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The full text of this report can be accessed and downloaded at URL http://pubs.usgs.gov/sir/2010/5024/.

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Appendix 1. Summary of selected national-scale studies on contaminant occurrence in public wells in the United States.

[USGS, U.S. Geological Survey; USEPA, U.S. Environmental Protection Agency. **Geographic scale:** UCM, USEPA Unregulated Contaminant Monitoring Program. **Targeted contaminants:** rad, radionuclides; VOCs, volatile organic compounds; fecal org, fecal-indicator microorganisms; SOCs, synthetic organic contaminants; IOCs, inorganic contaminants. **Study design:** NAWQA, National Water-Quality Assessment Program; SWQA, Source Water-Quality Assessment Program; CWS, community water system; MWDSC, Metropolitan Water District of Southern California; OHSU, Oregon Health & Science University; AWWA, American Water Works Association; AWWSC, American Water Works Service Company; UCMR1, first Unregulated Contaminant Monitoring Rule; PWS, public water system; SDWA, Safe Drinking Water Act; GW, groundwater]

Geographic scale; number of states with public well or system data	Targeted contaminants	Study design	Type of sample water (source or finished)	Approximate number of public GW systems or public wells	Years most samples were collected	Reference(s)
USGS national-scale public-well studies from most to least recent. Data from these studies are summarized in Appendixes 16–19.						
National; 41 states, 30 principal aquifers	6 water-quality properties & 215 regulated & unregulated major ions, trace elements, nutrients, rad, pesticides, VOCs, fecal org	Wells were part of various NAWQA ground-water assessment studies. National study design, nationally consistent sampling & analytical methods.	Source	932 public wells	1993–2007	This report
National cross section; 12 states and 12 principal aquifers	Up to 279 regulated & (mostly) unregulated VOCs, SOCs, personal-care & domestic-use compounds	NAWQA SWQA Program, focus on large systems. National study design, nationally consistent sampling & analytical methods.	Source and finished	221 public wells from CWSs	2002–2005	Hopple and others, 2009
National; 33 states	83 regulated & unregulated pesticides & degradates	Most data from major aquifer studies. National study design, nationally consistent sampling & analytical methods.	Source	364 public wells	1992–2001	Gilliom and others, 2006
National; 50 states	55 regulated & unregulated VOCs	Data from major aquifer studies & national source-water survey. NAWQA or similar study design, & random statistically based sampling by population served.	Source	1,096 public wells (329 NAWQA wells, 767 wells from other studies)	1985–2001, majority of samples collected 1991-2001	Ivahnenko and Zogorski, 2006; Moran and others, 2006; Zogorski and others, 2006
National; 50 states, Native American Lands, and Puerto Rico	66 regulated & unregulated VOCs	Random Survey, unbiased distribution of CWSs by state, type of source water, & population served (source-size categories). Conducted with MWDSC & OHSU.	Source	579 GW CWSs (98% wells, 2% springs)	1999–2000	Grady, 2002
National; 27 states and 8 physiographic provinces	Rads (radium-224, radium-226, radium-228, polonium-210, lead-210)	Targeted areas with elevated concentrations of radium in GW. Conducted with USEPA, AWWA, AWWSC.	Source	99 public wells	1998–1999	Focazio and others, 2001
Other USGS national-scale public-well studies. Data from these studies are not summarized in appendixes, but are discussed in this report.						
National; about 20 states	Fecal org	Public wells from major aquifer studies & SWQA networks.	Source	Public wells: 227 (total coliform), 220 (*Escherichia coli*), 183 (coliphage)	1993–2004	Embrey and Runkle, 2006
National	Arsenic	Public-well samples with arsenic measurements obtained from USGS National Water Information System.	Source	2,262 public wells	1973–1998	Focazio and others, 2000

Appendix 1. Summary of selected national-scale studies on contaminant occurrence in public wells in the United States.—Continued

[USGS, U.S. Geological Survey; USEPA, U.S. Environmental Protection Agency. **Geographic scale:** UCM, USEPA Unregulated Contaminant Monitoring Program. **Targeted contaminants:** rad, radionuclides; VOCs, volatile organic compounds; fecal org, fecal-indicator microorganisms; SOCs, synthetic organic contaminants; IOCs, inorganic contaminants. **Study design:** NAWQA, National Water-Quality Assessment Program; SWQA, Source Water-Quality Assessment Program; CWS, community water system; MWDSC, Metropolitan Water District of Southern California; OHSU, Oregon Health & Science University; AWWA, American Water Works Association; AWWSC, American Water Works Service Company; UCMR1, first Unregulated Contaminant Monitoring Rule; PWS, public water system; SDWA, Safe Drinking Water Act; GW, groundwater]

Geographic scale; number of states with public well or system data	Targeted contaminants	Study design	Type of sample water (source or finished)	Approximate number of public GW systems or public wells	Years most samples were collected	Reference(s)
USEPA national-scale PWS studies, from most to least recent. Data from these studies are summarized in Appendixes 16–19.						
National	24 unregulated SOCs, VOCs, perchlorate	UCMR1 tiered monitoring approach for large & small PWSs. Multiple samples collected per system.	About 70% finished, 30% source	1,200 to 17,000 samples from 160 to 1,900 GW PWSs	2001–2005	U.S. Environmental Protection Agency, 2007b
National cross sections; 16 states for occurrence data, 8 states for exceedance data	61 regulated VOCs, SOCs, & IOCs	First Six-Year Review of national drinking-water regulations. SDWA compliance monitoring of PWSs. Muliple samples collected per system.[1]	Finished	22,000 to 164,000 GW samples from 41,000 PWSs (not all are GW) for 16-state cross section; 13,000 to 133,000 samples from 2,700 to 12,000 GW PWSs for 8-state cross section	1993–1997	U.S. Environmental Protection Agency, 2002b, 2003f
National; 40 & 35 states and primacy entities, for UCM Rounds 1 & 2, respectively	76 regulated & unregulated SOCs, VOCs, sulfate	Original UCM program data (UCM Rounds 1 & 2) for PWSs serving more than 500 people. Multiple samples collected per system.	Finished	24,000 to 143,000 samples from 8,300 to 22,000 GW PWSs	1988–1992 for Round 1 and 1993-1997 for Round 2	U.S. Environmental Protection Agency, 2001c, 2002b
National; 50 states	101 regulated & unregulated pesticides, 25 pesticide degradates, nitrate	Statistical survey methods used to select nationally representative subset of CWS wells.	Presumed to be finished	540 CWS wells. Each well was sampled once.	1988–1990	U.S. Environmental Protection Agency, 1990, 1992a
National; 49 states	4 regulated rad (radon, radium-226, radium-228, uranium)	National Inorganics and Radionuclides Survey. Random, stratified by population category; representative of the distribution of CWS size ranges.	Finished	990 GW CWS sites	1984–1986	Longtin, 1988
National; 50 states	29 (mostly) regulated & unregulated VOCs, 5 trihalomethanes	GW supply survey. 466 randomly-selected systems; 479 state-selected, non-random systems where VOCs were likely to occur.	Finished	945 GW PWSs. One sample collected per system.	1981–1982	Westrick and others, 1984
National; 35 states	Regulated rad (radon, gross alpha and beta, radium-226, radium-228, total radium, uranium)	One sample per water supply; composite samples or systems samples (not individual wells); near source of water; more than 1,000 people served.	Finished	More than 2,500 GW PWSs	1981–1982	Horton, 1983

Appendix 1. Summary of selected national-scale studies on contaminant occurrence in public wells in the United States.—Continued

[USGS, U.S. Geological Survey; USEPA, U.S. Environmental Protection Agency. **Geographic scale:** UCM, USEPA Unregulated Contaminant Monitoring Program. **Targeted contaminants:** rad, radionuclides; VOCs, volatile organic compounds; fecal org, fecal-indicator microorganisms; SOCs, synthetic organic contaminants; IOCs, inorganic contaminants. **Study design:** NAWQA, National Water-Quality Assessment Program; SWQA, Source Water-Quality Assessment Program; CWS, community water system; MWDSC, Metropolitan Water District of Southern California; OHSU, Oregon Health & Science University; AWWA, American Water Works Association; AWWSC, American Water Works Service Company; UCMR1, first Unregulated Contaminant Monitoring Rule; PWS, public water system; SDWA, Safe Drinking Water Act; GW, groundwater]

Geographic scale; number of states with public well or system data	Targeted contaminants	Study design	Type of sample water (source or finished)	Approximate number of public GW systems or public wells	Years most samples were collected	Reference(s)
Other USEPA national-scale PWS studies. Data from these studies are not summarized in appendixes, but are discussed in this report or are partially included in USEPA studies shown above.						
National; 50 states, tribal, EPA regions, and commonwealths and territories	Regulated microbes, IOCs, SOCs, VOCs, rads	Annual SDWA compliance monitoring & inventory data. Number of PWSs, population served by system type, system size, & state.	Finished	140,000 GW PWSs	2008	U.S. Environmental Protection Agency, 2008c, 2008g
National cross section; 8 states	64 regulated IOCs, SOCs, VOCs. Limited data on ~200 unregulated IOCs, SOCs, VOCs	Review of contaminant occurrence in public water systems. SDWA compliance monitoring of PWSs.	Finished	3,183 to 12,388 GW PWSs	1993–1997	U.S. Environmental Protection Agency, 1999b
National; 50 states	Up to 34 (mostly) regulated VOCs, some SOCs	Summaries of four national surveys of VOCs.	Finished, some source	16 to 945 GW PWSs	1976–1982	Westrick, 1990

[1] In March 2010, USEPA completed their second Six-Year Review (U.S. Environmental Protection Agency, 2010b), but results from that study were not available in time for inclusion in this report.

Appendix 2. Description of the sampling networks (groundwater assessment studies) associated with 932 public wells sampled during 1993–2007.

[Public wells that were part of multiple assessment studies were assigned to one network and prioritized in the order shown.]

Description of sampling network	Number of public wells in this study	Public wells in this study (percent)	References
Major Aquifer Studies (previously called Study-Unit Surveys) involve the sampling of about 20 to 30 wells that withdraw water from aquifers or aquifer systems that are major current or future sources of water supply. Wells are randomly selected throughout the areas underlain by each aquifer, without regard to land use. Samples from these studies reflect the effects of mixtures of different land uses and groundwater ages on water quality.	496	53.2	Gilliom and others, 1995; Gilliom and others, 2006)
Groundwater Source Water-Quality Assessment (SWQA) Studies characterize the quality of selected aquifers used as a source of supply to community water systems in the United States. These assessments complement monitoring of drinking water required by federal, state, and local programs, which focus primarily on post-treatment compliance monitoring. Source-water samples from 15 high-production wells and the associated finished water were collected in each assessment.	280	30.0	Carter and others, 2007; Delzer and Hamilton, 2007
Principal Aquifer Studies are regional assessments that complement and extend the findings of the Study Units to fill critical gaps in the understanding of groundwater quality and flow over broad regions, and determine trends at sites that have been monitored for more than a decade. The aquifers selected for these regional assessments account for about 75 percent of the estimated withdrawals of groundwater for drinking-water supply.	111	11.9	Lapham and others, 2005
Transport of Anthropogenic and Natural Contaminants Topical Studies assess the vulnerability of public wells to contamination from various contaminants, and build upon previous NAWQA studies. They focus on the transport and chemical breakdown of selected anthropogenic contaminants from urban and agricultural sources, as well as contaminants from natural sources, within the part of the groundwater system that contributes water to public wells.	44	4.7	Eberts and others, 2005
Land Use Studies focus on shallow groundwater primarily within agricultural and urban land-use settings. About 20 to 30 randomly located wells within each targeted land-use area are sampled. Most wells are less than 20 feet below the water table to indicate as directly as possible the influence of land use on shallow groundwater quality.	1	0.1	Gilliom and others, 1995; Gilliom and others, 2006)

Appendix 3. Descriptions of principal aquifer rock types.

Principal aquifer rock-type name	Principal aquifer rock-type description	Reference(s)
Unconsolidated sand and gravel aquifers (non-glacial origin)	These loosely-bound sand and gravel aquifers are grouped into basin-fill aquifers, which also are called "valley-fill aquifers", and blanket sand and gravel aquifers. These aquifers occur in scattered places in the United States, including the west, southeast, and central United States.	(Miller, 2000; U.S. Geological Survey, 2009)
Glacial sand and gravel aquifers	Glacial aquifers consist of outwash, alluvium, terrace, or ice-contact deposits. Glacial-deposit aquifers form numerous local, and some regional, highly productive aquifers in the area north of the line of glaciation.	(Miller, 2000; Warner and Arnold, 2006; U.S. Geological Survey, 2009)
Semi-consolidated sand and gravel aquifers	Semi-consolidated aquifers consist of semi-consolidated sand interbedded with silt, clay, and minor carbonate rocks. These aquifers underlie the Coastal Plains that border the Atlantic Ocean and the Gulf of Mexico. They are of fluvial, deltaic, and shallow marine origin.	(Miller, 2000; U.S. Geological Survey, 2009)
Sandstone aquifers	Sandstone is a sedimentary rock. Cementation of sand-sized grains reduces pore spaces, and secondary openings, such as joints and fractures, contain and transmit most of the groundwater in sandstone. These aquifers are widespread across the United States.	(Bates and Jackson, 1984; Miller, 2000; U.S. Geological Survey, 2009)
Sandstone and carbonate-rock aquifers	These aquifers consist of interbedded sandstone and carbonate rocks; the carbonate rocks yield more water than the sandstones. They are most widespread in the eastern half of the Nation, but also extend over large areas of Texas and in scattered other areas of the United States.	(Miller, 2000; U.S. Geological Survey, 2009)
Carbonate-rock aquifers	Most carbonate-rock aquifers consist of limestone, but dolomite and marble locally yield water. They typically originate as sedimentary deposits in marine environments, and are most prominent in the central and southeastern United States.	(Miller, 2000; U.S. Geological Survey, 2009)
Basaltic and other volcanic-rock aquifers	Basalt is a fine-grained volcanic rock. Volcanic rock is a finely crystalline or glassy igneous rock resulting from volcanic action at or near the earth's surface. Volcanic flows cover large areas in the northwestern United States and Hawaii.	(Bates and Jackson, 1984; Miller, 2000; Blatt and Tracy, 2001; U.S. Geological Survey, 2009)
Crystalline-rock aquifers	These igneous and metamorphic rocks are permeable only where they are fractured. Fractured-rock aquifers supply water to large areas of the eastern, northeastern, and north-central parts of the Nation.	(Miller, 2000; U.S. Geological Survey, 2009)
Other	Other aquifers include large-to-small areas that are minor aquifers and are not principal aquifers. These aquifers are widespread across the United States.	(Miller, 2000; U.S. Geological Survey, 2009)

Appendix 4. List of six water-quality properties and 215 contaminants analyzed in public-well samples collected during 1993–2007, including reporting levels for non-detections and human-health benchmarks for drinking water.

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency (USEPA) Data Storage and Retrieval System; CAS, Chemical Abstract Service; –, not available or not applicable; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; µS/cm, microsiemens per centimeter; °C, degrees Celsius; MCL, Maximum Contaminant Level; µg/L, micrograms per liter; HBSL, Health-Based Screening Level; N, nitrogen; P, phosphorus; pCi/L, picocuries per liter; AMCL, Alternative Maximum Contaminant Level; DWLOC, Drinking Water Level of Comparison; TT, treatment technique; PrsAbs/L; presence or absence per liter; col/100 mL, colonies per 100 milliliters]

Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Water-quality properties								
Alkalinity as $CaCO_3$	mg/L as $CaCO_3$	39086, 00440, 00450, 00453	–	Field	840	1	–	–
Dissolved oxygen	mg/L	00300	–	Field	865	0.04–1	–	–
pH	standard units	00400	–	Field	878	–	–	–
Specific conductance	µS/cm at 25 °C	00095	–	Field	896	–	–	–
Temperature	°C	00010	–	Field	893	–	–	–
Total dissolved solids (Residue on evaporation)	mg/L	70300	–	2750	802	–	–	–
Major ions								
Bromide	mg/L	71870	24959-67-9	2750	787	0.008–0.015	–	–
Calcium	mg/L	00915	7740-70-2	2750	809	–	–	–
Chloride	mg/L	00940	16887-00-6	2750	809	0.1	–	–
Fluoride	mg/L	00950	16984-48-8	2750	808	0.05–0.17	4	MCL
Magnesium	mg/L	00925	7439-95-4	2750	809	–	–	–
Potassium	mg/L	00935	7440-09-7	2750	810	–	–	–
Silica	mg/L	00955	7631-86-9	2750	809	–	–	–
Sodium	mg/L	00930	7440-23-5	2750	809	–	–	–
Sulfate	mg/L	00945	14808-79-8	2750	810	0.05–0.15	–	–
Trace elements								
Aluminum	µg/L	01106	7429-90-5	2703	598	0.8–1	–	–
Antimony	µg/L	01095	7440-36-0	2703	619	0.024–1	6	MCL
Arsenic	µg/L	01000	7440-38-2	2703	638	0.03–1	10	MCL
Barium	µg/L	01005	7440-39-3	2703	630	1	2,000	MCL
Beryllium	µg/L	01010	7440-41-7	2703	622	0.004–1	4	MCL
Boron	µg/L	01020	7440-42-8	2710	501	4–10	1,000	HBSL
Cadmium	µg/L	01025	7440-43-9	2703	631	0.018–1	5	MCL
Chromium	µg/L	01030	7440-47-3	2703	626	0.02–1	100	MCL
Cobalt	µg/L	01035	7440-48-4	2703	627	0.01–1	–	–
Copper	µg/L	01040	7440-50-8	2703	625	0.12–1	1,300	MCL[4]

Appendix 4. List of six water-quality properties and 215 contaminants analyzed in public-well samples collected during 1993–2007, including reporting levels for non-detections and human-health benchmarks for drinking water.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency (USEPA) Data Storage and Retrieval System; CAS, Chemical Abstract Service; –, not available or not applicable; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; µS/cm, microsiemens per centimeter; °C, degrees Celsius; MCL, Maximum Contaminant Level; µg/L, micrograms per liter; HBSL, Health-Based Screening Level; N, nitrogen; P, phosphorus; pCi/L, picocuries per liter; AMCL, Alternative Maximum Contaminant Level; DWLOC, Drinking Water Level of Comparison; TT, treatment technique; PrsAbs/L; presence or absence per liter; col/100 mL, colonies per 100 milliliters]

Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Trace elements—Continued								
Iron	µg/L	01046	7439-89-6	2750	809	3–10	–	–
Lead	µg/L	01049	7439-92-1	2703	630	0.04–1	15	MCL[4]
Lithium	µg/L	01130	7439-93-2	2710	458	0.15–3	–	–
Manganese	µg/L	01056	7439-96-5	2703	808	0.05–4	300	HBSL
Molybdenum	µg/L	01060	7439-98-7	2703	628	0.06–1	40	HBSL
Nickel	µg/L	01065	7440-02-0	2703	629	0.03–1	100	HBSL
Selenium	µg/L	01145	7782-49-2	2703	632	0.02–1.2	50	MCL
Silver	µg/L	01075	7440-22-4	2703	606	0.05–1	100	HBSL
Strontium	µg/L	01080	7440-24-6	2710	503	–	4,000	HBSL
Thallium	µg/L	01057	7440-28-0	2710	437	0.02–0.9	2	MCL
Uranium	µg/L	22703	7440-61-1	2703	650	0.009–1	30	MCL
Vanadium	µg/L	01085	7440-62-2	2710	457	0.02–5	–	–
Zinc	µg/L	01090	7440-66-6	2703	613	0.3–3	2,000	HBSL
Nutrients and dissolved organic carbon								
Ammonia as N	mg/L as N	00608	7664-41-7	2702	806	0.005–0.021	–	–
Ammonia plus organic nitrogen as N	mg/L as N	00623	17778-88-0	2702	603	0.05–0.2	–	–
Dissolved organic carbon	mg/L	00681	–	–	817	0.1–0.2	–	–
Nitrate plus nitrite as N[5]	mg/L as N	00631	–	2702	806	0.02–0.05	10	MCL
Nitrite as N	mg/L as N	00613	14797-65-0	2702	807	0.001–0.01	1	MCL
Orthophosphate as P	mg/L as P	00671	14265-44-2	2702	804	0.003–0.01	–	–
Phosphorus, dissolved as P	mg/L	00666	7723-14-0	2702	454	0.004–0.03	–	–
Total nitrogen as N (nitrate + nitrite + ammonia + organic N)	mg/L as N	62854	–	2752	201	0.03	–	–
Radionuclides								
Gross alpha-particle radioactivity	pCi/L	04126	12587-46-1	–	84	3	15	MCL[6]
Gross beta-particle radioactivity	pCi/L	03515	12587-47-2	–	86	4	50	Screening level[7]
Radium-226 plus radium-228	pCi/L	09503, 09511, 81366	13982-63-3, 15262-20-1	–	191	[8]0.02–1	5	MCL
Radon-222	pCi/L	82303	14859-67-7	Radon	506	80	300	Proposed MCL
Radon-222	pCi/L	82303	14859-67-7	Radon	506	80	4,000	Proposed AMCL

Appendix 4. List of six water-quality properties and 215 contaminants analyzed in public-well samples collected during 1993–2007, including reporting levels for non-detections and human-health benchmarks for drinking water.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency (USEPA) Data Storage and Retrieval System; CAS, Chemical Abstract Service; –, not available or not applicable; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; µS/cm, microsiemens per centimeter; °C, degrees Celsius; MCL, Maximum Contaminant Level; µg/L, micrograms per liter; HBSL, Health-Based Screening Level; N, nitrogen; P, phosphorus; pCi/L, picocuries per liter; AMCL, Alternative Maximum Contaminant Level; DWLOC, Drinking Water Level of Comparison; TT, treatment technique; PrsAbs/L; presence or absence per liter; col/100 mL, colonies per 100 milliliters]

Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Pesticide compounds								
Acetochlor	µg/L	49260	34256-82-1	2010	800	0.002–0.003	1	HBSL low [9]
Acifluorfen	µg/L	49315	50594-66-6	2050	590	0.0033–0.0622	90	HBSL
Alachlor	µg/L	46342	15972-60-8	2010	869	0.0012–0.003	2	MCL
Aldicarb	µg/L	49312	116-06-3	2050	584	0.016–0.55	9	HBSL [10]
Aldicarb sulfone	µg/L	49313	1646-88-4	2050	569	0.009–0.1599	7	HBSL [10]
Aldicarb sulfoxide	µg/L	49314	1646-87-3	2050	569	0.0041–0.04	7	HBSL [10]
Atrazine	µg/L	39632	1912-24-9	2010	853	0.001–0.004	3	MCL
Azinphos-methyl (Guthion)	µg/L	82686	86-50-0	2010	894	0.001–0.06	10	HBSL
Benfluralin	µg/L	82673	1861-40-1	2010	896	0.002–0.005	4	HBSL
Bentazon	µg/L	38711	25057-89-0	2050	589	0.0055–0.0193	200	HBSL
Bromacil	µg/L	04029	314-40-9	2050	590	0.009–0.0807	70	HBSL
Bromoxynil	µg/L	49311	1689-84-5	2050	590	0.0085–0.06	10	HBSL
Butylate	µg/L	04028	2008-41-5	2010	511	0.001–0.002	400	HBSL
Carbaryl	µg/L	82680	63-25-2	2010	898	0.003–0.03	40	HBSL low [9]
Carbofuran	µg/L	82674	1563-66-2	2010	644	0.003–0.01	40	MCL
Chloramben methyl ester	µg/L	61188	7286-84-2	2050	580	0.0089–0.42	–	–
Chlorothalonil	µg/L	49306	1897-45-6	2050	507	0.007–0.48	5	HBSL low [9]
Chlorpyrifos	µg/L	38933	2921-88-2	2010	898	0.003–0.004	2	HBSL
Clopyralid	µg/L	49305	1702-17-6	2050	586	0.0069–0.23	–	–
Cyanazine	µg/L	04041	21725-46-2	2010	634	0.004–0.01	1	HBSL
2,4-D (2,4-Dichlorophenoxyacetic acid)	µg/L	39732	94-75-7	2050	590	0.0109–0.15	70	MCL
Dacthal (DCPA)	µg/L	82682	1861-32-1	2010	898	0.0015–0.002	70	HBSL
Dacthal monoacid	µg/L	49304	887-54-7	2050	590	0.0058–0.0722	–	–
2,4-DB (4-(2,4-Dichlorophenoxy) butyric acid)	µg/L	38746	94-82-6	2050	580	0.008–0.24	200	HBSL
*p,p'*DDE (1-chloro-4-[2,2-dichloro-1-(4-chlorophenyl)ethenyl]benzene)	µg/L	34653	72-55-9	2010	512	0.0013–0.006	0.1	HBSL low [9]
Deethylatrazine	µg/L	04040	6190-65-4	2010	853	0.002–0.007	–	–
Diazinon	µg/L	39572	333-41-5	2010	897	0.002–0.003	1	HBSL
Dicamba	µg/L	38442	1918-00-9	2050	584	0.0064–0.096	3,000	HBSL

Appendix 4. List of six water-quality properties and 215 contaminants analyzed in public-well samples collected during 1993–2007, including reporting levels for non-detections and human-health benchmarks for drinking water.—Continued

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Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Pesticide compounds—Continued								
Dichlobenil	µg/L	49303	1194-65-6	2050	159	0.02–1.2	9	HBSL
Dichlorprop	µg/L	49302	120-36-5	2050	590	0.0069–0.05	300	HBSL
Dieldrin	µg/L	39381	60-57-1	2010	896	0.001–0.004	0.002	HBSL low [9]
2,6-Diethylaniline	µg/L	82660	579-66-8	2010	898	0.003–0.008	–	–
Dinoseb	µg/L	49301	88-85-7	2050	590	0.006–0.0429	7	MCL
Disulfoton	µg/L	82677	298-04-4	2010	647	0.01–0.02	0.9	HBSL
Diuron	µg/L	49300	330-54-1	2050	587	0.0075–0.0793	2	HBSL low [9]
DNOC (2-Methyl-4,6-dinitrophenol)	µg/L	49299	534-52-1	2050	165	0.006–0.42	–	–
EPTC (Eptam)	µg/L	82668	759-94-4	2010	646	0.001–0.002	200	HBSL
Ethalfluralin	µg/L	82663	55283-68-6	2010	512	0.004–0.005	30	HBSL
Ethoprop (Ethoprophos)	µg/L	82672	13194-48-4	2010	647	0.002–0.006	1	HBSL low [9]
Fenuron	µg/L	49297	101-42-8	2050	587	0.013–0.0735	–	–
Fluometuron	µg/L	38811	2164-17-2	2050	590	0.008–0.0617	4	HBSL
Fonofos	µg/L	04095	944-22-9	2010	898	0.001–0.005	10	HBSL
alpha-HCH (*alpha*-Hexachlorocyclohexane)	µg/L	34253	319-84-6	2010	512	0.002–0.0023	0.006	HBSL low [9]
gamma-HCH (Lindane)	µg/L	39341	58-89-9	2010	512	0.002–0.004	0.2	MCL
3-Hydroxycarbofuran	µg/L	49308	16655-82-6	2050	580	0.0029–0.0623	–	–
Linuron	µg/L	82666	330-55-2	2010	512	0.002–0.018	5	HBSL
Malathion	µg/L	39532	121-75-5	2010	898	0.005–0.014	50	HBSL
MCPA (4-Chloro-2-methylphenoxy acetic acid)	µg/L	38482	94-74-6	2050	582	0.0081–0.17	30	HBSL
MCPB (4-(2-Methyl-4-chlorophenoxy)butyric acid)	µg/L	38487	94-81-5	2050	590	0.005–0.14	100	HBSL
Methiocarb	µg/L	38501	2032-65-7	2050	579	0.004–0.0795	40	HBSL
Methomyl	µg/L	49296	16752-77-5	2050	569	0.0022–0.0768	200	HBSL
Metolachlor	µg/L	39415	51218-45-2	2010	870	0.002–0.006	700	HBSL
Metribuzin	µg/L	82630	21087-64-9	2010	898	0.003–0.014	90	HBSL
Molinate	µg/L	82671	2212-67-1	2010	635	0.0008–0.004	0.7	HBSL
Napropamide	µg/L	82684	15299-99-7	2010	511	0.003	800	HBSL
Neburon	µg/L	49294	555-37-3	2050	584	0.001–0.0747	–	–

Appendix 4. List of six water-quality properties and 215 contaminants analyzed in public-well samples collected during 1993–2007, including reporting levels for non-detections and human-health benchmarks for drinking water.—Continued

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Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Pesticide compounds—Continued								
Norflurazon	µg/L	49293	27314-13-2	2050	585	0.0082–0.0774	10	HBSL
Oryzalin	µg/L	49292	19044-88-3	2050	582	0.006–0.31	4	HBSL low [9]
Oxamyl	µg/L	38866	23135-22-0	2050	569	0.0061–0.02	200	MCL
Parathion (Ethyl parathion)	µg/L	39542	56-38-2	2010	512	0.003–0.005	0.02	HBSL
Parathion-methyl (Methyl parathion)	µg/L	82667	298-00-0	2010	889	0.003–0.008	1	HBSL
Pebulate	µg/L	82669	1114-71-2	2010	512	0.0008–0.004	50	HBSL
Pendimethalin	µg/L	82683	40487-42-1	2010	898	0.004–0.011	70	HBSL
cis-Permethrin	µg/L	82687	54774-45-7	2010	898	0.003–0.005	4	HBSL low [9,11]
Phorate	µg/L	82664	298-02-2	2010	898	0.002–0.027	4	HBSL
Picloram	µg/L	49291	1918-02-1	2050	585	0.0099–0.0712	500	MCL
Prometon	µg/L	04037	1610-18-0	2010	885	0.002–0.018	400	HBSL
Pronamide (Propyzamide)	µg/L	82676	23950-58-5	2010	898	0.002–0.003	1	HBSL low [9]
Propachlor	µg/L	04024	1918-16-7	2010	512	0.005–0.007	1	HBSL low [9]
Propanil	µg/L	82679	709-98-8	2010	647	0.003–0.005	6	HBSL
Propargite	µg/L	82685	2312-35-8	2010	644	0.01–0.02	1	HBSL low [9]
Propham	µg/L	49236	122-42-9	2050	589	0.0048–0.0717	100	HBSL
Propoxur (Baygon)	µg/L	38538	114-26-1	2050	586	0.004–0.0594	9	HBSL low [9]
Simazine	µg/L	04035	122-34-9	2010	884	0.002–0.006	4	MCL
2,4,5-T (2-(2,4,5-Trichlorophenoxy)acetic acid)	µg/L	39742	93-76-5	2050	165	0.013–0.035	70	HBSL
Tebuthiuron	µg/L	82670	34014-18-1	2010	859	0.008–0.01	1,000	HBSL
Terbacil	µg/L	82665	5902-51-2	2010	508	0.007–0.017	90	HBSL
Terbufos	µg/L	82675	13071-79-9	2010	898	0.006–0.013	0.4	HBSL
Thiobencarb	µg/L	82681	28249-77-6	2010	647	0.002–0.005	70	HBSL
2,4,5-TP (Silvex)	µg/L	39762	93-72-1	2050	165	0.021	50	MCL
Triallate	µg/L	82678	2303-17-5	2010	512	0.001–0.0012	20	HBSL
Triclopyr	µg/L	49235	55335-06-3	2050	590	0.0112–0.25	400	HBSL
Trifluralin	µg/L	82661	1582-09-8	2010	898	0.002–0.005	20	HBSL
Total chlorotriazines (TCT) [12]	µg/L	04035, 04040, 39632	–	–	886	0.002–0.007	12.5	DWLOC [13]

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Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Volatile organic compounds								
Acetone	µg/L	81552	67-64-1	2020	771	2–5	6,000	HBSL
Acrylonitrile	µg/L	34215	107-13-1	2020	771	0.2–2	0.06	HBSL low [9]
tert-Amyl methyl ether (Methyl *tert*-pentyl ether)	µg/L	50005	994-05-8	2020	771	0.02–0.112	–	–
Benzene	µg/L	34030	71-43-2	2020	831	0.008–0.2	5	MCL
Bromobenzene	µg/L	81555	108-86-1	2020	832	0.01–0.2	–	– [14]
Bromochloromethane	µg/L	77297	74-97-5	2020	832	0.022–0.2	90	HBSL
Bromodichloromethane	µg/L	32101	75-27-4	2020	831	0.014–0.2	80	MCL [15]
Bromoform (Tribromomethane)	µg/L	32104	75-25-2	2020	832	0.03–0.2	80	MCL [15]
Bromomethane (Methyl bromide)	µg/L	34413	74-83-9	2020	832	0.074–0.26	100	HBSL
n-Butylbenzene	µg/L	77342	104-51-8	2020	831	0.05–0.2	–	–
sec-Butylbenzene	µg/L	77350	135-98-8	2020	831	0.016–0.2	–	–
tert-Butylbenzene	µg/L	77353	98-06-6	2020	832	0.024–0.2	–	–
Carbon disulfide	µg/L	77041	75-15-0	2020	765	0.013–0.185	700	HBSL
Carbon tetrachloride (Tetrachloromethane)	µg/L	32102	56-23-5	2020	832	0.03–0.2	5	MCL
Chlorobenzene (Monochlorobenzene)	µg/L	34301	108-90-7	2020	832	0.01–0.2	100	MCL
Chloroethane	µg/L	34311	75-00-3	2020	830	0.05–0.2	–	–
Chloroform (Trichloromethane)	µg/L	32106	67-66-3	2020	831	0.01–0.2	80	MCL [15]
Chloromethane (Methyl chloride)	µg/L	34418	74-87-3	2020	806	0.05–0.3	30	HBSL
3-Chloropropene	µg/L	78109	107-05-1	2020	771	0.03–0.5	–	–
2-Chlorotoluene (*o*-) (1-Chloro-2-methylbenzene)	µg/L	77275	95-49-8	2020	832	0.013–0.2	100	HBSL
4-Chlorotoluene (*p*-)	µg/L	77277	106-43-4	2020	832	0.02–0.2	100	HBSL
Dibromochloromethane	µg/L	32105	124-48-1	2020	832	0.05–0.2	80	MCL [15]
Dibromochloropropane (DBCP)	µg/L	82625	96-12-8	2020	832	0.105–1	0.2	MCL
Dibromomethane	µg/L	30217	74-95-3	2020	832	0.02–0.2	–	–
1,2-Dichlorobenzene (*o*-)	µg/L	34536	95-50-1	2020	831	0.01–0.2	600	MCL
1,3-Dichlorobenzene (*m*-)	µg/L	34566	541-73-1	2020	832	0.015–0.2	600	HBSL
1,4-Dichlorobenzene (*p*-)	µg/L	34571	106-46-7	2020	831	0.01–0.2	75	MCL

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Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Volatile organic compounds—Continued								
trans-1,4-Dichloro-2-butene	µg/L	73547	110-57-6	2020	771	0.3–5	–	–
Dichlorodifluoromethane	µg/L	34668	75-71-8	2020	832	0.069–0.2	1,000	HBSL
1,1-Dichloroethane	µg/L	34496	75-34-3	2020	832	0.018–0.2	–	–
1,2-Dichloroethane	µg/L	32103	107-06-2	2020	825	0.03–0.2	5	MCL
1,1-Dichloroethene	µg/L	34501	75-35-4	2020	832	0.01–0.2	7	MCL
cis-1,2-Dichloroethene	µg/L	77093	156-59-2	2020	832	0.01–0.2	70	MCL
trans-1,2-Dichloroethene	µg/L	34546	156-60-5	2020	832	0.009–0.2	100	MCL
1,2-Dichloropropane	µg/L	34541	78-87-5	2020	830	0.01–0.2	5	MCL
1,3-Dichloropropane	µg/L	77173	142-28-9	2020	832	0.03–0.2	–	–
2,2-Dichloropropane	µg/L	77170	594-20-7	2020	832	0.02–0.2	–	–
1,1-Dichloropropene	µg/L	77168	563-58-6	2020	832	0.013–0.2	–	–
cis-1,3-Dichloropropene	µg/L	34704	10061-01-5	2020	832	0.02–0.2	0.3	HBSL low [9,16]
trans-1,3-Dichloropropene	µg/L	34699	10061-02-6	2020	832	0.04–0.2	0.3	HBSL low [9,16]
Diethyl ether (Ethyl ether)	µg/L	81576	60-29-7	2020	771	0.04–0.17	1,000	HBSL
Diisopropyl ether	µg/L	81577	108-20-3	2020	758	0.03–0.1	–	–
Ethyl methacrylate	µg/L	73570	97-63-2	2020	771	0.07–1	–	–
Ethyl *tert*-butyl ether (*tert*-Butyl ethyl ether)	µg/L	50004	637-92-3	2020	771	0.015–0.1	–	–
Ethylbenzene	µg/L	34371	100-41-4	2020	830	0.01–0.2	700	MCL
Ethylene dibromide (1,2-Dibromoethane)	µg/L	77651	106-93-4	2020	832	0.018–0.2	0.05	MCL
2-Ethyltoluene (1-Ethyl-2-methylbenzene)	µg/L	77220	611-14-3	2020	770	0.02–0.1	–	–
Hexachlorobutadiene	µg/L	39702	87-68-3	2020	831	0.03–0.2	0.9	HBSL low [9]
Hexachloroethane	µg/L	34396	67-72-1	2020	771	0.05–0.362	0.7	HBSL
Iodomethane (Methyl iodide)	µg/L	77424	74-88-4	2020	771	0.05–0.35	–	–
Isopropylbenzene	µg/L	77223	98-82-8	2020	830	0.016–0.2	700	HBSL
n-Isopropyltoluene (1-Methyl-4-isopropylbenzene)	µg/L	77356	99-87-6	2020	831	0.03–0.2	–	–
Methyl acrylate	µg/L	49991	96-33-3	2020	771	0.2–2	–	–
Methyl acrylonitrile (Methacrylonitrile)	µg/L	81593	126-98-7	2020	771	0.1–2	0.7	HBSL
Methyl butyl ketone (2-Hexanone)	µg/L	77103	591-78-6	2020	771	0.139–5	–	– [14]

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Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Volatile organic compounds—Continued								
Methyl ethyl ketone (Ethyl methyl ketone)	µg/L	81595	78-93-3	2020	769	0.8–5	4,000	HBSL
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	78133	108-10-1	2020	769	0.1–5	–	–
Methyl methacrylate	µg/L	81597	80-62-6	2020	771	0.1–1	10,000	HBSL
Methyl *tert*-butyl ether	µg/L	78032	1634-04-4	2020	832	0.05–0.2	–	–
Methylene chloride (Dichloromethane)	µg/L	34423	75-09-2	2020	832	0.02–0.382	5	MCL
Naphthalene	µg/L	34696	91-20-3	2020	831	0.1–0.5	100	HBSL
Perchloroethene (Tetrachloroethene)	µg/L	34475	127-18-4	2020	829	0.013–0.2	5	MCL[17]
n-Propylbenzene	µg/L	77224	103-65-1	2020	831	0.02–0.2	–	–
Styrene	µg/L	77128	100-42-5	2020	829	0.02–0.2	100	MCL
1,1,1,2-Tetrachloroethane	µg/L	77562	630-20-6	2020	832	0.015–0.2	70	HBSL
1,1,2,2-Tetrachloroethane	µg/L	34516	79-34-5	2020	832	0.04–0.2	0.3	HBSL
Tetrahydrofuran	µg/L	81607	109-99-9	2020	771	0.5–5	–	–
1,2,3,4-Tetramethylbenzene	µg/L	49999	488-23-3	2020	770	0.05–0.23	–	–
1,2,3,5-Tetramethylbenzene	µg/L	50000	527-53-7	2020	770	0.05–0.24	–	–
Toluene[18]	µg/L	34010	108-88-3	2020	818	0.03–0.2	1,000	MCL
1,2,3-Trichlorobenzene	µg/L	77613	87-61-6	2020	832	0.04–0.266	–	–
1,2,4-Trichlorobenzene	µg/L	34551	120-82-1	2020	831	0.04–0.2	70	MCL
1,1,1-Trichloroethane	µg/L	34506	71-55-6	2020	832	0.01–0.2	200	MCL
1,1,2-Trichloroethane	µg/L	34511	79-00-5	2020	829	0.02–0.2	5	MCL
Trichloroethene	µg/L	39180	79-01-6	2020	832	0.01–0.2	5	MCL[17]
Trichlorofluoromethane	µg/L	34488	75-69-4	2020	832	0.04–0.2	2,000	HBSL
1,2,3-Trichloropropane	µg/L	77443	96-18-4	2020	832	0.06–0.2	40	HBSL[14]
Trichlorotrifluoroethane (1,1,2-Trichloro-1,2,2-trifluoroethane)	µg/L	77652	76-13-1	2020	832	0.016–0.2	200,000	HBSL
1,2,3-Trimethylbenzene	µg/L	77221	526-73-8	2020	770	0.03–0.124	–	–
1,2,4-Trimethylbenzene[18]	µg/L	77222	95-63-6	2020	828	0.05–0.2	–	–
1,3,5-Trimethylbenzene	µg/L	77226	108-67-8	2020	831	0.02–0.2	–	–
Vinyl bromide (Bromoethene)	µg/L	50002	593-60-2	2020	771	0.05–0.1	–	–
Vinyl chloride (Chloroethene)	µg/L	39175	75-01-4	2020	832	0.03–0.2	2	MCL

Appendix 4. List of six water-quality properties and 215 contaminants analyzed in public-well samples collected during 1993–2007, including reporting levels for non-detections and human-health benchmarks for drinking water.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency (USEPA) Data Storage and Retrieval System; CAS, Chemical Abstract Service; –, not available or not applicable; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; µS/cm, microsiemens per centimeter; °C, degrees Celsius; MCL, Maximum Contaminant Level; µg/L, micrograms per liter; HBSL, Health-Based Screening Level; N, nitrogen; P, phosphorus; pCi/L, picocuries per liter; AMCL, Alternative Maximum Contaminant Level; DWLOC, Drinking Water Level of Comparison; TT, treatment technique; PrsAbs/L; presence or absence per liter; col/100 mL, colonies per 100 milliliters]

Property or contaminant	Units	USGS parameter code(s)	CAS registry number(s)[1]	Primary USGS analytical schedule	Number of samples	Range of reporting levels for non-detections[2] (in units shown)	Human-health benchmark value (in units shown)[3]	Human-health benchmark type[3]
Volatile organic compounds—Continued								
o-Xylene	µg/L	77135	95-47-6	2020	769	0.019–0.064	10,000	MCL [19]
m- and *p*- Xylenes	µg/L	85795	108-38-3, 106-42-3	2020	769	0.03–0.064	10,000	MCL [19]
Total trihalomethanes (TTHMs) [12]	µg/L	32101, 32104, 32105, 32106	–	–	832	0.05–0.2	80	MCL [15]
Total xylenes [12]	µg/L	77135, 85795	1330-20-7	–	769	0.03–0.064	10,000	MCL [19]
Fecal-indicator microorganisms								
Coliphage, presence/absence	PrsAbs/L	99332, 99335	–	–	294	–	–	–[20,21]
Escherichia coli, all methods	col/100 mL	31633, 50278, 90901	–	–	330	–	See total coliforms	MCL [21,22]
Total coliforms, all methods	col/100 mL	31501, 90900	–	–	343	–	5% of samples	MCL [21,22]
Summary								
Total number of analytes		***221***						
Total number of analyses		***156,779***						

[1] This study contains CAS Registry Numbers®, which is a Registered Trademark of the American Chemical Society. CAS recommends the verification of the CAS registry numbers through CAS Client Services℠.

[2] Reporting levels are Minimum Reporting Levels (MRL) and (or) Long-Term Method Detection Levels (LT-MDL). The entire range of reporting levels for non-detections is shown. For some contaminants, only a few samples have non-detections with a given reporting level.

[3] Human-health benchmark values were current as of September 2009. MCL values were obtained from U.S. Environmental Protection Agency (2006a) and HBSL values were obtained from the HBSL website (Toccalino and others, 2008). USEPA published a revised edition of drinking water standards and guidelines in late 2009 (U.S. Environmental Protection Agency, 2009a), but data from the revised USEPA report were not available in time for inclusion in this report.

[4] MCL is a treatment technique. Copper action level = 1,300 µg/L (at tap); lead action level = 15 µg/L (at tap).

[5] The median nitrite concentration was about 1 percent of the nitrate plus nitrite concentrations in individual samples.

[6] The MCL for gross alpha-particle radioactivity excludes alpha-particle radioactivity from radon and uranium (U.S. Environmental Protection Agency, 2000b). Gross alpha-particle radioactivity values for public-well samples in this study were not corrected for radon or uranium.

[7] MCL = 4 mrem/yr, but because gross beta-particle radioactivity was measured in pCi/L, activities were compared to USEPA's screening level for gross beta-particle radioactivity of 50 pCi/L (U.S. Environmental Protection Agency, 2000b).

[8] The reporting level of 0.02 pCi/L corresponds to non-detections for some samples analyzed for radium-226.

[9] Low end of HBSL range corresponding to a 10^{-6} (1 in 1 million) cancer risk. The HBSL range corresponds to a 10^{-6} to 10^{-4} cancer risk range.

Appendix 4. List of six water-quality properties and 215 contaminants analyzed in public-well samples collected during 1993–2007, including reporting levels for non-detections and human-health benchmarks for drinking water.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency (USEPA) Data Storage and Retrieval System; CAS, Chemical Abstract Service; –, not available or not applicable; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; µS/cm, microsiemens per centimeter; °C, degrees Celsius; MCL, Maximum Contaminant Level; µg/L, micrograms per liter; HBSL, Health-Based Screening Level; N, nitrogen; P, phosphorus; pCi/L, picocuries per liter; AMCL, Alternative Maximum Contaminant Level; DWLOC, Drinking Water Level of Comparison; TT, treatment technique; PrsAbs/L; presence or absence per liter; col/100 mL, colonies per 100 milliliters]

[10] USEPA Office of Water recommends that the concentration of any combination of two or more of the three aldicarb compounds should not be greater than 7 µg/L because of similar mode of action.

[11] Concentrations of *cis*-permethrin were compared to the HBSL range (4–400 µg/L) for permethrin, CAS number 52645-53-1.

