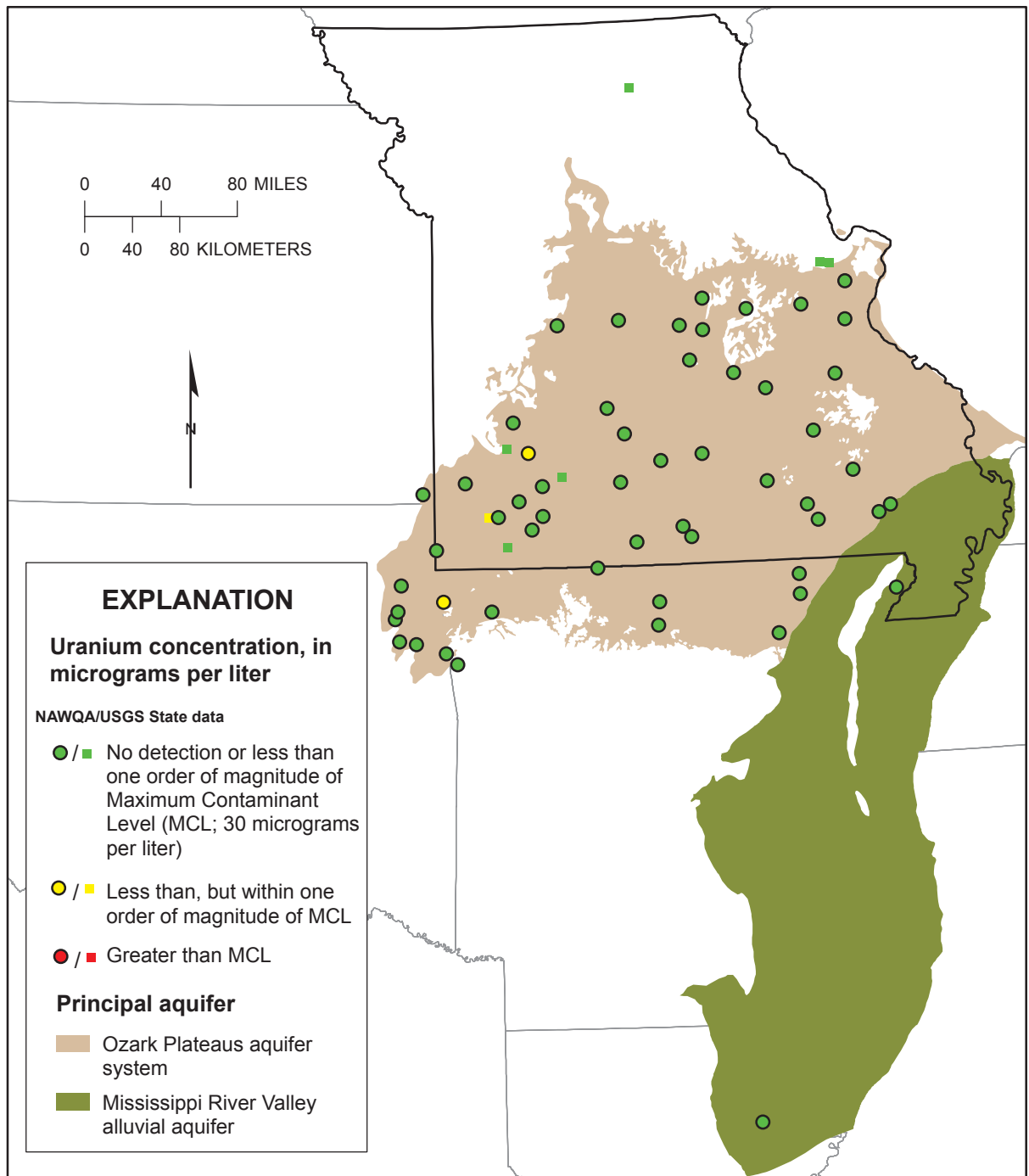


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Principal aquifer data from U.S. Geological Survey, 2003

**Figure M015.** Concentration of trichloroethene (TCE) in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).





Base information from U.S. Geological Survey digital data, 1:2,000,000  
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Principal aquifer data from U.S. Geological Survey, 2003

**Figure M016.** Concentration of uranium in samples from domestic wells in Missouri and nearby States (from National Water-Quality Assessment (NAWQA) studies and U.S. Geological Survey (USGS) State data in the National Water Information System (NWIS)).