[12] Not counted as one of the 221 individual water-quality properties or contaminants included in this assessment because it represents a sum of two or more contaminant concentrations that were analyzed separately. It is included as a sum of the specified individual contaminants in order to make appropriate benchmark comparisons.

[13] The DWLOC, developed by USEPA Office of Pesticide Programs, is for total chlorotriazines (TCT) (U.S. Environmental Protection Agency, 2003e). The sum of simazine, deethylatrazine, and atrazine concentrations were compared to the DWLOC.

[14] In September 2009, USEPA published updated toxicity data for bromobenzene, methyl butyl ketone (2-hexanone), and 1,2,3-trichloropropane (U.S. Environmental Protection Agency, 2010c); these updates may result in future new or revised HBSL values.

[15] The MCL is for total trihalomethanes.

[16] Sum of concentrations from *cis*-1,3- and *trans*-1,3-dichloropropene were compared to the HBSL range (0.3–30 µg/L) for the mixed isomer of 1,3-dichloropropene, CAS number 542-75-6.

[17] The MCLs for perchloroethene and trichloroethene are under review by USEPA.

[18] All data for toluene and 1,2,4-trimethylbenzene were censored at 0.03 and 0.05 µg/L, respectively, in order to limit the estimated probability of false detections due to random sample contamination to less than 1 percent (J.S. Zogorski and D.A. Bender, U.S. Geological Survey, written commun., 2008).

[19] The MCL is for total xylenes (*o*-, *m*-, and *p*-xylene), CAS number 1330-20-7.

[20] There is no MCL for coliphage. The MCL for viruses is a treatment technique requiring that 99.99 percent of viruses be removed or inactivated.

[21] Additional information about benchmarks for fecal-indicator microorganisms is available at U.S. Environmental Protection Agency (2009b).

[22] No more than 5 percent of samples per month may have total coliforms present. Sampling frequencies vary with the system size. Repeat sampling and analysis for fecal coliforms or *E. coli* are required when total coliform bacteria are detected; no fecal coliforms or *E. coli* bacteria are allowed.

Appendix 5. Primary use groups associated with pesticide compounds and volatile organic compounds analyzed in public-well samples collected during 1993–2007.

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency Data Storage and Retrieval System. Primary use group data are from Carter and others (2007) unless specified otherwise.]

Organic contaminant	USGS parameter code(s)	Primary use group or source
Pesticide Compounds		
Acetochlor	49260	Herbicides and herbicide degradates
Acifluorfen	49315	Herbicides and herbicide degradates
Alachlor	46342	Herbicides and herbicide degradates
Aldicarb	49312	Insecticides and insecticide degradates
Aldicarb sulfone	49313	Insecticides and insecticide degradates
Aldicarb sulfoxide	49314	Insecticides and insecticide degradates
Atrazine	39632	Herbicides and herbicide degradates
Azinphos-methyl	82686	Insecticides and insecticide degradates
Benfluralin	82673	Herbicides and herbicide degradates
Bentazon	38711	Herbicides and herbicide degradates
Bromacil	04029	Herbicides and herbicide degradates
Bromoxynil	49311	Herbicides and herbicide degradates
Butylate	04028	Herbicides and herbicide degradates [1]
Carbaryl	82680	Insecticides and insecticide degradates
Carbofuran	82674	Insecticides and insecticide degradates
Chloramben methyl ester	61188	Herbicides and herbicide degradates
Chlorothalonil	49306	Fungicides
Chlorpyrifos	38933	Insecticides and insecticide degradates
Clopyralid	49305	Herbicides and herbicide degradates
Cyanazine	04041	Herbicides and herbicide degradates [1]
2,4-D (2,4-Dichlorophenoxyacetic acid)	39732	Herbicides and herbicide degradates
Dacthal	82682	Herbicides and herbicide degradates
Dacthal monoacid	49304	Herbicides and herbicide degradates
2,4-DB (4-(2,4-Dichlorophenoxy) butyric acid)	38746	Herbicides and herbicide degradates
p,p'-DDE (1-Chloro-4-[2,2-dichloro-1-(4-chlorophenyl)ethenyl]benzene)	34653	Insecticides and insecticide degradates [1]
Deethylatrazine	04040	Herbicides and herbicide degradates
Diazinon	39572	Insecticides and insecticide degradates
Dicamba	38442	Herbicides and herbicide degradates
Dichlobenil	49303	Herbicides and herbicide degradates [1]
Dichlorprop	49302	Herbicides and herbicide degradates
Dieldrin	39381	Insecticides and insecticide degradates
2,6-Diethylaniline	82660	Herbicides and herbicide degradates
Dinoseb	49301	Herbicides and herbicide degradates
Disulfoton	82677	Insecticides and insecticide degradates [1]
Diuron	49300	Herbicides and herbicide degradates
DNOC (2-Methyl-4,6-dinitrophenol)	49299	Herbicides and herbicide degradates [1]
EPTC (Eptam)	82668	Herbicides and herbicide degradates [1]
Ethalfluralin	82663	Herbicides and herbicide degradates [1]
Ethoprop	82672	Insecticides and insecticide degradates [1]
Fenuron	49297	Herbicides and herbicide degradates
Fluometuron	38811	Herbicides and herbicide degradates
Fonofos	04095	Insecticides and insecticide degradates
alpha-HCH (*alpha*-Hexachlorocyclohexane)	34253	Insecticides and insecticide degradates [1]

Appendix 5. Primary use groups associated with pesticide compounds and volatile organic compounds analyzed in public-well samples collected during 1993–2007.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency Data Storage and Retrieval System. Primary use group data are from Carter and others (2007) unless specified otherwise.]

Organic contaminant	USGS parameter code(s)	Primary use group or source
Pesticide Compounds—Continued		
gamma-HCH (Lindane)	39341	Insecticides and insecticide degradates [1]
3-Hydroxycarbofuran	49308	Insecticides and insecticide degradates
Linuron	82666	Herbicides and herbicide degradates
Malathion	39532	Insecticides and insecticide degradates
MCPA (4-Chloro-2-methylphenoxy acetic acid)	38482	Herbicides and herbicide degradates
MCPB (4-(2-Methyl-4-chlorophenoxy)butyric acid)	38487	Herbicides and herbicide degradates
Methiocarb	38501	Insecticides and insecticide degradates
Methomyl	49296	Insecticides and insecticide degradates
Metolachlor	39415	Herbicides and herbicide degradates
Metribuzin	82630	Herbicides and herbicide degradates
Molinate	82671	Herbicides and herbicide degradates [1]
Napropamide	82684	Herbicides and herbicide degradates [1]
Neburon	49294	Herbicides and herbicide degradates
Norflurazon	49293	Herbicides and herbicide degradates
Oryzalin	49292	Herbicides and herbicide degradates
Oxamyl	38866	Insecticides and insecticide degradates
Parathion	39542	Insecticides and insecticide degradates [1]
Parathion-methyl	82667	Insecticides and insecticide degradates
Pebulate	82669	Herbicides and herbicide degradates [1]
Pendimethalin	82683	Herbicides and herbicide degradates
cis-Permethrin	82687	Insecticides and insecticide degradates
Phorate	82664	Insecticides and insecticide degradates
Picloram	49291	Herbicides and herbicide degradates
Prometon	04037	Herbicides and herbicide degradates
Pronamide	82676	Herbicides and herbicide degradates
Propachlor	04024	Herbicides and herbicide degradates
Propanil	82679	Herbicides and herbicide degradates [1]
Propargite	82685	Acaricide [1]
Propham	49236	Herbicides and herbicide degradates
Propoxur	38538	Insecticides and insecticide degradates
Simazine	04035	Herbicides and herbicide degradates
2,4,5-T (2-(2,4,5-Trichlorophenoxy)acetic acid)	39742	Herbicides and herbicide degradates [1]
Tebuthiuron	82670	Herbicides and herbicide degradates
Terbacil	82665	Herbicides and herbicide degradates
Terbufos	82675	Insecticides and insecticide degradates
Thiobencarb	82681	Herbicides and herbicide degradates [1]
2,4,5-TP (Silvex)	39762	Herbicides and herbicide degradates [1]
Triallate	82678	Herbicides and herbicide degradates [1]
Triclopyr	49235	Herbicides and herbicide degradates
Trifluralin	82661	Herbicides and herbicide degradates

Appendix 5. Primary use groups associated with pesticide compounds and volatile organic compounds analyzed in public-well samples collected during 1993–2007.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency Data Storage and Retrieval System. Primary use group data are from Carter and others (2007) unless specified otherwise.]

Organic contaminant	USGS parameter code(s)	Primary use group or source
Volatile Organic Compounds		
Acetone	81552	Solvents
Acrylonitrile	34215	Organic synthesis compounds
tert-Amyl methyl ether	50005	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Benzene	34030	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Bromobenzene	81555	Solvents
Bromochloromethane	77297	Personal care and domestic use products
Bromodichloromethane	32101	Disinfection by-products
Bromoform	32104	Disinfection by-products
Bromomethane	34413	Fumigant related compounds
n-Butylbenzene	77342	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
sec-Butylbenzene	77350	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
tert-Butylbenzene	77353	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Carbon disulfide	77041	Organic synthesis compounds
Carbon tetrachloride	32102	Solvents
Chlorobenzene	34301	Solvents
Chloroethane	34311	Solvents
Chloroform	32106	Disinfection by-products
Chloromethane	34418	Organic synthesis compounds
3-Chloropropene	78109	Organic synthesis compounds
2-Chlorotoluene	77275	Solvents
4-Chlorotoluene	77277	Solvents
Dibromochloromethane	32105	Disinfection by-products
Dibromochloropropane	82625	Fumigant related compounds
Dibromomethane	30217	Solvents
1,2-Dichlorobenzene	34536	Solvents
1,3-Dichlorobenzene	34566	Solvents
1,4-Dichlorobenzene	34571	Fumigant related compounds
trans-1,4-Dichloro-2-butene	73547	Organic synthesis compounds
Dichlorodifluoromethane	34668	Refrigerants and propellants
1,1-Dichloroethane	34496	Solvents
1,2-Dichloroethane	32103	Solvents
1,1-Dichloroethene	34501	Solvents
cis-1,2-Dichloroethene	77093	Solvents
trans-1,2-Dichloroethene	34546	Solvents
1,2-Dichloropropane	34541	Fumigant related compounds
1,3-Dichloropropane	77173	Fumigant related compounds
2,2-Dichloropropane	77170	Fumigant related compounds
1,1-Dichloropropene	77168	Organic synthesis compounds

Appendix 5. Primary use groups associated with pesticide compounds and volatile organic compounds analyzed in public-well samples collected during 1993–2007.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency Data Storage and Retrieval System. Primary use group data are from Carter and others (2007) unless specified otherwise.]

Organic contaminant	USGS parameter code(s)	Primary use group or source
Volatile Organic Compounds—Continued		
cis-1,3-Dichloropropene	34704	Fumigant related compounds
trans-1,3-Dichloropropene	34699	Fumigant related compounds
Diethyl ether	81576	Solvents
Diisopropyl ether	81577	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Ethyl methacrylate	73570	Organic synthesis compounds
Ethyl *tert*-butyl ether	50004	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Ethylbenzene	34371	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Ethylene dibromide	77651	Fumigant related compounds
2-Ethyltoluene	77220	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Hexachlorobutadiene	39702	Organic synthesis compounds
Hexachloroethane	34396	Solvents
Iodomethane	77424	Organic synthesis compounds
Isopropylbenzene	77223	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
n-Isopropyltoluene	77356	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Methyl acrylate	49991	Organic synthesis compounds
Methyl acrylonitrile	81593	Organic synthesis compounds
Methyl butyl ketone	77103	Solvents
Methyl ethyl ketone	81595	Solvents
Methyl isobutyl ketone	78133	Solvents
Methyl methacrylate	81597	Organic synthesis compounds
Methyl *tert*-butyl ether	78032	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Methylene chloride	34423	Solvents
Naphthalene	34696	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Perchloroethene	34475	Solvents
n-Propylbenzene	77224	Solvents
Styrene	77128	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
1,1,1.2-Tetrachloroethane	77562	Solvents
1,1,2,2-Tetrachloroethane	34516	Solvents
Tetrahydrofuran	81607	Solvents
1,2,3,4-Tetramethylbenzene	49999	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
1,2,3,5-Tetramethylbenzene	50000	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Toluene	34010	Gasoline hydrocarbons, oxygenates, and oxygenate degradates

Appendix 5. Primary use groups associated with pesticide compounds and volatile organic compounds analyzed in public-well samples collected during 1993–2007.—Continued

[USGS, U.S. Geological Survey; Parameter code, the number used to identify a contaminant in the USGS National Water Information System and the U.S. Environmental Protection Agency Data Storage and Retrieval System. Primary use group data are from Carter and others (2007) unless specified otherwise.]

Organic contaminant	USGS parameter code(s)	Primary use group or source
Volatile Organic Compounds—Continued		
1,2,3-Trichlorobenzene	77613	Organic synthesis compounds
1,2,4-Trichlorobenzene	34551	Solvents
1,1,1-Trichloroethane	34506	Solvents
1,1,2-Trichloroethane	34511	Solvents
Trichloroethene	39180	Solvents
Trichlorofluoromethane	34488	Refrigerants and propellants
1,2,3-Trichloropropane	77443	Organic synthesis compounds
Trichlorotrifluoroethane	77652	Refrigerants and propellants
1,2,3-Trimethylbenzene	77221	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
1,2,4-Trimethylbenzene	77222	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
1,3,5-Trimethylbenzene	77226	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
Vinyl bromide	50002	Organic synthesis compounds
Vinyl chloride	39175	Organic synthesis compounds
o-Xylene	77135	Gasoline hydrocarbons, oxygenates, and oxygenate degradates
m- and *p*- Xylenes	85795	Gasoline hydrocarbons, oxygenates, and oxygenate degradates

[1] Source of primary use-group information is Gilliom and others (2006).

Appendix 6. Alkalinity calculations.

For about 8 percent of samples in this study (69 of 840 samples for which alkalinity was reported), alkalinity as milligrams per liter as calcium carbonate (mg/L as $CaCO_3$) was calculated from reported bicarbonate concentrations (as mg/L), pH, and temperature using the chemical equations described in Pankow (1991), neglecting activity corrections.

$$\text{Alk} = [HCO_3^-] + 2[CO_3^{2-}] + [OH^-] - [H^+] \quad (1)$$

where

Alk is alkalinity in units of equivalents per liter (eq/L) [1],

$[HCO_3^-]$ is the bicarbonate ion concentration in eq/L,

$[CO_3^{2-}]$ is the carbonate ion concentration in eq/L estimated from $[HCO_3^-]$,

$[OH^-]$ is the hydroxide ion concentration, estimated from $[H^+]$, and

$[H^+]$ is the hydrogen ion concentration = 10^{-pH}.

$$\text{Alk} = [HCO_3^-] + \frac{2K_2[HCO_3^-]}{[H^+]} + \frac{Kw}{[H^+]} - [H^+] \quad (2)$$

where

K_2 is the equilibrium constant for $HCO_3^- = H^+ + CO_3^{2-}$,

K_2 values vary as a function of temperature, and different K_2 values were used depending on the temperature of the water sample.

$K_2 = 10^{-10.33}$ at 25°C (Pankow, 1991), and

Kw is the equilibrium constant for $H_2O = H^+ + OH^-$; $Kw = 10^{-14}$ at 25°C.

Before calculating alkalinity, bicarbonate ion concentrations were first converted from units of mg/L to eq/L using:

$$HCO_3^-\,(\text{eq/L}) = \frac{(HCO_3^-\,(\text{mg/L})) \times (1\,\text{g}/1{,}000\,\text{mg}) \times (1\ \text{eq/mole})}{(61.0171\,\text{g}\ HCO_3^-/\text{mole})} \quad (3)$$

where

g/mg is grams per milligram,

eq/mole is equivalents per mole of constituent, and

g/mole is grams per mole.

After alkalinity was calculated in units of eq/L, the result was converted into units of mg/L as $CaCO_3$ using:

$$\text{Alk}\,(\text{mg/L as}\,CaCO_3) = \frac{(\text{Alk}\,(\text{eq/L})) \times (100.088\,\text{g}\,CaCO_3/\text{mole}) \times (1{,}000\,\text{mg/g})}{(2\,\text{eq/mole})} \quad (4)$$

[1] An equivalent of a chemical is the amount that possesses a mole of electronic charge. If a chemical has two electronic charge units per molecule, one mole constitutes two equivalents. For example, one mole of calcium (Ca^{2+}) is equal to two equivalents (Hemond and Fechner, 1994).

Appendix 7. Water hardness calculations.

Water hardness is normally expressed as the total concentration of calcium (Ca^{2+}) and magnesium (Mg^{2+}) reported in terms of an equivalent concentration of calcium carbonate ($CaCO_3$) (Freeze and Cherry, 1979; Hem, 1985). Hardness was calculated in this manner for all samples in which Ca^{2+} and Mg^{2+} were analyzed (809 samples).

$$Ca^{2+}\,(eq/L) = \frac{(Ca^{2+}\,(mg/L)) \times (1\,g/1{,}000\,mg) \times (2\,eq/mole)}{(40.08\,g\,Ca^{2+}/mole)} \quad (5)$$

where

eq/L is equivalents per liter of water (see footnote for alkalinity in Appendix 6),
mg/L is milligrams per liter,
g/mg is grams per milligrams,
eq/mole is equivalents per mole of constituent, and
g/mole is grams per mole of constituent.

$$Mg^{2+}\,(eq/L) = \frac{(Mg^{2+}\,(mg/L)) \times (1\,g/1{,}000\,mg) \times (2\,eq/mole)}{(24.312\,g\,Mg^{2+}/mole)} \quad (6)$$

$$Hardness\,(eq/L) = Ca^{2+}\,(eq/L) + Mg^{2+}\,(eq/L) \quad (7)$$

$$Hardness\,(mg/L\,as\,CaCO_3) = \frac{(Hardness\,(eq/L)) \times (100.088\,g\,CaCO_3/mole) \times (1{,}000\,mg/g)}{(2\,eq/mole)} \quad (8)$$

Appendix 8. Concentration statistics for water-quality properties, major ions, nutrients, radionuclides, and fecal-indicator microorganisms analyzed in public-well samples collected during 1993–2007.

[No common assessment level was applied to these data. A percentile is the value below which a certain percentage of observations fall. For example, 90 percent of the samples had concentrations less than the 90th percentile. mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; µS/cm, microsiemens per centimeter; °C, degrees Celsius; N, nitrogen; P, phosphorus; pCi/L, picocuries per liter; col/100 mL, colonies per 100 milliliters; <, less than; < values correspond to the maximum reporting level for a given compound; –, not applicable; >, greater than]

Contaminant	Number of samples	Number of detections	Detection frequency (percent)	Percentile concentrations					Maximum detected concentration
				10th	25th	50th (median)	75th	90th	
Water-quality properties									
Alkalinity (mg/L as $CaCO_3$) [1]	840	838	99.8	21.2	98	158	229	295	500
Dissolved oxygen (mg/L)	865	803	92.8	0.1	0.3	2.5	5.9	7.8	11
pH (standard units)	878	878	100	5.6	6.8	7.3	7.6	7.9	9.2
Specific conductance (µS/cm at 25°C)	896	896	100	127	277	471	644	964	3,970
Temperature (°C)	893	884	99.0	10.8	13.5	17.4	22.4	25	39.8
Total dissolved solids (mg/L)	802	802	100	102	187.2	293.4	413	615	2,810
Major ions (mg/L)									
Bromide	787	749	95.2	0.01	0.03	0.07	0.1	0.3	2.4
Calcium	809	809	100	4.8	21	50.5	75.6	98.0	330
Chloride	809	808	99.9	2.5	7.0	16.5	39	100.7	870
Fluoride	808	610	75.5	0.05	0.1	0.2	0.5	1.0	6
Magnesium	809	809	100	1.5	4.4	10.7	21.6	33.4	120
Potassium	810	810	100	0.9	1.4	2.4	4.2	8.0	42.9
Silica	809	809	100	8.2	11.2	16.1	29.4	49.8	105
Sodium	809	809	100	4.5	9.9	21	49.9	91.9	565
Sulfate	810	795	98.1	2.4	8.8	21.8	56.3	133.5	1,069
Hardness as $CaCO_3$ [2]	809	809	100	20.6	76.3	182.3	275.0	350.8	1,199
Nutrients (mg/L)									
Ammonia as N	806	357	44.3	<0.021	0.005	0.01	0.09	0.5	4.3
Ammonia plus organic nitrogen as N	603	206	34.2	<0.2	<0.2	<0.2	0.09	0.3	3.6
Dissolved organic carbon	817	735	90.0	0.1	0.2	0.4	0.8	2.1	248
Nitrate plus nitrite as N	806	578	71.7	<0.05	< 0.05	0.7	2.4	5.3	20.1
Nitrite as N	807	83	10.3	<0.01	<0.01	<0.01	0.001	0.004	0.1
Orthophosphate as P	804	521	64.8	<0.01	0.004	0.01	0.03	0.1	1.0
Phosphorus, dissolved as P	454	285	62.8	0.003	0.004	0.01	0.04	0.1	1.0
Total nitrogen as N (nitrate + nitrite + ammonia + organic N)	201	194	96.5	0.09	0.4	1.1	1.8	2.8	19.4

Appendix 8. Concentration statistics for water-quality properties, major ions, nutrients, radionuclides, and fecal-indicator microorganisms analyzed in public-well samples collected during 1993–2007.—Continued

[No common assessment level was applied to these data. A percentile is the value below which a certain percentage of observations fall. For example, 90 percent of the samples had concentrations less than the 90th percentile. mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; µS/cm, microsiemens per centimeter; °C, degrees Celsius; N, nitrogen; P, phosphorus; pCi/L, picocuries per liter; col/100 mL, colonies per 100 milliliters; <, less than; < values correspond to the maximum reporting level for a given compound; –, not applicable; >, greater than]

Contaminant	Number of samples	Number of detections	Detection frequency (percent)	Percentile concentrations					Maximum detected concentration
				10th	25th	50th (median)	75th	90th	
Radionuclides (pCi/L)									
Gross alpha-particle radioactivity	84	61	72.6	0.6	1.3	1.8	6.2	12	42.2
Gross beta-particle radioactivity	86	69	80.2	1.6	2.9	4.8	8.2	11.4	44.9
Radium-226 plus radium-228	191	176	92.1	0.2	0.4	0.8	3.8	7.5	21.9
Radon-222	506	497	98.2	89	168	326	610	1,156	15,402
Fecal-indicator microorganisms									
Coliphage, presence/absence	294	7	2.4			not detemined			–
Escherichia coli, all methods, in col/100 mL	330	8	2.4			not detemined			>80
Total coliforms, all methods, in col/100 mL	343	36	10.5			not detemined			>80

[1] Alkalinity was calculated from bicarbonate concentrations in 69 samples (Appendix 6), and was directly analyzed in 771 samples.

[2] Hardness was calculated from calcium and magnesium concentrations (Appendix 7).

Appendix 9. Concentration statistics for trace elements analyzed in public-well samples collected during 1993–2007.

[µg/L, micrograms per liter. A percentile is the value below which a certain percentage of observations fall. For example, 90 percent of the samples had concentrations less than the 90th percentile. <, less than; < values correspond to the common assessment level for a given compound; ND, not detected]

Trace element	Common assessment level = 1 µg/L[1]								
	Number of samples	Number of detections	Detection frequency (percent)	Percentile concentrations (µg/L)					Maximum detected concentration
				10th	25th	50th (median)	75th	90th	
Aluminum	598	262	43.8	<1	<1	<1	2.7	5.8	412
Antimony	619	4	0.6	<1	<1	<1	<1	<1	9.5
Arsenic	638	280	43.9	<1	<1	<1	2.4	9.4	97.7
Barium	630	625	99.2	7.1	16.9	46.7	96.2	164.1	11,080
Beryllium	622	0	0	ND	ND	ND	ND	ND	ND
Boron	501	459	91.6	14.7	23.2	51.4	113.5	360.9	1,895
Cadmium	631	1	0.2	<1	<1	<1	<1	<1	2
Chromium	626	226	36.1	<1	<1	<1	1.8	4.3	34.4
Cobalt	627	15	2.4	<1	<1	<1	< 1	< 1	10.8
Copper	625	335	53.6	<1	<1	1.2	2.5	5.5	88.9
Iron	809	356	44.0	<10	<10	<10	100	714.2	17,000
Lead	630	107	17.0	<1	<1	<1	<1	1.8	46.5
Lithium	458	395	86.2	<1	2.0	4.8	18.6	78.9	650
Manganese	808	437	54.1	<1	<1	1.6	17	97.1	1,923
Molybdenum	628	332	52.9	<1	<1	1.1	3.4	6.7	89
Nickel	629	272	43.2	<1	<1	<1	1.9	4.1	25.6
Selenium	632	135	21.4	<1	<1	<1	<1	1.9	62.0
Silver	606	0	0	ND	ND	ND	ND	ND	ND
Strontium	503	503	100	84.3	204.5	384.5	754.9	1,811.3	43,950
Thallium	437	1	0.2	<1	<1	<1	<1	<1	1.7
Uranium	650	278	42.8	<1	<1	<1	2.8	6.9	86.8
Vanadium	457	285	62.4	<1	<1	2.5	8.1	21.9	121
Zinc	613	515	84.0	<1	1.5	3.7	8.0	22.4	3,290

[1] Common assessment level was 12 µg/L for boron and 10 µg/L for iron.

Appendix 10. Detection frequencies for trace elements at various common assessment levels in public-well samples collected during 1993–2007.

[µg/L, micrograms per liter]

Trace element	No common assessment level			Common assessment level = 1 µg/L[1]		
	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)
Aluminum	598	299	50	598	262	43.8
Antimony	619	105	17	619	4	0.6
Arsenic	638	444	69.6	638	280	43.9
Barium	630	627	99.5	630	625	99.2
Beryllium	622	37	5.9	622	0	0
Boron	501	497	99.2	501	459	91.6
Cadmium	631	109	17.3	631	1	0.2
Chromium	626	309	49.4	626	226	36.1
Cobalt	627	396	63.2	627	15	2.4
Copper	625	497	79.5	625	335	53.6
Iron	809	449	55.5	809	356	44.0
Lead	630	348	55.2	630	107	17.0
Lithium	458	448	97.8	458	395	86.2
Manganese	808	543	67.2	808	437	54.1
Molybdenum	628	485	77.2	628	332	52.9
Nickel	629	444	70.6	629	272	43.2
Selenium	632	299	47.3	632	135	21.4
Silver	606	4	0.7	606	0	0
Strontium	503	503	100	503	503	100
Thallium	437	93	21.3	437	1	0.2
Uranium	650	467	71.8	650	278	42.8
Vanadium	457	404	88.4	457	285	62.4
Zinc	613	561	91.5	613	515	84.0

[1] Common assessment level was 12 µg/L for boron and 10 µg/L for iron.

Appendix 11. Detection frequencies for pesticide compounds at various common assessment levels in public-well samples collected during 1993–2007.

[µg/L, micrograms per liter; GCMS, gas chromatography/mass spectrometry; HPLC, high performance liquid chromatography; –, not assessed because the reporting levels generally were greater than the common assessment level]

Pesticide compound	Analysis method	No common assessment level			Common assessment level = 0.02 µg/L			Common assessment level = 0.1 µg/L			Common assessment level = 0.2 µg/L		
		Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)
Acetochlor	GCMS	800	2	0.3	800	2	0.3	800	1	0.1	800	0	0
Acifluorfen	HPLC	590	0	0	–	–	–	590	0	0	590	0	0
Alachlor	GCMS	869	16	1.8	869	6	0.7	869	1	0.1	869	1	0.1
Aldicarb	HPLC	584	0	0	–	–	–	584	0	0	584	0	0
Aldicarb sulfone	HPLC	569	3	0.5	–	–	–	569	1	0.2	569	0	0
Aldicarb sulfoxide	HPLC	569	2	0.4	–	–	–	569	1	0.2	569	0	0
Atrazine	GCMS	853	227	26.6	853	76	8.9	853	17	2.0	853	6	0.7
Azinphos-methyl	GCMS	894	0	0	894	0	0	894	0	0	894	0	0
Benfluralin	GCMS	896	0	0	896	0	0	896	0	0	896	0	0
Bentazon	HPLC	589	16	2.7	–	–	–	589	2	0.3	589	1	0.2
Bromacil	HPLC	590	30	5.1	–	–	–	590	5	0.8	590	3	0.5
Bromoxynil	HPLC	590	1	0.2	–	–	–	590	0	0	590	0	0
Butylate	GCMS	511	1	0.2	511	1	0.2	511	0	0	511	0	0
Carbaryl	GCMS	898	6	0.7	898	0	0	898	0	0	898	0	0
Carbofuran	GCMS	644	13	2.0	644	6	0.9	644	4	0.6	644	0	0
Chloramben methyl ester	HPLC	580	1	0.2	–	–	–	580	0	0	580	0	0
Chlorothalonil	HPLC	507	0	0	–	–	–	507	0	0	507	0	0
Chlorpyrifos	GCMS	898	2	0.2	898	0	0	898	0	0	898	0	0
Clopyralid	HPLC	586	1	0.2	–	–	–	586	0	0	586	0	0
Cyanazine	GCMS	634	3	0.5	634	1	0.2	634	0	0	634	0	0
2,4-D	HPLC	590	2	0.3	–	–	–	590	0	0	590	0	0
Dacthal	GCMS	898	3	0.3	898	0	0	898	0	0	898	0	0
Dacthal monoacid	HPLC	590	0	0	–	–	–	590	0	0	590	0	0
2,4-DB	HPLC	580	0	0	–	–	–	580	0	0	580	0	0
p,p'-DDE	GCMS	512	14	2.7	512	0	0	512	0	0	512	0	0
Deethylatrazine	GCMS	853	257	30.1	853	65	7.6	853	10	1.2	853	4	0.5
Diazinon	GCMS	897	3	0.3	897	1	0.1	897	0	0	897	0	0
Dicamba	HPLC	584	0	0	–	–	–	584	0	0	584	0	0
Dichlobenil	HPLC	159	0	0	–	–	–	159	0	0	159	0	0
Dichlorprop	HPLC	590	0	0	–	–	–	590	0	0	590	0	0
Dieldrin	GCMS	896	28	3.1	896	12	1.3	896	2	0.2	896	0	0
2,6-Diethylaniline	GCMS	898	1	0.1	898	0	0	898	0	0	898	0	0
Dinoseb	HPLC	590	5	0.8	–	–	–	590	1	0.2	590	0	0
Disulfoton	GCMS	647	0	0	647	0	0	647	0	0	647	0	0

Appendix 11. Detection frequencies for pesticide compounds at various common assessment levels in public-well samples collected during 1993–2007.—Continued

[µg/L, micrograms per liter; GCMS, gas chromatography/mass spectrometry; HPLC, high performance liquid chromatography; –, not assessed because the reporting levels generally were greater than the common assessment level]

Pesticide compound	Analysis method	No common assessment level			Common assessment level = 0.02 µg/L			Common assessment level = 0.1 µg/L			Common assessment level = 0.2 µg/L		
		Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)
Diuron	HPLC	587	31	5.3	–	–	–	587	8	1.4	587	4	0.7
DNOC	HPLC	165	0	0	–	–	–	165	0	0	165	0	0
EPTC	GCMS	646	2	0.3	646	0	0	646	0	0	646	0	0
Ethalfluralin	GCMS	512	0	0	512	0	0	512	0	0	512	0	0
Ethoprop	GCMS	647	1	0.2	647	0	0	647	0	0	647	0	0
Fenuron	HPLC	587	6	1.0	–	–	–	587	0	0	587	0	0
Fluometuron	HPLC	590	6	1.0	–	–	–	590	2	0.3	590	1	0.2
Fonofos	GCMS	898	0	0	898	0	0	898	0	0	898	0	0
alpha-HCH	GCMS	512	1	0.2	512	1	0.2	512	0	0	512	0	0
gamma-HCH	GCMS	512	2	0.4	512	1	0.2	512	1	0.2	512	0	0
3-Hydroxycarbofuran	HPLC	580	0	0	–	–	–	580	0	0	580	0	0
Linuron	GCMS	512	1	0.2	512	0	0	512	0	0	512	0	0
Malathion	GCMS	898	0	0	898	0	0	898	0	0	898	0	0
MCPA	HPLC	582	0	0	–	–	–	582	0	0	582	0	0
MCPB	HPLC	590	0	0	–	–	–	590	0	0	590	0	0
Methiocarb	HPLC	579	0	0	–	–	–	579	0	0	579	0	0
Methomyl	HPLC	569	0	0	–	–	–	569	0	0	569	0	0
Metolachlor	GCMS	870	75	8.6	870	22	2.5	870	7	0.8	870	3	0.3
Metribuzin	GCMS	898	11	1.2	898	2	0.2	898	1	0.1	898	0	0
Molinate	GCMS	635	3	0.5	635	0	0	635	0	0	635	0	0
Napropamide	GCMS	511	0	0	511	0	0	511	0	0	511	0	0
Neburon	HPLC	584	0	0	–	–	–	584	0	0	584	0	0
Norflurazon	HPLC	585	6	1.0	–	–	–	585	0	0	585	0	0
Oryzalin	HPLC	582	0	0	–	–	–	582	0	0	582	0	0
Oxamyl	HPLC	569	0	0	–	–	–	569	0	0	569	0	0
Parathion	GCMS	512	0	0	512	0	0	512	0	0	512	0	0
Parathion-methyl	GCMS	889	1	0.1	889	0	0	889	0	0	889	0	0
Pebulate	GCMS	512	0	0	512	0	0	512	0	0	512	0	0
Pendimethalin	GCMS	898	0	0	898	0	0	898	0	0	898	0	0
cis-Permethrin	GCMS	898	0	0	898	0	0	898	0	0	898	0	0
Phorate	GCMS	898	0	0	898	0	0	898	0	0	898	0	0
Picloram	HPLC	585	2	0.3	–	–	–	585	0	0	585	0	0
Prometon	GCMS	885	93	10.5	885	10	1.1	885	1	0.1	885	1	0.1
Pronamide	GCMS	898	0	0	898	0	0	898	0	0	898	0	0

Appendix 11. Detection frequencies for pesticide compounds at various common assessment levels in public-well samples collected during 1993–2007.—Continued

[µg/L, micrograms per liter; GCMS, gas chromatography/mass spectrometry; HPLC, high performance liquid chromatography; –, not assessed because the reporting levels generally were greater than the common assessment level]

Pesticide compound	Analysis method	No common assessment level			Common assessment level = 0.02 µg/L			Common assessment level = 0.1 µg/L			Common assessment level = 0.2 µg/L		
		Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)
Propachlor	GCMS	512	0	0	512	0	0	512	0	0	512	0	0
Propanil	GCMS	647	0	0	647	0	0	647	0	0	647	0	0
Propargite	GCMS	644	0	0	644	0	0	644	0	0	644	0	0
Propham	HPLC	589	0	0	–	–	–	589	0	0	589	0	0
Propoxur	HPLC	586	1	0.2	–	–	–	586	0	0	586	0	0
Simazine	GCMS	884	126	14.3	884	26	2.9	884	5	0.6	884	2	0.2
2,4,5-T	HPLC	165	0	0	–	–	–	165	0	0	165	0	0
Tebuthiuron	GCMS	859	40	4.7	859	18	2.1	859	4	0.5	859	3	0.3
Terbacil	GCMS	508	4	0.8	508	3	0.6	508	0	0	508	0	0
Terbufos	GCMS	898	0	0	898	0	0	898	0	0	898	0	0
Thiobencarb	GCMS	647	0	0	647	0	0	647	0	0	647	0	0
2,4,5-TP	HPLC	165	0	0	–	–	–	165	0	0	165	0	0
Triallate	GCMS	512	0	0	512	0	0	512	0	0	512	0	0
Triclopyr	HPLC	590	0	0	–	–	–	590	0	0	590	0	0
Trifluralin	GCMS	898	0	0	898	0	0	898	0	0	898	0	0
Total chlorotriazines	GCMS	886	293	33.1	886	107	12.1	886	24	2.7	886	10	1.1

Appendix 12. Detection frequencies for volatile organic compounds at various common assessment levels in public-well samples collected during 1993–2007.

[µg/L, micrograms per liter; –, not assessed because the reporting levels generally were greater than the common assessment level. The common assessment levels of 0.02 µg/L and 0.1 µg/L were not applied to volatile organic compounds (VOCs) in samples analyzed prior to April 1996 because the laboratory reporting level was 0.2 µg/L for most VOCs. ≥, greater than or equal to]

Volatile organic compound	No common assessment level			Common assessment level = 0.02 µg/L			Common assessment level = 0.1 µg/L			Common assessment level = 0.2 µg/L		
	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)
Acetone	771	5	0.6	–	–	–	–	–	–	–	–	–
Acrylonitrile	771	1	0.1	–	–	–	–	–	–	–	–	–
tert-Amyl methyl ether	771	14	1.8	771	14	1.8	771	8	1.0	771	4	0.5
Benzene	831	21	2.5	770	10	1.3	770	7	0.9	831	3	0.4
Bromobenzene	832	1	0.1	771	0	0	771	0	0	832	0	0
Bromochloromethane	832	2	0.2	771	2	0.3	771	0	0	832	0	0
Bromodichloromethane	831	92	11.1	771	74	9.6	771	31	4.0	831	22	2.6
Bromoform	832	37	4.4	771	37	4.8	771	27	3.5	832	23	2.8
Bromomethane	832	0	0	771	0	0	771	0	0	832	0	0
n-Butylbenzene	831	1	0.1	770	1	0.1	770	0	0	831	0	0
sec-Butylbenzene	831	3	0.4	770	2	0.3	770	1	0.1	831	1	0.1
tert-Butylbenzene	832	1	0.1	771	1	0.1	771	0	0	832	0	0
Carbon disulfide	765	44	5.8	765	31	4.1	765	8	1.0	765	4	0.5
Carbon tetrachloride	832	28	3.4	771	19	2.5	771	2	0.3	832	2	0.2
Chlorobenzene	832	11	1.3	771	7	0.9	771	2	0.3	832	1	0.1
Chloroethane	830	0	0	770	0	0	770	0	0	830	0	0
Chloroform	831	381	45.8	771	318	41.2	771	145	18.8	831	103	12.4
Chloromethane	806	22	2.7	757	19	2.5	757	2	0.3	806	0	0
3-Chloropropene	771	0	0	771	0	0	771	0	0	771	0	0
2-Chlorotoluene	832	0	0	771	0	0	771	0	0	832	0	0
4-Chlorotoluene	832	0	0	771	0	0	771	0	0	832	0	0
Dibromochloromethane	832	38	4.6	771	35	4.5	771	26	3.4	832	17	2.0
Dibromochloropropane	832	2	0.2	–	–	–	–	–	–	832	2	0.2
Dibromomethane	832	6	0.7	771	5	0.6	771	0	0	832	0	0
1,2-Dichlorobenzene	831	9	1.1	771	7	0.9	771	2	0.3	831	1	0.1
1,3-Dichlorobenzene	832	4	0.5	771	2	0.3	771	0	0	832	0	0
1,4-Dichlorobenzene	831	21	2.5	771	7	0.9	771	1	0.1	831	1	0.1
trans-1,4-Dichloro-2-butene	771	0	0	–	–	–	–	–	–	–	–	–
Dichlorodifluoromethane	832	27	3.2	771	25	3.2	771	13	1.7	832	8	1.0
1,1-Dichloroethane	832	64	7.7	771	50	6.5	771	20	2.6	832	12	1.4
1,2-Dichloroethane	825	8	1.0	771	8	1.0	771	6	0.8	825	2	0.2
1,1-Dichloroethene	832	63	7.6	771	45	5.8	771	15	1.9	832	9	1.1
cis-1,2-Dichloroethene	832	67	8.1	771	54	7.0	771	26	3.4	832	22	2.6
trans-1,2-Dichloroethene	832	13	1.6	771	9	1.2	771	2	0.3	832	1	0.1

Appendix 12. Detection frequencies for volatile organic compounds at various common assessment levels in public-well samples collected during 1993–2007.—Continued

[µg/L, micrograms per liter; –, not assessed because the reporting levels generally were greater than the common assessment level. The common assessment levels of 0.02 µg/L and 0.1 µg/L were not applied to volatile organic compounds (VOCs) in samples analyzed prior to April 1996 because the laboratory reporting level was 0.2 µg/L for most VOCs. ≥, greater than or equal to]

Volatile organic compound	No common assessment level			Common assessment level = 0.02 µg/L			Common assessment level = 0.1 µg/L			Common assessment level = 0.2 µg/L		
	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)
1,2-Dichloropropane	830	27	3.3	769	20	2.6	769	9	1.2	830	5	0.6
1,3-Dichloropropane	832	1	0.1	771	1	0.1	771	0	0	832	0	0
2,2-Dichloropropane	832	0	0	771	0	0	771	0	0	832	0	0
1,1-Dichloropropene	832	1	0.1	771	1	0.1	771	0	0	832	0	0
cis-1,3-Dichloropropene	832	0	0	771	0	0	771	0	0	832	0	0
trans-1,3-Dichloropropene	832	0	0	771	0	0	771	0	0	832	0	0
Diethyl ether	771	2	0.3	771	2	0.3	771	1	0.1	771	1	0.1
Diisopropyl ether	758	8	1.1	758	8	1.1	758	5	0.7	758	2	0.3
Ethyl methacrylate	771	0	0	–	–	–	–	–	–	–	–	–
Ethyl *tert*-butyl ether	771	1	0.1	771	1	0.1	771	1	0.1	771	1	0.1
Ethylbenzene	830	8	1.0	769	4	0.5	769	3	0.4	830	2	0.2
Ethylene dibromide	832	4	0.5	771	3	0.4	771	0	0	832	0	0
2-Ethyltoluene	770	3	0.4	770	3	0.4	770	3	0.4	770	1	0.1
Hexachlorobutadiene	831	1	0.1	771	1	0.1	771	0	0	831	0	0
Hexachloroethane	771	0	0	771	0	0	771	0	0	771	0	0
Iodomethane	771	1	0.1	771	1	0.1	771	0	0	771	0	0
Isopropylbenzene	830	6	0.7	769	3	0.4	769	0	0	830	0	0
n-Isopropyltoluene	831	2	0.2	770	1	0.1	770	0	0	831	0	0
Methyl acrylate	771	0	0	–	–	–	–	–	–	–	–	–
Methyl acrylonitrile	771	0	0	–	–	–	–	–	–	–	–	–
Methyl butyl ketone	771	0	0	–	–	–	–	–	–	–	–	–
Methyl ethyl ketone	769	13	1.7	–	–	–	–	–	–	–	–	–
Methyl isobutyl ketone	769	3	0.4	–	–	–	–	–	–	–	–	–
Methyl methacrylate	771	0	0	–	–	–	–	–	–	–	–	–
Methyl *tert*-butyl ether	832	115	13.8	771	114	14.8	771	78	10.1	832	53	6.4
Methylene chloride	832	22	2.6	771	15	1.9	771	2	0.3	832	3	0.4
Naphthalene	831	1	0.1	771	1	0.1	771	1	0.1	831	1	0.1
Perchloroethene	829	187	22.6	770	140	18.2	770	69	9.0	829	39	4.7
n-Propylbenzene	831	1	0.1	770	1	0.1	770	1	0.1	831	0	0
Styrene	829	2	0.2	768	1	0.1	768	0	0	829	0	0
1,1,1.2-Tetrachloroethane	832	3	0.4	771	0	0	771	0	0	832	0	0
1,1,2,2-Tetrachloroethane	832	0	0	771	0	0	771	0	0	832	0	0
Tetrahydrofuran	771	6	0.8	–	–	–	–	–	–	–	–	–
1,2,3,4-Tetramethylbenzene	770	3	0.4	770	3	0.4	770	1	0.1	770	1	0.1

Appendix 12. Detection frequencies for volatile organic compounds at various common assessment levels in public-well samples collected during 1993–2007.—Continued

[µg/L, micrograms per liter; –, not assessed because the reporting levels generally were greater than the common assessment level. The common assessment levels of 0.02 µg/L and 0.1 µg/L were not applied to volatile organic compounds (VOCs) in samples analyzed prior to April 1996 because the laboratory reporting level was 0.2 µg/L for most VOCs. ≥, greater than or equal to]

Volatile organic compound	No common assessment level			Common assessment level = 0.02 µg/L			Common assessment level = 0.1 µg/L			Common assessment level = 0.2 µg/L		
	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)	Number of samples	Number of detections	Detection frequency (percent)
1,2,3,5-Tetramethylbenzene	770	1	0.1	770	1	0.1	770	1	0.1	770	1	0.1
Toluene[1]	818	12	1.5	757	12	1.6	757	5	0.7	818	3	0.4
1,2,3-Trichlorobenzene	832	1	0.1	771	1	0.1	771	0	0	832	0	0
1,2,4-Trichlorobenzene	831	1	0.1	771	1	0.1	771	0	0	831	0	0
1,1,1-Trichloroethane	832	100	12.0	771	75	9.7	771	21	2.7	832	12	1.4
1,1,2-Trichloroethane	829	5	0.6	768	4	0.5	768	1	0.1	829	0	0
Trichloroethene	832	122	14.7	771	100	13.0	771	54	7.0	832	42	5.0
Trichlorofluoromethane	832	42	5.0	771	37	4.8	771	16	2.1	832	12	1.4
1,2,3-Trichloropropane	832	10	1.2	771	10	1.3	771	10	1.3	832	7	0.8
Trichlorotrifluoroethane	832	38	4.6	771	35	4.5	771	15	1.9	832	11	1.3
1,2,3-Trimethylbenzene	770	2	0.3	770	2	0.3	770	2	0.3	770	1	0.1
1,2,4-Trimethylbenzene[1]	828	11	1.3	767	11	1.4	767	6	0.8	828	3	0.4
1,3,5-Trimethylbenzene	831	2	0.2	770	1	0.1	770	1	0.1	831	1	0.1
Vinyl bromide	771	0	0	771	0	0	771	0	0	771	0	0
Vinyl chloride	832	3	0.4	771	3	0.4	771	2	0.3	832	2	0.2
o-Xylene	769	7	0.9	769	5	0.7	769	4	0.5	769	3	0.4
m- and *p*- Xylenes	769	10	1.3	769	9	1.2	769	3	0.4	769	3	0.4
Total trihalomethanes	832	381	45.8	771	326	42.3	771	156	20.2	832	114	13.7
Total xylenes	769	11	1.4	769	9	1.2	769	4	0.5	769	4	0.5

[1] At no common assessment level and at the 0.02 µg/L common assessment level, detection frequencies for toluene and 1,2,4-trimethylbenzene were evaluated at an assessment level of 0.03 µg/L and 0.05 µg/L, respectively, in order to limit the estimated probability of false detections due to random sample contamination to less than 1 percent, and thus are likely to underestimate the actual occurrence ≥0.02 µg/L (J.S. Zogorski and D.A. Bender, U.S. Geological Survey, written commun., 2008).

Appendix 13. Concentration statistics for pesticide compounds and volatile organic compounds detected in at least 1 percent of public-well samples collected during 1993–2007.

[No common assessment level was applied to these data. Only those volatile organic compounds and pesticide compounds detected in at least 1 percent of samples are included in this appendix. Detection frequencies for all pesticide compounds and volatile organic compounds at various common assessment levels are provided in Appendixes 11 and 12, respectively. A percentile is the value below which a certain percentage of observations fall. For example, 90 percent of the samples had concentrations less than the 90th percentile. µg/L, micrograms per liter; <, less than; < values correspond to the maximum reporting level for a given compound.]

Contaminant	Number of samples	Number of detections	Detection frequency (percent)	Percentile concentrations (µg/L)					Maximum detected concentration
				50th (median)	75th	90th	95th	99th	
Pesticide compounds									
Alachlor	869	16	1.8	<0.003	<0.003	<0.003	<0.003	0.011	0.249
Atrazine	853	227	26.6	<0.004	0.003	0.017	0.037	0.19	1.23
Bentazon	589	16	2.7	0.005	0.006	0.007	0.010	0.011	0.491
Bromacil	590	30	5.1	0.004	0.006	0.011	0.026	0.091	1.079
Carbofuran	644	13	2.0	<0.01	<0.01	<0.01	<0.01	0.013	0.17
p,p'-DDE	512	14	2.7	0.001	0.001	0.001	0.001	0.002	0.004
Deethylatrazine	853	257	30.1	0.002	0.004	0.014	0.035	0.11	0.346
Dieldrin	896	28	3.1	<0.004	<0.004	<0.004	<0.004	0.038	0.106
Diuron	587	31	5.3	0.005	0.006	0.010	0.018	0.16	0.3
Fenuron	587	6	1.0	0.004	0.004	0.004	0.004	0.03	0.067
Fluometuron	590	6	1.0	0.007	0.007	0.007	0.007	0.021	1.22
Metolachlor	870	75	8.6	0.001	0.001	0.003	0.005	0.064	3.58
Metribuzin	898	11	1.2	<0.014	<0.014	<0.014	<0.014	0.007	0.105
Norflurazon	585	6	1.0	<0.077	<0.077	<0.077	<0.077	0.019	0.069
Prometon	885	93	10.5	0.001	0.001	0.005	0.008	0.022	0.244
Simazine	884	126	14.3	0.002	0.002	0.005	0.012	0.067	0.315
Tebuthiuron	859	40	4.7	0.007	0.007	0.007	0.007	0.031	1.44
Total chlorotriazines	886	293	33.1	0.004	0.009	0.043	0.091	0.34	1.576
Volatile organic compounds									
tert-Amyl methyl ether	771	14	1.8	<0.112	<0.112	<0.112	<0.112	0.12	0.437
Benzene	831	21	2.5	0.007	0.007	0.007	0.009	0.066	0.631
Bromodichloromethane	831	92	11.1	0.011	0.014	0.021	0.076	1.81	10.96
Bromoform	832	37	4.4	0.028	0.028	0.028	0.038	1.00	3.09
Carbon disulfide	765	44	5.8	0.007	0.01	0.01	0.025	0.12	12.69
Carbon tetrachloride	832	28	3.4	0.017	0.025	0.027	0.029	0.066	0.677
Chlorobenzene	832	11	1.3	0.004	0.007	0.007	0.007	0.011	0.488
Chloroform	831	381	45.8	0.011	0.067	0.30	0.71	8.26	24.65
Chloromethane	806	22	2.7	0.04	0.043	0.047	0.062	0.083	0.207
Dibromochloromethane	832	38	4.6	0.017	0.024	0.04	0.064	0.59	7.034
1,2-Dichlorobenzene	831	9	1.1	0.005	0.005	0.005	0.015	0.021	1.466
1,4-Dichlorobenzene	831	21	2.5	0.008	0.009	0.011	0.012	0.024	0.511
Dichlorodifluoromethane	832	27	3.2	0.031	0.063	0.068	0.068	0.18	14.71
1,1-Dichloroethane	832	64	7.7	0.011	0.015	0.016	0.033	0.44	4.878
1,1-Dichloroethene	832	63	7.6	0.008	0.009	0.013	0.035	0.23	6.951
cis-1,2-Dichloroethene	832	67	8.1	0.009	0.009	0.012	0.039	0.7	16.11
trans-1,2-Dichloroethene	832	13	1.6	0.007	0.008	0.008	0.008	0.038	0.258
1,2-Dichloropropane	830	27	3.3	<0.2	<0.2	<0.2	0.010	0.13	1.42
Diisopropyl ether	758	8	1.1	<0.1	<0.1	<0.1	<0.1	0.053	0.593
Methyl ethyl ketone	769	13	1.7	0.3	0.4	0.5	0.5	1	330.2
Methyl *tert*-butyl ether	832	115	13.8	0.04	0.048	0.094	0.28	1.41	12.03

Appendix 13. Concentration statistics for pesticide compounds and volatile organic compounds detected in at least 1 percent of public-well samples collected during 1993–2007.—Continued

[No common assessment level was applied to these data. Only those volatile organic compounds and pesticide compounds detected in at least 1 percent of samples are included in this appendix. Detection frequencies for all pesticide compounds and volatile organic compounds at various common assessment levels are provided in Appendixes 11 and 12, respectively. A percentile is the value below which a certain percentage of observations fall. For example, 90 percent of the samples had concentrations less than the 90th percentile. µg/L, micrograms per liter; <, less than; < values correspond to the maximum reporting level for a given compound.]

Contaminant	Number of samples	Number of detections	Detection frequency (percent)	Percentile concentrations (µg/L)					Maximum detected concentration
				50th (median)	75th	90th	95th	99th	
Volatile organic compounds—Continued									
Methylene chloride	832	22	2.6	0.018	0.019	0.024	0.029	0.047	0.994
Perchloroethene	829	187	22.6	0.01	0.014	0.075	0.19	4.3	80.43
Toluene	818	12	1.5	<0.2	<0.2	<0.2	<0.2	0.042	0.536
1,1,1-Trichloroethane	832	100	12.0	0.010	0.012	0.021	0.061	0.36	16.71
Trichloroethene	832	122	14.7	0.009	0.012	0.046	0.2	4.42	140.4
Trichlorofluoromethane	832	42	5.0	0.022	0.026	0.037	0.040	0.31	7.98
1,2,3-Trichloropropane	832	10	1.2	<0.2	<0.2	<0.2	<0.2	0.14	2.654
Trichlorotrifluoroethane	832	38	4.6	0.016	0.016	0.016	0.021	0.26	1.069
1,2,4-Trimethylbenzene	828	11	1.3	<0.2	<0.2	<0.2	<0.2	0.06	2.37
m- and *p*- Xylenes	769	10	1.3	0.021	0.030	0.030	0.030	0.030	3.278
Total trihalomethanes	832	381	45.8	0.035	0.085	0.39	0.99	14.42	41.97
Total xylenes	769	11	1.4	0.021	0.030	0.030	0.030	0.030	6.119

Appendix 14. Organic contaminants not detected in any public-well sample collected during 1993–2007.

Contaminant	Number of samples
Pesticide compounds	
Acifluorfen	590
Aldicarb	584
Azinphos-methyl	894
Benfluralin	896
Chlorothalonil	507
Dacthal monoacid	590
2,4-DB (4-(2,4-Dichlorophenoxy) butyric acid)	580
Dicamba	584
Dichlobenil	159
Dichlorprop	590
Disulfoton	647
DNOC (2-Methyl-4,6-dinitrophenol)	165
Ethalfluralin	512
Fonofos	898
3-Hydroxycarbofuran	580
Malathion	898
MCPA (4-Chloro-2-methylphenoxy acetic acid)	582
MCPB (4-(2-Methyl-4-chlorophenoxy)butyric acid)	590
Methiocarb	579
Methomyl	569
Napropamide	511
Neburon	584
Oryzalin	582
Oxamyl	569
Parathion	512
Pebulate	512
Pendimethalin	898
cis-Permethrin	898
Phorate	898
Pronamide	898
Propachlor	512
Propanil	647
Propargite	644
Propham	589
2,4,5-T (2-(2,4,5-Trichlorophenoxy)acetic acid)	165
Terbufos	898
Thiobencarb	647
2,4,5-TP (Silvex)	165
Triallate	512
Triclopyr	590
Trifluralin	898

Contaminant	Number of samples
Volatile organic compounds	
Bromomethane	832
Chloroethane	830
3-Chloropropene	771
2-Chlorotoluene	832
4-Chlorotoluene	832
trans-1,4-Dichloro-2-butene	771
2,2-Dichloropropane	832
cis-1,3-Dichloropropene	832
trans-1,3-Dichloropropene	832
Ethyl methacrylate	771
Hexachloroethane	771
Methyl acrylate	771
Methyl acrylonitrile	771
Methyl butyl ketone	771
Methyl methacrylate	771
1,1,2,2-Tetrachloroethane	832
Vinyl bromide	771

Appendix 15. Contaminants that were detected, but do not have human-health benchmarks, in public-well samples collected during 1993–2007.

[No common assessment level was applied to these data. In addition to the contaminants in this appendix, no human-health benchmarks are available for the six water-quality properties. N, nitrogen; P, phosphorus]

Contaminant	Number of samples	Number of detections	Detection frequency (percent)
Major ions			
Bromide	787	749	95.2
Calcium	809	809	100
Chloride [1]	809	808	99.9
Magnesium	809	809	100
Potassium	810	810	100
Silica	809	809	100
Sodium [1]	809	809	100
Sulfate [1]	810	795	98.1
Trace elements			
Aluminum [1]	598	299	50
Cobalt	627	396	63.2
Iron [1]	809	449	55.5
Lithium	458	448	97.8
Vanadium	457	404	88.4
Nutrients			
Ammonia as N [1]	806	357	44.3
Ammonia plus organic nitrogen as N	603	206	34.2
Dissolved organic carbon	817	735	90.0
Orthophosphate as P	804	521	64.8
Phosphorus, dissolved as P	454	285	62.8
Total nitrogen as N (nitrate + nitrite + ammonia + organic N)	201	194	96.5
Pesticide compounds			
Chloramben methyl ester	580	1	0.2
Clopyralid	586	1	0.2
Deethylatrazine	853	257	30.1
2,6-Diethylaniline	898	1	0.1
Fenuron	587	6	1.0
Volatile organic compounds			
tert-Amyl methyl ether	771	14	1.8
Bromobenzene [2]	832	1	0.1
n-Butylbenzene	831	1	0.1
sec-Butylbenzene	831	3	0.4
tert-Butylbenzene	832	1	0.1
Dibromomethane	832	6	0.7
1,1-Dichloroethane	832	64	7.7
1,3-Dichloropropane	832	1	0.1
1,1-Dichloropropene	832	1	0.1
Diisopropylether	758	8	1.1
Ethyl *tert*-butyl ether	771	1	0.1
2-Ethyltoluene	770	3	0.4
Iodomethane	771	1	0.1
n-Isopropyltoluene	831	2	0.2

Appendix 15. Contaminants that were detected, but do not have human-health benchmarks, in public-well samples collected during 1993–2007.—Continued

[No common assessment level was applied to these data. In addition to the contaminants in this appendix, no human-health benchmarks are available for the six water-quality properties. N, nitrogen; P, phosphorus]

Contaminant	Number of samples	Number of detections	Detection frequency (percent)
Volatile organic compounds—Continued			
Methyl isobutyl ketone	769	3	0.4
Methyl *tert*-butyl ether [1]	832	115	13.8
n-Propylbenzene	831	1	0.1
Tetrahydrofuran	771	6	0.8
1,2,3,4-Tetramethylbenzene	770	3	0.4
1,2,3,5-Tetramethylbenzene	770	1	0.1
1,2,3-Trichlorobenzene	832	1	0.1
1,2,3-Trimethylbenzene	770	2	0.3
1,2,4-Trimethylbenzene	828	11	1.3
1,3,5-Trimethylbenzene	831	2	0.2

[1] Contaminant has a non-health guideline (U.S. Environmental Protection Agency, 2006a).

[2] In September 2009, USEPA published updated toxicity data for bromobenzene (U.S. Environmental Protection Agency, 2010c); this update may result in a future new HBSL value.

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; >, greater than; pCi/L, picocuries per liter; <, less than; PWS, public water system; –, not analyzed or not available; ND, not detected]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]		Reconnaissance of radionuclides (1998–1999)[5]
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Detection frequency (percent of 99 samples >1 pCi/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Pesticide compounds													
Alachlor	869	1.8	0.1	221	1.4	0.5	358	0.6	–	–	–	–	–
Atrazine	853	26.6	0.7	221	29.9	3.2	358	23.7	–	–	–	–	–
Carbofuran	644	2.0	ND	215	1.4	ND	358	0.6	–	–	–	–	–
2,4-D	590	0.3	ND	215	0.5	ND	219	0.5	–	–	–	–	–
Dinoseb	590	0.8	ND	215	0.9	ND	219	0.9	–	–	–	–	–
gamma-HCH	512	0.4	ND	–	–	–	358	0.3	–	–	–	–	–
Oxamyl	569	ND	ND	215	ND	ND	202	0.5	–	–	–	–	–
Picloram	585	0.3	ND	215	0.9	ND	211	ND	–	–	–	–	–
Simazine	884	14.3	0.2	221	16.7	0.5	358	12.0	–	–	–	–	–
2,4,5-TP	165	ND	ND	–	–	–	219	ND	–	–	–	–	–
Volatile organic compounds													
Benzene	831	2.5	0.4	192	2.1	1.0	–	–	1,095	0.46	578	0.34	–
Bromodichloromethane	831	11.1	2.6	221	7.7	2.7	–	–	1,095	4.2	578	5.9	–
Bromoform	832	4.4	2.8	221	4.5	3.6	–	–	1,096	4.5	579	4.7	–
Carbon tetrachloride	832	3.4	0.2	221	1.4	0.5	–	–	1,096	0.73	579	0.86	–
Chlorobenzene	832	1.3	0.1	206	ND	ND	–	–	1,096	0.18	579	0.17	–
Chloroform	831	45.8	12.4	180	36.1	12.8	–	–	1,092	11.4	575	12	–
Dibromochloromethane	832	4.6	2.0	221	3.6	3.6	–	–	1,095	4.4	578	6.1	–
Dibromochloropropane	832	0.2	0.2	221	ND	ND	–	–	378	ND	–	–	–
1,2-Dichlorobenzene	831	1.1	0.1	221	ND	ND	–	–	1,087	0.18	579	0.17	–
1,4-Dichlorobenzene	831	2.5	0.1	221	ND	ND	–	–	1,067	0.094	579	0.17	–
1,2-Dichloroethane	825	1.0	0.2	221	1.8	1.4	–	–	1,073	0.56	579	0.52	–
1,1-Dichloroethene	832	7.6	1.1	221	5	1.8	–	–	1,096	1.3	579	1.4	–
cis-1,2-Dichloroethene	832	8.1	2.6	221	9.5	4.1	–	–	969	1.5	579	1.9	–
trans-1,2-Dichloroethene	832	1.6	0.1	221	1.8	0.5	–	–	1,050	1	579	0	–

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; >, greater than; pCi/L, picocuries per liter; <, less than; PWS, public water system; –, not analyzed or not available; ND, not detected]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]		Reconnaissance of radionuclides (1998–1999)[5]
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Detection frequency (percent of 99 samples >1 pCi/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Volatile organic compounds—Continued													
1,2-Dichloropropane	830	3.3	0.6	221	1.4	ND	–	–	1,078	0.74	561	0.18	–
Ethylbenzene	830	1.0	0.2	176	0.6	0.6	–	–	1,083	0.46	566	0.53	–
Ethylene dibromide	832	0.5	ND	221	0.5	ND	–	–	462	ND	–	–	–
Methylene chloride	832	2.6	0.4	192	ND	ND	–	–	1,094	0.46	577	0.17	–
Perchloroethene	829	22.6	4.7	221	19.5	10	–	–	1,093	5.3	577	4.2	–
Styrene	829	0.2	ND	221	ND	ND	–	–	1,074	0.19	562	0.36	–
Toluene	818	1.5	0.4	117	ND	ND	–	–	1,077	1	562	0.53	–
1,2,4-Trichlorobenzene	831	0.1	ND	221	ND	ND	–	–	962	ND	579	0	–
1,1,1-Trichloroethane	832	12.0	1.4	221	9.5	3.2	–	–	1,095	2.2	578	1.7	–
1,1,2-Trichloroethane	829	0.6	ND	220	0.5	ND	–	–	1,078	ND	579	0	–
Trichloroethene	832	14.7	5.0	221	14	6.3	–	–	1,093	4.3	576	3.3	–
Vinyl chloride	832	0.4	0.2	221	0.9	0.9	–	–	1,096	0.18	579	0.17	–
o-Xylene	769	0.9	0.4	176	0.6	0.6	–	–	830	0.48	566	0.71	–
m- and *p*- Xylenes	769	1.3	0.4	161	1.2	0.6	–	–	828	0.6	564	0.71	–
Total trihalomethanes	832	45.8	13.7	–	–	–	–	–	1,096	14.8	–	–	–
Total xylenes	769	1.4	0.5	–	–	–	–	–	1,069	0.56	–	–	–
Trace elements													
Antimony	619	17.0	0.6	–	–	–	–	–	–	–	–	–	–
Arsenic	638	69.6	43.9	–	–	–	–	–	–	–	–	–	–
Barium	630	99.5	99.2	–	–	–	–	–	–	–	–	–	–
Beryllium	622	5.9	ND	–	–	–	–	–	–	–	–	–	–
Cadmium	631	17.3	0.2	–	–	–	–	–	–	–	–	–	–
Chromium (total)	626	49.4	36.1	–	–	–	–	–	–	–	–	–	–
Copper	625	80	53.6	–	–	–	–	–	–	–	–	–	–
Lead	630	55.2	17.0	–	–	–	–	–	–	–	–	–	–

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; >, greater than; pCi/L, picocuries per liter; <, less than; PWS, public water system; –, not analyzed or not available; ND, not detected]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]		Reconnaissance of radionuclides (1998–1999)[5]
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Detection frequency (percent of 99 samples >1 pCi/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Trace elements—Continued													
Selenium	632	47.3	21.4	–	–	–	–	–	–	–	–	–	–
Thallium	437	21.3	0.2	–	–	–	–	–	–	–	–	–	–
Uranium	650	71.8	42.8	–	–	–	–	–	–	–	–	–	–
Other inorganic contaminants													
Fluoride	808	75.5	–	–	–	–	–	–	–	–	–	–	–
Nitrate	806	71.7	–	–	–	–	–	–	–	–	–	–	–
Gross alpha-particle radioactivity	84	72.6	–	–	–	–	–	–	–	–	–	–	–
Gross beta-particle radioactivity	86	80.2	–	–	–	–	–	–	–	–	–	–	–
Radium-226	–	–	–	–	–	–	–	–	–	–	–	–	33
Radium-228	–	–	–	–	–	–	–	–	–	–	–	–	26
Radium-226 plus radium-228	191	92.1	–	–	–	–	–	–	–	–	–	–	–
Radon-222	506	98.2	–	–	–	–	–	–	–	–	–	–	–
Radon-222	506	98.2	–	–	–	–	–	–	–	–	–	–	–
Other synthetic organic contaminants													
Benzo(a)pyrene	–	–	–	217	ND	ND	–	–	–	–	–	–	–
Bis(2-ethylhexyl)adipate	–	–	–	–	–	–	–	–	–	–	–	–	–
Bis(2-ethylhexyl)phthlate	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlordane	–	–	–	–	–	–	–	–	–	–	–	–	–
Cyanide	–	–	–	–	–	–	–	–	–	–	–	–	–
Dalapon	–	–	–	–	–	–	–	–	–	–	–	–	–
Diquat	–	–	–	–	–	–	–	–	–	–	–	–	–
Endothall	–	–	–	–	–	–	–	–	–	–	–	–	–

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

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Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]		Reconnaissance of radionuclides (1998–1999)[5]
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Detection frequency (percent of 99 samples >1 pCi/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Other synthetic organic contaminants—Continued													
Endrin	–	–	–	–	–	–	–	–	–	–	–	–	–
Glyphosate	–	–	–	–	–	–	–	–	–	–	–	–	–
Heptachlor	–	–	–	–	–	–	–	–	–	–	–	–	–
Heptachlor Epoxide	–	–	–	–	–	–	–	–	–	–	–	–	–
Hexachlorobenzene	–	–	–	–	–	–	–	–	–	–	–	–	–
Hexachlorocyclopentadiene	–	–	–	–	–	–	–	–	–	–	–	–	–
Mercury	–	–	–	–	–	–	–	–	–	–	–	–	–
Methoxychlor	–	–	–	–	–	–	–	–	–	–	–	–	–
PCBs	–	–	–	–	–	–	–	–	–	–	–	–	–
Pentachlorophenol	–	–	–	211	ND	ND	–	–	–	–	–	–	–
Toxaphene	–	–	–	–	–	–	–	–	–	–	–	–	–

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; >, greater than; pCi/L, picocuries per liter; <, less than; PWS, public water system; –, not analyzed or not available; ND, not detected]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
	Six-year review of regulations, 16 states (1993–1997)[6]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6]		Pesticides survey (1988–1990)[7]	Inorganics and radionuclides survey (1984–1986)[8]		VOCs survey (1981–1982)[9]				Occurrence of radioactivity (1981–1982)[10]	
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[11]	Number of sites	Detection frequency (percent)	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)	Number of PWSs	Detection frequency (percent)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Pesticide compounds													
Alachlor	45,672	0.1	–	–	ND	–	–	–	–	–	–	–	–
Atrazine	52,187	2.2	–	–	1.7	–	–	–	–	–	–	–	–
Carbofuran	41,843	0.01	–	–	ND	–	–	–	–	–	–	–	–
2,4-D	46,962	0.2	–	–	ND	–	–	–	–	–	–	–	–
Dinoseb	39,696	0.08	–	–	<0.1	–	–	–	–	–	–	–	–
gamma-HCH	47,078	0.04	–	–	ND	–	–	–	–	–	–	–	–
Oxamyl	38,377	0.02	–	–	ND	–	–	–	–	–	–	–	–
Picloram	36,821	0.09	–	–	ND	–	–	–	–	–	–	–	–
Simazine	51,740	0.5	–	–	1.1	–	–	–	–	–	–	–	–
2,4,5-TP	45,675	0.1	–	–	ND	–	–	–	–	–	–	–	–
Volatile organic compounds													
Benzene	158,033	0.7	39,757	1.0	–	–	–	0.4	1.1	1.6	1.9	–	–
Bromodichloromethane	–	–	134,778	11.4	–	–	–	35.1	54.3	44.9	63.3	–	–
Bromoform	–	–	135,152	6.3	–	–	–	15.7	30.6	27.4	38	–	–
Carbon tetrachloride	152,441	1.1	40,683	2.2	–	–	–	1.8	5.4	2.8	3.8	–	–
Chlorobenzene	116,884	0.2	58,566	0.1	–	–	–	ND	ND	0.3	ND	–	–
Chloroform	–	–	136,306	16.8	–	–	–	37.1	57	48.3	63.3	–	–
Dibromochloromethane	–	–	133,712	10.3	–	–	–	31.1	51.6	42.1	55.1	–	–
Dibromochloropropane	79,532	6.3	47,629	12.4	0.4	–	–	0.4	ND	ND	ND	–	–
1,2-Dichlorobenzene	116,104	0.2	58,385	0.1	–	–	–	ND	ND	0.3	0.6	–	–
1,4-Dichlorobenzene	106,779	0.5	40,875	0.6	–	–	–	0.7	1.6	1.2	ND	–	–
1,2-Dichloroethane	150,865	0.7	39,843	1.1	–	–	–	ND	1.6	0.9	2.5	–	–
1,1-Dichloroethene	137,761	1.4	41,146	3.5	–	–	–	1.4	2.7	1.6	6.3	–	–
cis-1,2-Dichloroethene	152,219	2.6	49,061	3.2	–	–	–	1.1	7	3.4	17.1	–	–
trans-1,2-Dichloroethene	150,433	0.2	57,951	0.5	–	–	–	–	–	–	–	–	–

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

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Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
	Six-year review of regulations, 16 states (1993–1997)[6]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6]		Pesticides survey (1988–1990)[7]	Inorganics and radionuclides survey (1984–1986)[8]		VOCs survey (1981–1982)[9]				Occurrence of radioactivity (1981–1982)[10]	
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[11]	Number of sites	Detection frequency (percent)	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)	Number of PWSs	Detection frequency (percent)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Volatile organic compounds													
1,2-Dichloropropane	151,677	0.2	57,624	0.6	ND	–	–	0.4	2.7	0.9	2.5	–	–
Ethylbenzene	154,881	0.8	58,406	0.6	–	–	–	0.7	0.5	0.9	ND	–	–
Ethylene dibromide	101,580	0.3	42,130	1.0	ND	–	–	–	–	–	–	–	–
Methylene chloride	143,513	2.0	56,680	1.7	–	–	–	–	–	–	–	–	–
Perchloroethene	159,298	7.6	65,466	12.2	–	–	–	4.6	11.3	8.4	11.4	–	–
Styrene	147,301	0.2	47,629	0.2	–	–	–	ND	ND	ND	ND	–	–
Toluene	155,159	1.0	58,505	1.5	–	–	–	1.4	1.1	1.2	0.6	–	–
1,2,4-Trichlorobenzene	141,254	0.1	39,953	0.2	–	–	–	–	–	–	–	–	–
1,1,1-Trichloroethane	159,508	1.8	41,186	5.8	–	–	–	4.3	8.1	7.8	16.5	–	–
1,1,2-Trichloroethane	146,533	0.09	57,373	0.1	–	–	–	ND	ND	ND	ND	–	–
Trichloroethene	163,786	7.4	46,412	15.5	–	–	–	3.2	11.3	7.2	24.1	–	–
Vinyl chloride	157,443	0.2	38,517	0.4	–	–	–	ND	0.5	ND	3.8	–	–
o-Xylene	–	–	38,152	0.8	–	–	–	2.1	1.1	3.1	ND	–	–
m- and *p*- Xylenes	–	–	33,358	0.6	–	–	–	2.1	1.1	2.5	ND	–	–
Total trihalomethanes	–	–	–	–	–	–	–	–	–	–	–	–	–
Total xylenes	143,057	1.0	29,311	1.0	–	–	–	–	–	–	–	–	–
Trace elements													
Antimony	35,163	8.1	–	–	–	–	–	–	–	–	–	–	–
Arsenic	50,136	21.0	–	–	–	–	–	–	–	–	–	–	–
Barium	49,929	46.7	–	–	–	–	–	–	–	–	–	–	–
Beryllium	39,903	1.9	–	–	–	–	–	–	–	–	–	–	–
Cadmium	48,548	7.9	–	–	–	–	–	–	–	–	–	–	–
Chromium (total)	52,384	9.7	–	–	–	–	–	–	–	–	–	–	–
Copper	–	–	–	–	–	–	–	–	–	–	–	–	–
Lead	–	–	–	–	–	–	–	–	–	–	–	–	–

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

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Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
	Six-year review of regulations, 16 states (1993–1997)[6]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6]		Pesticides survey (1988–1990)[7]	Inorganics and radionuclides survey (1984–1986)[8]		VOCs survey (1981–1982)[9]				Occurrence of radioactivity (1981–1982)[10]	
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[11]	Number of sites	Detection frequency (percent)	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)	Number of PWSs	Detection frequency (percent)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Trace elements—Continued													
Selenium	48,116	9.5	–	–	–	–	–	–	–	–	–	–	–
Thallium	38,231	2.4	–	–	–	–	–	–	–	–	–	–	–
Uranium	–	–	–	–	–	978	72.2	–	–	–	–	–	–
Other inorganic contaminants													
Fluoride	74,450	80.3	–	–	–	–	–	–	–	–	–	–	–
Nitrate	–	–	–	–	52.1	–	–	–	–	–	–	–	–
Gross alpha-particle radioactivity	–	–	–	–	–	–	–	–	–	–	–	2,535	9
Gross beta-particle radioactivity	–	–	–	–	–	–	–	–	–	–	–	2,515	19
Radium-226	–	–	–	–	–	989	40.2	–	–	–	–	386	40
Radium-228	–	–	–	–	–	987	11.9	–	–	–	–	100	78
Radium-226 plus radium-228	–	–	–	–	–	–	–	–	–	–	–	91	100
Radon-222	–	–	–	–	–	986	71.9	–	–	–	–	2,520	16.4
Radon-222	–	–	–	–	–	986	71.9	–	–	–	–	2,520	16.4
Other synthetic organic contaminants													
Benzo(a)pyrene	35,990	0.1	–	–	–	–	–	–	–	–	–	–	–
Bis(2-ethylhexyl)adipate	34,244	3.9	–	–	–	–	–	–	–	–	–	–	–
Bis(2-ethylhexyl)phthlate	33,204	6.5	–	–	–	–	–	–	–	–	–	–	–
Chlordane	47,536	0.08	–	–	–	–	–	–	–	–	–	–	–
Cyanide	22,430	9.0	–	–	–	–	–	–	–	–	–	–	–
Dalapon	35,270	0.3	–	–	–	–	–	–	–	–	–	–	–
Diquat	30,165	0.2	–	–	–	–	–	–	–	–	–	–	–
Endothall	27,494	0.03	–	–	–	–	–	–	–	–	–	–	–

Appendix 16. Comparison among detection frequencies for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

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Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)												
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Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Other synthetic organic contaminants—Continued													
Endrin	50,540	0.03	–	–	–	–	–	–	–	–	–	–	–
Glyphosate	27,877	0.03	–	–	–	–	–	–	–	–	–	–	–
Heptachlor	44,976	0.03	–	–	–	–	–	–	–	–	–	–	–
Heptachlor Epoxide	44,927	0.03	–	–	–	–	–	–	–	–	–	–	–
Hexachlorobenzene	41,449	0.02	–	–	–	–	–	–	–	–	–	–	–
Hexachlorocyclopentadiene	41,109	0.06	–	–	–	–	–	–	–	–	–	–	–
Mercury	50,717	7.5	–	–	–	–	–	–	–	–	–	–	–
Methoxychlor	50,548	0.1	–	–	–	–	–	–	–	–	–	–	–
PCBs	24,133	0.03	–	–	–	–	–	–	–	–	–	–	–
Pentachlorophenol	40,858	0.2	–	–	ND	–	–	–	–	–	–	–	–
Toxaphene	41,516	0.01	–	–	–	–	–	–	–	–	–	–	–

[1] Data from Hopple and others (2009).

[2] Data from Gilliom and others (2006) and P.E. Stackelberg, U.S. Geological Survey, written commun., May 2009.

[3] Data from Zogorski and others (2006).

[4] Data from Grady (2002).

[5] Data from Focazio and others (2001).

[6] Data from U.S. Environmental Protection Agency (2002b).

[7] Data from U.S. Environmental Protection Agency (1990).

[8] Data from Longtin (1988).

[9] Data from Westrick and others (1984).

[10] Data from Horton (1983).

[11] Minimum reporting level ranged from 0.01 to 1.3 µg/L.

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	MCL, µg/L unless noted otherwise	This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]	Assessment of VOCs (1991–2001)[3]		Recon-naisssance of radionuclides (1998–1999)[4]
		Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of samples)
Sample water type	–	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Pesticide compounds									
Alachlor	2	0.1	0	0.5	0	0	–	–	–
Atrazine	3	0.5	0	0.5	0	0	–	–	–
Carbofuran	40	0	0	0	0	0	–	–	–
2,4-D	70	0	0	0	0	0	–	–	–
Dinoseb	7	0	0	0	0	0	–	–	–
gamma-HCH	0.2	0.2	0	–	–	0	–	–	–
Oxamyl	200	ND	ND	ND	ND	0	–	–	–
Picloram	500	0	0	0	0	ND	–	–	–
Simazine	4	0	0	0	0	0	–	–	–
2,4,5-TP	50	ND	ND	–	–	ND	–	–	–
Volatile organic compounds									
Benzene	5	0.1	0	0.5	0	–	0.5	0	–
Bromodichloromethane	[10] 80	0.1	0	0	0	–	0.09	0	–
Bromoform	[10] 80	0	0	0	0	–	0.09	0	–
Carbon tetrachloride	5	0.1	0	0.5	0	–	0.5	0	–
Chlorobenzene	100	0	0	ND	ND	–	0	0	–
Chloroform	[10] 80	1.2	0	0	0	–	0.5	0	–
Dibromochloromethane	[10] 80	0	0	0	0	–	0.2	0	–
Dibromochloropropane	0.2	0.2	0.2	ND	ND	–	ND	ND	–
1,2-Dichlorobenzene	600	0	0	ND	ND	–	0	0	–
1,4-Dichlorobenzene	75	0	0	ND	ND	–	0	0	–
1,2-Dichloroethane	5	0.1	0	0	0	–	0.2	0	–
1,1-Dichloroethene	7	0.6	0	0.5	0	–	0.7	0.2	–
cis-1,2-Dichloroethene	70	0.2	0	0	0	–	0.1	0	–

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	MCL, µg/L unless noted otherwise	This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]	Assessment of VOCs (1991–2001)[3]		Recon-naisssance of radionuclides (1998–1999)[4]
		Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of samples)
Sample water type	–	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Volatile organic compounds—Continued									
trans-1,2-Dichloroethene	100	0	0	0	0	–	0	0	–
1,2-Dichloropropane	5	0.2	0	0	0	–	0.2	0	–
Ethylbenzene	700	0	0	0	0	–	0	0	–
Ethylene dibromide	0.05	0.5	0.2	0	0.5	–	ND	ND	–
Methylene chloride	5	0.1	0	ND	ND	–	0.4	0.2	–
Perchloroethene	[15] 5	3.1	1.0	1.8	0.5	–	3.2	0.8	–
Styrene	100	0	0	ND	ND	–	0	0	–
Toluene	1,000	0	0	ND	ND	–	0	0	–
1,2,4-Trichlorobenzene	70	0	0	ND	ND	–	ND	ND	–
1,1,1-Trichloroethane	200	0	0	0	0	–	0	0	–
1,1,2-Trichloroethane	5	0	0	0	0	–	ND	ND	–
Trichloroethene	[15] 5	3.0	0.8	1.4	0.9	–	3.3	0.8	–
Vinyl chloride	2	0.2	0	0.5	0	–	0.2	0.2	–
o-Xylene	[17] 10,000	0	0	0	0	–	0	0	–
m- and *p*- Xylenes	[17] 10,000	0	0	0	0	–	0	0	–
Total trihalomethanes	[10] 80	1.3	0	–	–	–	0.9	0	–
Total xylenes	[17] 10,000	0	0	–	–	–	0	0	–
Trace elements									
Antimony	6	1.0	0.2	–	–	–	–	–	–
Arsenic	[18] 50, 10	42.2	9.9	–	–	–	–	–	–
Barium	2,000	7.9	0.2	–	–	–	–	–	–
Beryllium	4	0.2	0	–	–	–	–	–	–
Cadmium	5	0.2	0	–	–	–	–	–	–
Chromium (total)	100	2.1	0	–	–	–	–	–	–

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	MCL, µg/L unless noted otherwise	This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]	Assessment of VOCs (1991–2001)[3]		Recon-naisssance of radionuclides (1998–1999)[4]
		Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of samples)
Sample water type	–	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Trace elements—Continued									
Copper	[19] 1,300	0	0	–	–	–	–	–	–
Lead	[19] 15	12	0.5	–	–	–	–	–	–
Selenium	50	2.8	0.2	–	–	–	–	–	–
Thallium	2	1.1	0	–	–	–	–	–	–
Uranium	30	23.5	0.8	–	–	–	–	–	–
Other inorganic contaminants									
Fluoride	4 mg/L	–	0.5		–	–	–	–	–
Nitrate	10 mg/L as N	44.8	1.9	–	–	–	–	–	–
Gross alpha-particle radioactivity	[20] 15 pCi/L	53.6	4.8	–	–	–	–	–	–
Gross beta-particle radioactivity	[21] 50 pCi/L	45.3	0	–	–	–	–	–	–
Radium-226	[22] 5 pCi/L	–	–	–	–	–	–	–	10
Radium-228	[22] 5 pCi/L	–	–	–	–	–	–	–	9
Combined radium-226 and radium-228	[22] 5 pCi/L	62.3	18.8	–	–	–	–	–	21
Radon	[23] 300 pCi/L	–	54.7	–	–	–	–	–	–
Radon	[24] 4,000 pCi/L	54.7	0.6	–	–	–	–	–	–
Other synthetic organic contaminants									
Benzo(a)pyrene	0.2	–	–	ND	ND	–	–	–	–
Bis(2-ethylhexyl)adipate	400	–	–	–	–	–	–	–	–
Bis(2-ethylhexyl)phthlate	6	–	–	–	–	–	–	–	–

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	MCL, µg/L unless noted otherwise	This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]	Assessment of VOCs (1991–2001)[3]		Recon-naisssance of radionuclides (1998–1999)[4]
		Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > 0.1 MCL (percent of wells)	Concentration > MCL (percent of wells)	Concentration > MCL (percent of samples)
Sample water type	–	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**
Other synthetic organic contaminants—Continued									
Chlordane	2	–	–	–	–	–	–	–	–
Cyanide	200	–	–	–	–	–	–	–	–
Dalapon	200	–	–	–	–	–	–	–	–
Diquat	20	–	–	–	–	–	–	–	–
Endothall	100	–	–	–	–	–	–	–	–
Endrin	2	–	–	–	–	–	–	–	–
Glyphosate	700	–	–	–	–	–	–	–	–
Heptachlor	0.4	–	–	–	–	–	–	–	–
Heptachlor Epoxide	0.2	–	–	–	–	–	–	–	–
Hexachlorobenzene	1	–	–	–	–	–	–	–	–
Hexachlorocyclopentadiene	50	–	–	–	–	–	–	–	–
Mercury	2	–	–	–	–	–	–	–	–
Methoxychlor	40	–	–	–	–	–	–	–	–
PCBs	0.5	–	–	–	–	–	–	–	–
Pentachlorophenol	1	–	–	ND	ND	–	–	–	–
Toxaphene	3	–	–	–	–	–	–	–	–

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

Contaminant	National USEPA GW stuies including public wells or public water systems, from most to least recent (years that most samples were collected)							
	MCL, µg/L unless noted otherwise	Six-year review of regulations, 8 states (1993–1997)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6]		Pesticides survey (1988–1990)[7]	Inorganics and radionuclides survey (1984–1986)[8]	Occurrence of radioactivity (1981–1982)[9]
		Concentration > 0.5 MCL (percent of PWSs)	Concentration > MCL (percent of PWSs)	Concentration > MCL, Round 1 (percent of PWSs)	Concentration > MCL, Round 2 (percent of PWSs)	Concentration > MCL (estimated national percent of CWS wells)	Concentration > MCL (percent of sites)	Concentration > MCL (percent of PWSs)
Sample water type	–	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Pesticide compounds								
Alachlor	2	0.05	0.02	–	–	ND	–	–
Atrazine	3	0.26	0.08	–	–	0	–	–
Carbofuran	40	0	0	–	–	ND	–	–
2,4-D	70	0.02	0	–	–	ND	–	–
Dinoseb	7	0.06	0.04	–	–	0	–	–
gamma-HCH	0.2	0.12	0.07	–	–	ND	–	–
Oxamyl	200	0	0	–	–	ND	–	–
Picloram	500	0	0	–	–	ND	–	–
Simazine	4	0.03	0	–	–	0	–	–
2,4,5-TP	50	0	0	–	–	ND	–	–
Volatile orgaic compounds								
Benzene	5	0.38	0.23	0.25	–	–	–	–
Bromodichloromethane	[10] 80	–	–	[11] 0.04	[11] 0.05	–	–	–
Bromoform	[10] 80	–	–	[12] 0.01	[12] 0	–	–	–
Carbon tetrachloride	5	0.39	0.25	0.15	–	–	–	–
Chlorobenzene	100	0	0	0	–	–	–	–
Chloroform	[10] 80	–	–	[13] 0.01	[13] 0.01	–	–	–
Dibromochloromethane	[10] 80	–	–	[11] 0.02	[11] 0.05	–	–	–
Dibromochloropropane	0.2	2.32	1.99	1.35	–	0	–	–
1,2-Dichlorobenzene	600	0	0	0	–	–	–	–
1,4-Dichlorobenzene	75	0.02	0	[14] 0	–	–	–	–
1,2-Dichloroethane	5	0.33	0.15	0.17	–	–	–	–

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

Contaminant	National USEPA GW stuies including public wells or public water systems, from most to least recent (years that most samples were collected)							
	MCL, µg/L unless noted otherwise	Six-year review of regulations, 8 states (1993–1997)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6]		Pesticides survey (1988–1990)[7]	Inorganics and radionuclides survey (1984–1986)[8]	Occurrence of radioactivity (1981–1982)[9]
		Concentration > 0.5 MCL (percent of PWSs)	Concentration > MCL (percent of PWSs)	Concentration > MCL, Round 1 (percent of PWSs)	Concentration > MCL, Round 2 (percent of PWSs)	Concentration > MCL (estimated national percent of CWS wells)	Concentration > MCL (percent of sites)	Concentration > MCL (percent of PWSs)
Volatile orgaic compounds—Continued								
1,1-Dichloroethene	7	0.4	0.25	0.20	–	–	–	–
cis-1,2-Dichloroethene	70	0.1	0.03	0.03	–	–	–	–
trans-1,2-Dichloroethene	100	0.02	0.01	0.01	–	–	–	–
1,2-Dichloropropane	5	0.26	0.12	0.09	–	ND	–	–
Ethylbenzene	700	0.01	0.01	0	–	–	–	–
Ethylene dibromide	0.05	0.9	0.73	0.12	–	ND	–	–
Methylene chloride	5	1.74	0.61	0.52	–	–	–	–
Perchloroethene	[15] 5	1.86	1.2	0.93	–	–	–	–
Styrene	100	0	0	0	–	–	–	–
Toluene	1,000	0.02	0.02	[16] 0	–	–	–	–
1,2,4-Trichlorobenzene	70	0	0	0	–	–	–	–
1,1,1-Trichloroethane	200	0.02	0.02	0.03	–	–	–	–
1,1,2-Trichloroethane	5	0.13	0.07	0.02	–	–	–	–
Trichloroethene	[15] 5	1.47	0.96	1.00	–	–	–	–
Vinyl chloride	2	0.15	0.09	0.23	–	–	–	–
o-Xylene	[17] 10,000	–	–	–	–	–	–	–
m- and *p*- Xylenes	[17] 10,000	–	–	–	–	–	–	–
Total trihalomethanes	[10] 80	–	–	–	–	–	–	–
Total xylenes	[17] 10,000	0.01	0.01	0	–	–	–	–

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

Contaminant	National USEPA GW stuies including public wells or public water systems, from most to least recent (years that most samples were collected)							
	MCL, µg/L unless noted otherwise	Six-year review of regulations, 8 states (1993–1997)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6]		Pesticides survey (1988–1990)[7]	Inorganics and radionuclides survey (1984–1986)[8]	Occurrence of radioactivity (1981–1982)[9]
		Concentration > 0.5 MCL (percent of PWSs)	Concentration > MCL (percent of PWSs)	Concentration > MCL, Round 1 (percent of PWSs)	Concentration > MCL, Round 2 (percent of PWSs)	Concentration > MCL (estimated national percent of CWS wells)	Concentration > MCL (percent of sites)	Concentration > MCL (percent of PWSs)
Trace elements								
Antimony	6	1.27	0.43	–	–	–	–	–
Arsenic	[18] 50, 10	1.67	0.98	–	–	–	–	–
Barium	2,000	0.8	0.24	–	–	–	–	–
Beryllium	4	0.51	0.24	–	–	–	–	–
Cadmium	5	1.39	0.72	–	–	–	–	–
Chromium (total)	100	0.61	0.27	–	–	–	–	–
Copper	[19] 1,300	–	–	–	–	–	–	–
Lead	[19] 15	–	–	–	–	–	–	–
Selenium	50	0.39	0.23	–	–	–	–	–
Thallium	2	1.36	0.47	–	–	–	–	–
Uranium	30	–	–	–	–	–	1.2	–
Other inorganic contaminants								
Fluoride	4 mg/L	4.02	1.42	–	–	–	–	–
Nitrate	10 mg/L as N	–	–	–	–	1.2	–	–
Gross alpha-particle radioactivity	[20] 15 pCi/L	–	–	–	–	–	–	2
Gross beta-particle radioactivity	[21] 50 pCi/L	–	–	–	–	–	–	≤2
Radium-226	[22] 5 pCi/L	–	–	–	–	–	1	9
Radium-228	[22] 5 pCi/L	–	–	–	–	–	0.8	25
Combined radium-226 and radium-228	[22] 5 pCi/L	–	–	–	–	–	–	79
Radon	[23] 300 pCi/L	–	–	–	–	–	11.2 - 71.9	≥16.4
Radon	[24] 4,000 pCi/L	–	–	–	–	–	3	≤0.4

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

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	MCL, µg/L unless noted otherwise	Six-year review of regulations, 8 states (1993–1997)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6]		Pesticides survey (1988–1990)[7]	Inorganics and radionuclides survey (1984–1986)[8]	Occurrence of radioactivity (1981–1982)[9]
		Concentration > 0.5 MCL (percent of PWSs)	Concentration > MCL (percent of PWSs)	Concentration > MCL, Round 1 (percent of PWSs)	Concentration > MCL, Round 2 (percent of PWSs)	Concentration > MCL (estimated national percent of CWS wells)	Concentration > MCL (percent of sites)	Concentration > MCL (percent of PWSs)
Other synthetic organic contaminants								
Benzo(a)pyrene	0.2	0.18	0.05	–	–	–	–	–
Bis(2-ethylhexyl)adipate	400	0	0	–	–	–	–	–
Bis(2-ethylhexyl)phthlate	6	3.52	2.17	–	–	–	–	–
Chlordane	2	0	0	–	–	–	–	–
Cyanide	200	0.44	0.25	–	–	–	–	–
Dalapon	200	0	0	–	–	–	–	–
Diquat	20	0.1	0.06	–	–	–	–	–
Endothall	100	0.06	0.03	–	–	–	–	–
Endrin	2	0.07	0.05	–	–	–	–	–
Glyphosate	700	0	0	–	–	–	–	–
Heptachlor	0.4	0.09	0.02	–	–	–	–	–
Heptachlor Epoxide	0.2	0.04	0.04	–	–	–	–	–
Hexachlorobenzene	1	0	0	–	–	–	–	–
Hexachlorocyclopentadiene	50	0	0	–	–	–	–	–
Mercury	2	0.74	0.39	–	–	–	–	–
Methoxychlor	40	0	0	–	–	–	–	–
PCBs	0.5	0.09	0.06	–	–	–	–	–
Pentachlorophenol	1	0.14	0.06	–	–	ND	–	–
Toxaphene	3	0.02	0	–	–	–	–	–

[1] Data from Hopple and others (2009).

[2] Data from Gilliom and others (2006) and P.E. Stackelberg, U.S. Geological Survey, written commun., May 2009.

[3] Data from Zogorski and others (2006).

[4] Data from Focazio and others (2001).

Appendix 17. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for regulated contaminants analyzed in selected national-scale public-well studies.—Continued

[MCL, Maximum Contaminant Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; ≤, less than or equal to; ≥, greater than or equal to. Concentrations greater than MCLs do not necessarily indicate an MCL violation.]

[5] Data from U.S. Environmental Protection Agency (2003f).

[6] Data from U.S. Environmental Protection Agency (2001c).

[7] Data from U.S. Environmental Protection Agency (1990).

[8] Data from Longtin (1988).

[9] Data from Horton (1983).

[10] The MCL is for total trihalomethanes.

[11] Percentage of PWSs with concentrations greater than benchmarks is based on USEPA Health Reference Level of 60 µg/L.

[12] Percentage of PWSs with concentrations greater than benchmarks is based on USEPA Health Reference Level of 400 µg/L.

[13] Percentage of PWSs with concentrations greater than benchmarks is based on USEPA Health Reference Level of 600 µg/L.

[14] Percentage of PWSs with concentrations greater than benchmarks is based on USEPA MCL of 750 µg/L.

[15] MCL is under review by USEPA.

[16] Percentage of PWSs with concentrations greater than benchmarks is based on USEPA MCL of 100 µg/L.

[17] The MCL is for total xylenes (*o*-, *m*-, and *p*-xylene), CAS number 1330-20-7.

[18] The arsenic MCL was lowered from 50 µg/L to 10 µg/L in 2001 (U.S. Environmental Protection Agency, 2001b).

[19] MCL is a treatment technique. Copper action level = 1,300 µg/L (at tap); lead action level = 15 µg/L (at tap).

[20] The MCL for gross alpha-particle radioactivity excludes alpha-particle radioactivity from radon and uranium (U.S. Environmental Protection Agency, 2000b). Gross alpha-particle radioactivity values for public-well samples in this study were not corrected for radon or uranium.

[21] MCL = 4 mrem/yr, but because gross beta-particle radioactivity was measured in pCi/L, activities were compared to USEPA's screening level for gross beta-particle radioactivity of 50 pCi/L (U.S. Environmental Protection Agency, 2000b).

[22] MCL is for combined radium-226 and radium-228.

[23] Proposed MCL.

[24] Proposed Alternative MCL.

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)											
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]	
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L organics, ≥1 µg/L trace elements)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**
Pesticide compounds												
Acetochlor	800	0.3	ND	221	0.5	ND	298	0.3	–	–	–	–
Acifluorfen	590	ND	ND	215	ND	ND	219	ND	–	–	–	–
Aldicarb	584	ND	ND	215	ND	ND	219	ND	–	–	–	–
Aldicarb sulfone	569	0.5	ND	215	0.5	ND	202	0.5	–	–	–	–
Aldicarb sulfoxide	569	0.4	ND	215	ND	ND	202	0.5	–	–	–	–
Aldrin	–	–	–	–	–	–	–	–	–	–	–	–
Azinphos-methyl	894	ND	ND	221	ND	ND	358	ND	–	–	–	–
Benfluralin	896	ND	ND	221	ND	ND	358	ND	–	–	–	–
Bentazon	589	2.7	0.2	215	3.7	0.5	218	2.3	–	–	–	–
Bromacil	590	5.1	0.5	216	3.2	0.5	218	1.8	–	–	–	–
Bromoxynil	590	0.2	ND	215	ND	ND	219	ND	–	–	–	–
Butachlor	–	–	–	–	–	–	–	–	–	–	–	–
Butylate	511	0.2	ND	–	–	–	358	0.3	–	–	–	–
Carbaryl	898	0.7	ND	–	–	–	358	0.6	–	–	–	–
Chloramben methyl ester	580	0.2	ND	215	ND	ND	219	ND	–	–	–	–
Chlorothalonil	507	ND	ND	215	ND	ND	219	ND	–	–	–	–
Chlorpyrifos	898	0.2	ND	221	ND	ND	358	0.3	–	–	–	–
Clopyralid	586	0.2	ND	215	0.5	ND	213	ND	–	–	–	–
Cyanazine	634	0.5	ND	–	–	–	358	ND	–	–	–	–
Dacthal	898	0.3	ND	221	ND	ND	358	ND	–	–	–	–
Dacthal monoacid	590	ND	ND	215	ND	ND	219	ND	–	–	–	–
2,4-DB	580	ND	ND	215	ND	ND	209	ND	–	–	–	–
p,p'-DDE	512	2.7	ND	–	–	–	358	1.4	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)											
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]	
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L organics, ≥1 µg/L trace elements)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**
Pesticide compounds—Continued												
Deethylatrazine	853	30.1	0.5	221	34.4	4.1	357	24.9	–	–	–	–
Diazinon	897	0.3	ND	221	ND	ND	358	0.8	–	–	–	–
Dicamba	584	ND	ND	213	ND	ND	219	ND	–	–	–	–
Dichlobenil	159	ND	ND	–	–	–	219	0.5	–	–	–	–
Dichlorprop	590	ND	ND	215	ND	ND	219	ND	–	–	–	–
Dieldrin	896	3.1	ND	221	0.5	ND	358	2.2	–	–	–	–
2,6-Diethylaniline	898	0.1	ND	221	ND	ND	358	0.3	–	–	–	–
Disulfoton	647	ND	ND	–	–	–	358	ND	–	–	–	–
Diuron	587	5.3	0.7	215	3.3	0.5	219	5.9	–	–	–	–
DNOC	165	ND	ND	–	–	–	219	ND	–	–	–	–
EPTC	646	0.3	ND	–	–	–	358	0.3	–	–	–	–
Ethalfluralin	512	ND	ND	–	–	–	358	ND	–	–	–	–
Ethoprop	647	0.2	ND	–	–	–	358	ND	–	–	–	–
Fenuron	587	1.0	ND	215	ND	ND	218	3.2	–	–	–	–
Fluometuron	590	1.0	0.2	215	0.5	ND	218	0.9	–	–	–	–
Fonofos	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
alpha-HCH	512	0.2	ND	–	–	–	358	0.3	–	–	–	–
3-Hydroxycarbofuran	580	ND	ND	215	ND	ND	219	0.5	–	–	–	–
Linuron	512	0.2	ND	–	–	–	358	ND	–	–	–	–
Malathion	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
MCPA	582	ND	ND	207	ND	ND	219	ND	–	–	–	–
MCPB	590	ND	ND	215	ND	ND	219	ND	–	–	–	–
Methiocarb	579	ND	ND	215	ND	ND	217	0.5	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)											
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]	
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L organics, ≥1 µg/L trace elements)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**
Pesticide compounds—Continued												
Methomyl	569	ND	ND	215	ND	ND	202	0.5	–	–	–	–
Metolachlor	870	8.6	0.3	221	10.9	0.9	358	4.5	–	–	–	–
Metribuzin	898	1.2	ND	221	0.5	ND	358	1.1	–	–	–	–
Molinate	635	0.5	ND	–	–	–	358	0.6	–	–	–	–
Napropamide	511	ND	ND	–	–	–	358	ND	–	–	–	–
Neburon	584	ND	ND	215	ND	ND	218	0.5	–	–	–	–
Norflurazon	585	1.0	ND	215	0.9	ND	207	1.0	–	–	–	–
Oryzalin	582	ND	ND	215	ND	ND	218	0.5	–	–	–	–
Parathion	512	ND	ND	–	–	–	358	ND	–	–	–	–
Parathion-methyl	889	0.1	ND	221	ND	ND	351	ND	–	–	–	–
Pebulate	512	ND	ND	–	–	–	358	ND	–	–	–	–
Pendimethalin	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
cis-Permethrin	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
Phorate	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
Prometon	885	10.5	0.1	221	11.3	ND	358	9.8	–	–	–	–
Pronamide	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
Propachlor	512	ND	ND	17	ND	ND	358	ND	–	–	–	–
Propanil	647	ND	ND	–	–	–	358	ND	–	–	–	–
Propargite	644	ND	ND	–	–	–	356	ND	–	–	–	–
Propham	589	ND	ND	215	ND	ND	218	0.5	–	–	–	–
Propoxur	586	0.2	ND	215	ND	ND	218	0.5	–	–	–	–
2,4,5-T	165	ND	ND	–	–	–	219	ND	–	–	–	–
Tebuthiuron	859	4.7	0.3	218	0.9	ND	354	8.2	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)											
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]	
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L organics, ≥1 µg/L trace elements)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**
Pesticide compounds—Continued												
Terbacil	508	0.8	ND	–	–	–	357	ND	–	–	–	–
Terbufos	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
Thiobencarb	647	ND	ND	–	–	–	358	ND	–	–	–	–
Triallate	512	ND	ND	–	–	–	358	ND	–	–	–	–
Triclopyr	590	ND	ND	215	ND	ND	219	ND	–	–	–	–
Trifluralin	898	ND	ND	221	ND	ND	358	ND	–	–	–	–
Volatile organic compounds												
Acetone	771	0.6	0.6	161	ND	ND	–	–	–	–	–	–
Acrolein	–	–	–	–	–	–	–	–	126	ND	–	–
Acrylonitrile	771	0.1	0.1	221	0.5	0.5	–	–	837	ND	579	ND
tert-Amyl methyl ether	771	1.8	0.5	221	1.4	0.9	–	–	818	0.49	579	0.34
Bromobenzene	832	0.1	ND	221	ND	ND	–	–	–	–	579	ND
Bromochloromethane	832	0.2	ND	221	ND	ND	–	–	–	–	579	ND
Bromomethane	832	ND	ND	221	ND	ND	–	–	1,078	0.093	579	0.17
n-Butylbenzene	831	0.1	ND	221	0.5	ND	–	–	950	0.11	579	0.17
sec-Butylbenzene	831	0.4	0.1	221	0.5	ND	–	–	–	–	579	ND
tert-Butylbenzene	832	0.1	ND	221	ND	ND	–	–	–	–	579	ND
Carbon disulfide	765	5.8	0.5	175	1.7	1.7	–	–	–	–	–	–
Chloroethane	830	ND	ND	221	ND	ND	–	–	1,078	0.28	579	0.17
Chloromethane	806	2.7	ND	221	ND	ND	–	–	1,045	0.38	579	0.52
3-Chloropropene	771	ND	ND	221	ND	ND	–	–	–	–	–	–
2-Chlorotoluene	832	ND	ND	221	ND	ND	–	–	–	–	579	ND

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)											
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]	
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L organics, ≥1 µg/L trace elements)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**
Volatile organic compounds—Continued												
4-Chlorotoluene	832	ND	ND	221	ND	ND	–	–	–	–	579	ND
Dibromomethane	832	0.7	ND	221	0.5	ND	–	–	–	–	562	0.36
1,3-Dichlorobenzene	832	0.5	ND	221	ND	ND	–	–	913	ND	579	ND
trans-1,4-Dichloro-2-butene	771	ND	ND	221	ND	ND	–	–	–	–	–	–
Dichlorodifluoromethane	832	3.2	1.0	221	1.4	0.5	–	–	1,096	1.7	579	0.69
1,1-Dichloroethane	832	7.7	1.4	221	5.9	2.7	–	–	1,096	2.0	579	1.9
1,3-Dichloropropane	832	0.1	ND	221	ND	ND	–	–	–	–	569	ND
2,2-Dichloropropane	832	ND	ND	221	ND	ND	–	–	–	–	579	ND
1,1-Dichloropropene	832	0.1	ND	221	ND	ND	–	–	–	–	579	ND
1,3-Dichloropropene	–	–	–	–	–	–	–	–	1,078	ND	–	–
cis-1,3-Dichloropropene	832	ND	ND	221	ND	ND	–	–	1,078	ND	579	ND
trans-1,3-Dichloropropene	832	ND	ND	221	ND	ND	–	–	1,078	ND	579	ND
Diethyl ether	771	0.3	0.1	221	ND	ND	–	–	–	–	–	–
Diisopropyl ether	758	1.1	0.3	221	0.5	0.5	–	–	807	0.37	579	0.34
Ethyl methacrylate	771	ND	ND	221	ND	ND	–	–	–	–	–	–
Ethyl *tert*-butyl ether	771	0.1	0.1	221	ND	ND	–	–	818	0.12	579	0.17
2-Ethyltoluene	770	0.4	0.1	221	0.9	0.9	–	–	–	–	–	–
Hexachlorobutadiene	831	0.1	ND	221	ND	ND	–	–	962	ND	579	ND
Hexachloroethane	771	ND	ND	221	ND	ND	–	–	829	ND	579	ND
Iodomethane	771	0.1	ND	221	ND	ND	–	–	–	–	–	–
Isopropylbenzene	830	0.7	ND	221	0.9	ND	–	–	944	0.11	573	0.17
n-Isopropyltoluene	831	0.2	ND	221	0.5	ND	–	–	–	–	579	ND
Methyl acrylate	771	ND	ND	221	ND	ND	–	–	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)											
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]	
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L organics, ≥1 µg/L trace elements)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**
Volatile organic compounds—Continued												
Methyl acrylonitrile	771	ND	ND	221	ND	ND	–	–	–	–	–	–
Methyl butyl ketone	771	ND	ND	221	ND	ND	–	–	–	–	–	–
Methyl ethyl ketone	769	1.7	1.6	221	0.5	0.5	–	–	–	–	577	0.35
Methyl isobutyl ketone	769	0.4	0.4	221	0.5	0.5	–	–	–	–	–	–
Methyl methacrylate	771	ND	ND	221	ND	ND	–	–	–	–	–	–
Methyl *tert*-butyl ether	832	13.8	6.4	221	12.7	6.8	–	–	913	5.4	571	5.4
Naphthalene	831	0.1	0.1	221	0.5	0.5	–	–	962	0.1	579	0.17
n-Propylbenzene	831	0.1	ND	221	0.5	0.5	–	–	950	ND	579	ND
1,1,1.2-Tetrachloroethane	832	0.4	ND	221	ND	ND	–	–	–	–	579	ND
1,1,2,2-Tetrachloroethane	832	ND	ND	221	ND	ND	–	–	–	–	579	ND
Tetrahydrofuran	771	0.8	0.8	221	0.5	0.5	–	–	–	–	–	–
1,2,3,4-Tetramethylbenzene	770	0.4	0.1	221	0.9	0.5	–	–	–	–	–	–
1,2,3,5-Tetramethylbenzene	770	0.1	0.1	221	0.5	0.5	–	–	–	–	–	–
1,2,3-Trichlorobenzene	832	0.1	ND	221	ND	ND	–	–	950	ND	579	ND
Trichlorofluoromethane	832	5.0	1.4	221	2.3	0.5	–	–	1,096	1.1	579	0.86
1,2,3-Trichloropropane	832	1.2	0.8	221	ND	ND	–	–	997	0.80	579	0.17
Trichlorotrifluoroethane	832	4.6	1.3	221	1.8	0.9	–	–	931	0.32	579	0.17
1,2,3-Trimethylbenzene	770	0.3	0.1	221	0.5	0.5	–	–	–	–	–	–
1,2,4-Trimethylbenzene	828	1.3	0.4	176	2.3	0.6	–	–	938	0.32	571	0.18
1,3,5-Trimethylbenzene	831	0.2	0.1	221	0.5	0.5	–	–	–	–	579	ND
Vinyl bromide	771	ND	ND	221	ND	ND	–	–	818	ND	579	ND

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)											
	This study—assessment of multiple contaminant groups (1993–2007)			Assessment of organic contaminants (2002–2005)[1]			Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		MTBE and VOCs survey (1999–2000)[4]	
	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.2 µg/L organics, ≥1 µg/L trace elements)	Number of samples	Detection frequency (percent)	Detection frequency (percent ≥0.1 µg/L)	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent ≥0.2 µg/L)	Number of samples from CWSs	Detection frequency (percent ≥0.2 µg/L)
Sample water type	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**
Trace elements—Not listed because unregulated trace elements were analyzed in this study, but not in any of the other listed studies												
Other contaminants												
DCPA di-acid degradate	–	–	–	–	–	–	–	–	–	–	–	–
2,4-Dichlorophenol	–	–	–	–	–	–	–	–	–	–	–	–
2,4-Dinitrophenol	–	–	–	–	–	–	–	–	–	–	–	–
2,4-Dinitrotoluene	–	–	–	–	–	–	–	–	–	–	–	–
2,6-Dinitrotoluene	–	–	–	–	–	–	–	–	–	–	–	–
1,2-Diphenylhydrazine	–	–	–	–	–	–	–	–	–	–	–	–
2-Methyl-phenol	–	–	–	–	–	–	–	–	–	–	–	–
Nitrobenzene	–	–	–	–	–	–	–	–	–	–	–	–
LL-Nitrobenzene	–	–	–	–	–	–	–	–	–	–	–	–
Perchlorate	–	–	–	–	–	–	–	–	–	–	–	–
2,4,6-Trichlorophenol	–	–	–	–	–	–	–	–	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	First unregulated contaminant montoring rule (UCMR1) (2001–2005)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6,7]		Pesticides survey (1988–1990)[8]	VOCs survey (1981–1982)[9]			
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[10]	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Pesticide compounds									
Acetochlor	16,704	ND	–	–	–	–	–	–	–
Acifluorfen	–	–	–	–	ND	–	–	–	–
Aldicarb	–	–	24,542	0.05	ND	–	–	–	–
Aldicarb sulfone	–	–	24,516	0.07	ND	–	–	–	–
Aldicarb sulfoxide	–	–	24,497	0.07	ND	–	–	–	–
Aldrin	–	–	24,827	0.06	ND	–	–	–	–
Azinphos-methyl	–	–	–	–	–	–	–	–	–
Benfluralin	–	–	–	–	–	–	–	–	–
Bentazon	–	–	–	–	ND	–	–	–	–
Bromacil	–	–	–	–	ND	–	–	–	–
Bromoxynil	–	–	–	–	–	–	–	–	–
Butachlor	–	–	24,073	0.05	ND	–	–	–	–
Butylate	–	–	–	–	ND	–	–	–	–
Carbaryl	–	–	25,907	0.06	ND	–	–	–	–
Chloramben methyl ester	–	–	–	–	–	–	–	–	–
Chlorothalonil	–	–	–	–	ND	–	–	–	–
Chlorpyrifos	–	–	–	–	–	–	–	–	–
Clopyralid	–	–	–	–	ND	–	–	–	–
Cyanazine	–	–	–	–	ND	–	–	–	–
Dacthal	–	–	–	–	ND	–	–	–	–
Dacthal monoacid	16,838	3.1	–	–	6.4	–	–	–	–
2,4-DB	–	–	–	–	ND	–	–	–	–
p,p'-DDE	16,752	0.006	–	–	ND	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	First unregulated contaminant montoring rule (UCMR1) (2001–2005)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6,7]		Pesticides survey (1988–1990)[8]	VOCs survey (1981–1982)[9]			
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[10]	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
					Pesticide compounds—Continued				
Deethylatrazine	–	–	–	–	ND	–	–	–	–
Diazinon	1,164	ND	–	–	ND	–	–	–	–
Dicamba	–	–	27,743	0.2	ND	–	–	–	–
Dichlobenil	–	–	–	–	–	–	–	–	–
Dichlorprop	–	–	–	–	ND	–	–	–	–
Dieldrin	–	–	24,045	0.1	ND	–	–	–	–
2,6-Diethylaniline	–	–	–	–	–	–	–	–	–
Disulfoton	1,163	ND	–	–	ND	–	–	–	–
Diuron	1,185	ND	–	–	ND	–	–	–	–
DNOC	–	–	–	–	–	–	–	–	–
EPTC	16,721	ND	–	–	ND	–	–	–	–
Ethalfluralin	–	–	–	–	–	–	–	–	–
Ethoprop	–	–	–	–	ND	–	–	–	–
Fenuron	–	–	–	–	–	–	–	–	–
Fluometuron	–	–	–	–	ND	–	–	–	–
Fonofos	1,164	ND	–	–	–	–	–	–	–
alpha-HCH	–	–	–	–	ND	–	–	–	–
3-Hydroxycarbofuran	–	–	25,927	0.06	–	–	–	–	–
Linuron	1,182	ND	–	–	ND	–	–	–	–
Malathion	–	–	–	–	–	–	–	–	–
MCPA	–	–	–	–	–	–	–	–	–
MCPB	–	–	–	–	–	–	–	–	–
Methiocarb	–	–	–	–	ND	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	First unregulated contaminant montoring rule (UCMR1) (2001–2005)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6,7]		Pesticides survey (1988–1990)[8]	VOCs survey (1981–1982)[9]			
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[10]	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
					Pesticide compounds—Continued				
Methomyl	–	–	25,871	0.07	ND	–	–	–	–
Metolachlor	–	–	27,723	0.2	ND	–	–	–	–
Metribuzin	–	–	27,544	0.04	ND	–	–	–	–
Molinate	16,720	ND	–	–	ND	–	–	–	–
Napropamide	–	–	–	–	ND	–	–	–	–
Neburon	–	–	–	–	ND	–	–	–	–
Norflurazon	–	–	–	–	ND	–	–	–	–
Oryzalin	–	–	–	–	–	–	–	–	–
Parathion	–	–	–	–	–	–	–	–	–
Parathion-methyl	–	–	–	–	–	–	–	–	–
Pebulate	–	–	–	–	ND	–	–	–	–
Pendimethalin	–	–	–	–	–	–	–	–	–
cis-Permethrin	–	–	–	–	ND	–	–	–	–
Phorate	–	–	–	–	–	–	–	–	–
Prometon	1,164	ND	–	–	0.5	–	–	–	–
Pronamide	–	–	–	–	ND	–	–	–	–
Propachlor	–	–	24,610	0.05	ND	–	–	–	–
Propanil	–	–	–	–	ND	–	–	–	–
Propargite	–	–	–	–	–	–	–	–	–
Propham	–	–	–	–	ND	–	–	–	–
Propoxur	–	–	–	–	ND	–	–	–	–
2,4,5-T	–	–	–	–	ND	–	–	–	–
Tebuthiuron	–	–	–	–	ND	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	First unregulated contaminant montoring rule (UCMR1) (2001–2005)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6,7]		Pesticides survey (1988–1990)[8]	VOCs survey (1981–1982)[9]			
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[10]	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Pesticide compounds—Continued									
Terbacil	16,708	ND	–	–	ND	–	–	–	–
Terbufos	1,164	ND	–	–	ND	–	–	–	–
Thiobencarb	–	–	–	–	–	–	–	–	–
Triallate	–	–	–	–	–	–	–	–	–
Triclopyr	–	–	–	–	–	–	–	–	–
Trifluralin	–	–	–	–	ND	–	–	–	–
Volatile organic compounds									
Acetone	–	–	–	–	–	–	–	–	–
Acrolein	–	–	–	–	–	–	–	–	–
Acrylonitrile	–	–	–	–	–	–	–	–	–
tert-Amyl methyl ether	–	–	–	–	–	–	–	–	–
Bromobenzene	–	–	130,149	0.04	–	1.1	0.5	0.6	ND
Bromochloromethane	–	–	117,343	0.1	–	–	–	–	–
Bromomethane	–	–	136,200	0.3	–	–	–	–	–
n-Butylbenzene	–	–	116,294	0.06	–	–	–	–	–
sec-Butylbenzene	–	–	115,286	0.06	–	–	–	–	–
tert-Butylbenzene	–	–	115,352	0.04	–	–	–	–	–
Carbon disulfide	–	–	–	–	–	–	–	–	–
Chloroethane	–	–	140,632	0.1	–	–	–	–	–
Chloromethane	–	–	137,095	0.7	–	–	–	–	–
3-Chloropropene	–	–	–	–	–	–	–	–	–
2-Chlorotoluene	–	–	125,911	0.05	–	ND	ND	ND	0.6

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	First unregulated contaminant montoring rule (UCMR1) (2001–2005)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6,7]		Pesticides survey (1988–1990)[8]	VOCs survey (1981–1982)[9]			
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[10]	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Volatile organic compounds—Continued									
4-Chlorotoluene	–	–	118,677	0.04	–	ND	ND	ND	ND
Dibromomethane	–	–	124,310	0.1	–	–	–	–	–
1,3-Dichlorobenzene	–	–	142,102	0.09	–	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	–	–	–	–	–	–	–	–	–
Dichlorodifluoromethane	–	–	121,882	0.8	–	–	–	–	–
1,1-Dichloroethane	–	–	142,956	0.8	–	3.6	4.3	1.9	10.8
1,3-Dichloropropane	–	–	134,915	0.03	–	–	–	–	–
2,2-Dichloropropane	–	–	129,830	0.04	–	–	–	–	–
1,1-Dichloropropene	–	–	130,330	0.03	–	–	–	–	–
1,3-Dichloropropene	–	–	89,390	0.09	–	–	–	–	–
cis-1,3-Dichloropropene	–	–	23,736	0.3	ND	–	–	–	–
trans-1,3-Dichloropropene	–	–	25,154	0.08	ND	–	–	–	–
Diethyl ether	–	–	–	–	–	–	–	–	–
Diisopropyl ether	–	–	–	–	–	–	–	–	–
Ethyl methacrylate	–	–	–	–	–	–	–	–	–
Ethyl *tert*-butyl ether	–	–	–	–	–	–	–	–	–
2-Ethyltoluene	–	–	–	–	–	–	–	–	–
Hexachlorobutadiene	–	–	116,316	0.06	–	–	–	–	–
Hexachloroethane	–	–	–	–	–	–	–	–	–
Iodomethane	–	–	–	–	–	–	–	–	–
Isopropylbenzene	–	–	116,762	0.1	–	ND	ND	ND	ND
n-Isopropyltoluene	–	–	114,334	0.07	–	–	–	–	–
Methyl acrylate	–	–	–	–	–	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	First unregulated contaminant montoring rule (UCMR1) (2001–2005)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6,7]		Pesticides survey (1988–1990)[8]	VOCs survey (1981–1982)[9]			
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[10]	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Volatile organic compounds—Continued									
Methyl acrylonitrile	–	–	–	–	–	–	–	–	–
Methyl butyl ketone	–	–	–	–	–	–	–	–	–
Methyl ethyl ketone	–	–	–	–	–	–	–	–	–
Methyl isobutyl ketone	–	–	–	–	–	–	–	–	–
Methyl methacrylate	–	–	–	–	–	–	–	–	–
Methyl *tert*-butyl ether	16,766	0.1	–	–	–	–	–	–	–
Naphthalene	–	–	119,384	0.3	–	–	–	–	–
n-Propylbenzene	–	–	115,612	0.1	–	ND	ND	0.3	ND
1,1,1.2-Tetrachloroethane	–	–	130,760	0.05	–	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	–	–	142,315	0.07	–	ND	ND	ND	ND
Tetrahydrofuran	–	–	–	–	–	–	–	–	–
1,2,3,4-Tetramethylbenzene	–	–	–	–	–	–	–	–	–
1,2,3,5-Tetramethylbenzene	–	–	–	–	–	–	–	–	–
1,2,3-Trichlorobenzene	–	–	115,985	0.09	–	–	–	–	–
Trichlorofluoromethane	–	–	128,252	0.8	–	–	–	–	–
1,2,3-Trichloropropane	–	–	131,292	0.07	–	–	–	–	–
Trichlorotrifluoroethane	–	–	–	–	–	–	–	–	–
1,2,3-Trimethylbenzene	–	–			–	–	–	–	–
1,2,4-Trimethylbenzene	–	–	116,412	0.3	–	–	–	–	–
1,3,5-Trimethylbenzene	–	–	115,511	0.2	–	–	–	–	–
Vinyl bromide	–	–	–	–	–	–	–	–	–

Appendix 18. Comparison among detection frequencies for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[No common assessment level was applied to the data unless otherwise indicated. USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOCs, volatile organic compounds; MTBE, methyl *tert*-butyl ether; ≥, greater than or equal to; µg/L, micrograms per liter; CWS, community water system; <, less than; >, greater than; ND, not detected; –, not analyzed or not available]

Contaminant	National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								
	First unregulated contaminant montoring rule (UCMR1) (2001–2005)[5]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[6,7]		Pesticides survey (1988–1990)[8]	VOCs survey (1981–1982)[9]			
	Number of samples	Detection frequency (percent)	Number of samples	Detection frequency (percent)	Estimated national detection frequency from 540 CWS wells (percent)[10]	Detection frequency (percent of 280 random sites serving <10,000 people)	Detection frequency (percent of 186 random sites serving >10,000 people)	Detection frequency (percent of 321 non-random sites serving <10,000 people)	Detection frequency (percent of 158 non-random sites serving >10,000 people)
Sample water type	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**	**Finished**
Trace elements—Not listed because unregulated trace elements were analyzed in this study, but not in any of the other listed studies									
Other contaminants									
DCPA di-acid degradate	16,838	3.1	–	–	–	–	–	–	–
2,4-Dichlorophenol	1,157	ND	–	–	–	–	–	–	–
2,4-Dinitrophenol	1,157	ND	–	–	–	–	–	–	–
2,4-Dinitrotoluene	16,703	ND	–	–	–	–	–	–	–
2,6-Dinitrotoluene	16,706	ND	–	–	–	–	–	–	–
1,2-Diphenylhydrazine	1,164	ND	–	–	–	–	–	–	–
2-Methyl-phenol	1,157	ND	–	–	–	–	–	–	–
Nitrobenzene	16,666	0.006	–	–	–	–	–	–	–
LL-Nitrobenzene	1,267	ND	–	–	–	–	–	–	–
Perchlorate	16,863	1.0	–	–	–	–	–	–	–
2,4,6-Trichlorophenol	1,157	ND	–	–	–	–	–	–	–

[1] Data from Hopple and others (2009).

[2] Data from Gilliom and others (2006) and P.E. Stackelberg, U.S. Geological Survey, written commun., May 2009.

[3] Data from Zogorski and others (2006).

[4] Data from Grady (2002).

[5] Data from U.S. Environmental Protection Agency (2007b).

[6] Data from U.S. Environmental Protection Agency (2002b).

[7] Data from U.S. Environmental Protection Agency (2001c).

[8] Data from U.S. Environmental Protection Agency (1990).

[9] Data from Westrick and others (1984).

[10] Minimum reporting level ranged from 0.01 to 2.4 µg/L.

Appendix 19. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for unregulated contaminants analyzed in selected national-scale public-well studies.

[HBSL, Health-Based Screening Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; CRC5, cancer risk concentration corresponding to a 10^{-5} (1 in 100,000) cancer risk; MCL*, Maximum Contaminant Level (administrative stay); HRL, Health Reference Level; LHA, Lifetime Health Advisory, MCL, Maximum Contaminant Level]

Contaminant	HBSL (µg/L)	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)			
		This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[4]			Pesticides survey (1998–1999)[5]
		Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark (percent of wells)	Human-health benchmark value (µg/L), type	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark, Round 1 (percent of PWSs)	Concentration > benchmark, Round 2 (percent of PWSs)	Human-health benchmark value (µg/L,), type	Concentration > benchmark (estimated national percent of CWS wells)
Sample water type		**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**	**Finished**	**Finished**	**Finished**
Pesticide compounds													
Acetochlor	[6] 1	0.1	0	0	0	–	–	–	–	–	–	–	–
Acifluorfen	90	ND	ND	ND	ND	ND	10, CRC5	–	–	–	–	–	ND
Aldicarb	[7] 9	ND	ND	ND	ND	ND	3, MCL*	–	–	–	0	7, HRL	ND
Aldicarb sulfone	[7] 7	0	0	0	0	0	2, MCL*	–	–	–	0	7, HRL	ND
Aldicarb sulfoxide	[7] 7	0	0	ND	ND	0	4, MCL*	–	–	–	0.01	7, HRL	ND
Aldrin	[6] 0.002	–	–	–	–	–	–	–	–	–	0.01	0.002, HRL	ND
Azinphos-methyl	10	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Benfluralin	4	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Bentazon	200	0	0	0	0	0	200, LHA	–	–	–	–	–	ND
Bromacil	70	0	0	0	0	0	90, LHA	–	–	–	–	–	ND
Bromoxynil	10	0	0	ND	ND	–	–	–	–	–	–	–	–
Butachlor	–	–	–	–	–	–	–	–	–	–	–	–	ND
Butylate	400	0	0	–	–	0	400, LHA	–	–	–	–	–	ND
Carbaryl	[6] 40	0	0	–	–	0	700, LHA	–	–	–	0	700, MCL	ND
Chloramben methyl ester	–	–	–	ND	ND	–	–	–	–	–	–	–	–
Chlorothalonil	[6] 5	ND	ND	ND	ND	ND	15, CRC5	–	–	–	–	–	ND
Chlorpyrifos	2	0	0	ND	ND	0	20, LHA	–	–	–	–	–	–
Clopyralid	–	–	–	–	–	–	–	–	–	–	–	–	ND
Cyanazine	1	0	0	–	–	ND	1, LHA	–	–	–	–	–	ND
Dacthal	70	0	0	ND	ND	ND	70, LHA	–	–	–	–	–	ND

Appendix 19. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[HBSL, Health-Based Screening Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; CRC5, cancer risk concentration corresponding to a 10^{-5} (1 in 100,000) cancer risk; MCL*, Maximum Contaminant Level (administrative stay); HRL, Health Reference Level; LHA, Lifetime Health Advisory, MCL, Maximum Contaminant Level]

Contaminant	HBSL (µg/L)	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)			
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		Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark (percent of wells)	Human-health benchmark value (µg/L), type	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark, Round 1 (percent of PWSs)	Concentration > benchmark, Round 2 (percent of PWSs)	Human-health benchmark value (µg/L), type	Concentration > benchmark (estimated national percent of CWS wells)
Sample water type		**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**	**Finished**	**Finished**	**Finished**
Pesticide compounds—Continued													
Dacthal monoacid	–	–	–	–	–	–	–	–	–	–	–	–	[8] 0
2,4-DB	200	ND	ND	ND	ND	–	–	–	–	–	–	–	ND
p,p'-DDE	[6] 0.1	0	0	–	–	0	1, CRC5	–	–	–	–	–	ND
Deethylatrazine	–	–	–	–	–	–	–	–	–	–	–	–	ND
Diazinon	1	0	0	ND	ND	0	0.6, LHA	–	–	–	–	–	ND
Dicamba	3,000	ND	ND	ND	ND	ND	200, LHA	–	–	–	0	200, MCL	ND
Dichlobenil	9	ND	ND	–	–	–	–	–	–	–	–	–	–
Dichlorprop	300	ND	ND	ND	ND	–	–	–	–	–	–	–	ND
Dieldrin	[7] 0.002	3.1	3.0	0.5	0.5	2.0	0.02, CRC5	–	–	–	0.09	0.002, HRL	ND
2,6-Diethylaniline	–	–	–	ND	ND	–	–	–	–	–	–	–	–
Disulfoton	0.9	ND	ND	–	–	ND	0.3, LHA	–	–	–	–	–	ND
Diuron	[6] 2	0.7	0	0	0	0	10, LHA	–	–	–	–	–	ND
DNOC	–	–	–	–	–	–	–	–	–	–	–	–	–
EPTC	200	0	0	–	–	–	–	–	–	–	–	–	ND
Ethalfluralin	30	ND	ND	–	–	–	–	–	–	–	–	–	–
Ethoprop	[6] 1	0	0	–	–	–	–	–	–	–	–	–	ND
Fenuron	–	–	–	ND	ND	–	–	–	–	–	–	–	–
Fluometuron	4	0.2	0	0	0	0	90, LHA	–	–	–	–	–	ND
Fonofos	10	ND	ND	ND	ND	ND	10, LHA	–	–	–	–	–	–
alpha-HCH	[6] 0.006	0.2	0.2	–	–	0.3	0.06, CRC5	–	–	–	–	–	ND

Appendix 19. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[HBSL, Health-Based Screening Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; CRC5, cancer risk concentration corresponding to a 10^{-5} (1 in 100,000) cancer risk; MCL*, Maximum Contaminant Level (administrative stay); HRL, Health Reference Level; LHA, Lifetime Health Advisory, MCL, Maximum Contaminant Level]

Contaminant	HBSL (µg/L)	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)			
		This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[4]			Pesticides survey (1998–1999)[5]
		Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark (percent of wells)	Human-health benchmark value (µg/L), type	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark, Round 1 (percent of PWSs)	Concentration > benchmark, Round 2 (percent of PWSs)	Human-health benchmark value (µg/L), type	Concentration > benchmark (estimated national percent of CWS wells)
Sample water type		Source	Source	Source	Source	Source	Source	Source	Source	Finished	Finished	Finished	Finished
Pesticide compounds—Continued													
3-Hydroxycarbofuran	–	–	–	–	–	–	–	–	–	–	–	–	–
Linuron	5	0	0	–	–	–	–	–	–	–	–	–	ND
Malathion	50	ND	ND	ND	ND	ND	100, LHA	–	–	–	–	–	–
MCPA	30	ND	ND	ND	ND	ND	4, LHA	–	–	–	–	–	–
MCPB	100	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Methiocarb	40	ND	ND	ND	ND	–	–	–	–	–	–	–	ND
Methomyl	200	ND	ND	ND	ND	0	200, LHA	–	–	–	0	200, MCL	ND
Metolachlor	700	0	0	0	0	0	100, LHA	–	–	–	0	70, HRL	ND
Metribuzin	90	0	0	0	0	0	200, LHA	–	–	–	0	91, HRL	ND
Molinate	0.7	0	0	–	–	–	–	–	–	–	–	–	ND
Napropamide	800	ND	ND	–	–	–	–	–	–	–	–	–	ND
Neburon	–	–	–	–	–	–	–	–	–	–	–	–	ND
Norflurazon	10	0	0	0	0	–	–	–	–	–	–	–	ND
Oryzalin	[6] 4	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Parathion	0.02	ND	ND	–	–	–	–	–	–	–	–	–	–
Parathion-methyl	1	0	0	ND	ND	ND	2, LHA	–	–	–	–	–	–
Pebulate	50	ND	ND	–	–	–	–	–	–	–	–	–	ND
Pendimethalin	70	ND	ND	ND	ND	–	–	–	–	–	–	–	–
cis-Permethrin	[6,9] 4	ND	ND	ND	ND	–	–	–	–	–	–	–	ND
Phorate	4	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Prometon	400	0	0	0	0	0	100, LHA	–	–	–	–	–	[10] 0

Appendix 19. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[HBSL, Health-Based Screening Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; CRC5, cancer risk concentration corresponding to a 10^{-5} (1 in 100,000) cancer risk; MCL*, Maximum Contaminant Level (administrative stay); HRL, Health Reference Level; LHA, Lifetime Health Advisory, MCL, Maximum Contaminant Level]

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		Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark (percent of wells)	Human-health benchmark value (µg/L), type	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark, Round 1 (percent of PWSs)	Concentration > benchmark, Round 2 (percent of PWSs)	Human-health benchmark value (µg/L), type	Concentration > benchmark (estimated national percent of CWS wells)
Sample water type		**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**	**Finished**	**Finished**	**Finished**
Pesticide compounds—Continued													
Pronamide	[6] 1	ND	ND	ND	ND	ND	50, LHA	–	–	–	–	–	ND
Propachlor	[6] 1	ND	ND	ND	ND	ND	90, LHA	–	–	–	0	90, MCL	ND
Propanil	6	ND	ND	–	–	–	–	–	–	–	–	–	ND
Propargite	[6] 1	ND	ND	–	–	–	–	–	–	–	–	–	–
Propham	100	ND	ND	ND	ND	0	100, LHA	–	–	–	–	–	ND
Propoxur	[6] 9	0	0	ND	ND	0	3, LHA	–	–	–	–	–	ND
2,4,5-T	70	ND	ND	–	–	ND	70, LHA	–	–	–	–	–	ND
Tebuthiuron	1,000	0	0	0	0	0	500, LHA	–	–	–	–	–	ND
Terbacil	90	0	0	–	–	ND	90, LHA	–	–	–	–	–	ND
Terbufos	0.4	ND	ND	ND	ND	ND	0.9, LHA	–	–	–	–	–	ND
Thiobencarb	70	ND	ND	–	–	–	–	–	–	–	–	–	–
Triallate	20	ND	ND	–	–	–	–	–	–	–	–	–	–
Triclopyr	400	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Trifluralin	20	ND	ND	ND	ND	ND	5, LHA	–	–	–	–	–	ND
Volatile organic compounds													
Acetone	6,000	0	0	ND	ND	–	–	–	–	–	–	–	–
Acrolein	4	–	–	–	–	–	–	ND	ND	–	–	–	–
Acrylonitrile	[6] 0.06	0.1	0.1	0.5	0.5	–	–	ND	ND	–	–	–	–
tert-Amyl methyl ether	–	–	–	–	–	–	–	–	–	–	–	–	–

Appendix 19. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

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		This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[4]			Pesticides survey (1998–1999)[5]
		Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark (percent of wells)	Human-health benchmark value (µg/L), type	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark, Round 1 (percent of PWSs)	Concentration > benchmark, Round 2 (percent of PWSs)	Human-health benchmark value (µg/L), type	Concentration > benchmark (estimated national percent of CWS wells)
Sample water type		**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**	**Finished**	**Finished**	**Finished**
Volatile organic compounds—Continued													
Bromobenzene	–	–	–	ND	ND	–	–	–	–	–	–	–	–
Bromochloromethane	90	0	0	ND	ND	–	–	–	–	0.03	0.02	10, MCL	–
Bromomethane	100	ND	ND	ND	ND	–	–	0	0	0.08	0.05	10, MCL	–
n-Butylbenzene	–	–	–	–	–	–	–	–	–	–	–	–	–
sec-Butylbenzene	–	–	–	–	–	–	–	–	–	–	–	–	–
tert-Butylbenzene	–	–	–	ND	ND	–	–	–	–	–	–	–	–
Carbon disulfide	700	0	0	0	0	–	–	–	–	–	–	–	–
Chloroethane	–	–	–	–	–	–	–	–	–	–	–	–	–
Chloromethane	30	0	0	ND	ND	–	–	0	0	0.41	0.55	3, MCL	–
3-Chloropropene	–	–	–	–	–	–	–	–	–	–	–	–	–
2-Chlorotoluene	100	ND	ND	ND	ND	–	–	–	–	0	0	100, MCL	–
4-Chlorotoluene	100	ND	ND	ND	ND	–	–	–	–	0	0	100, MCL	–
Dibromomethane	–	–	–	–	–	–	–	–	–	–	–	–	–
1,3-Dichlorobenzene	600	0	0	ND	ND	–	–	ND	ND	0	0	600, LHA	–
trans-1,4-Dichloro-2-butene	–	–	–	–	–	–	–	–	–	–	–	–	–
Dichlorodifluoromethane	1,000	0	0	0	0	–	–	0	0	0	0	1,000, MCL	–
1,1-Dichloroethane	–	–	–	–	–	–	–	–	–	0.16	0.07	5, MCL	–
1,3-Dichloropropane	–	–	–	ND	ND	–	–	–	–	–	–	–	–
2,2-Dichloropropane	–	–	–	–	–	–	–	–	–	–	–	–	–
1,1-Dichloropropene	–	–	–	ND	ND	–	–	–	–	–	–	–	–
1,3-Dichloropropene	[6,11] 0.3	–	–	–	–	–	–	ND	ND	0	0	40, HRL	–

Appendix 19. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

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		Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark (percent of wells)	Human-health benchmark value (µg/L), type	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark, Round 1 (percent of PWSs)	Concentration > benchmark, Round 2 (percent of PWSs)	Human-health benchmark value (µg/L), type	Concentration > benchmark (estimated national percent of CWS wells)
Sample water type		**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**	**Finished**	**Finished**	**Finished**
Volatile organic compounds—Continued													
cis-1,3-Dichloropropene	[6,11] 0.3	ND	ND	ND	ND	–	–	ND	ND	–	–	–	ND
trans-1,3-Dichloropropene	[6,11] 0.3	ND	ND	ND	ND	–	–	ND	ND	–	–	–	ND
Diethyl ether	1,000	0	0	ND	ND	–	–	–	–	–	–	–	–
Diisopropyl ether	–	–	–	–	–	–	–	–	–	–	–	–	–
Ethyl methacrylate	–	–	–	–	–	–	–	–	–	–	–	–	–
Ethyl *tert*-butyl ether	–	–	–	ND	ND	–	–	–	–	–	–	–	–
2-Ethyltoluene	–	–	–	–	–	–	–	–	–	–	–	–	–
Hexachlorobutadiene	[6] 0.9	0	0	ND	ND	–	–	ND	ND	0.06	0	0.9, HRL	–
Hexachloroethane	0.7	ND	ND	ND	ND	–	–	ND	ND	–	–	–	–
Iodomethane	–	–	–	ND	ND	–	–	–	–	–	–	–	–
Isopropylbenzene	700	0	0	0	0	–	–	0	0	–	–	–	–
n-Isopropyltoluene	–	–	–	–	–	–	–	–	–	–	–	–	–
Methyl acrylate	–	–	–	–	–	–	–	–	–	–	–	–	–
Methyl acrylonitrile	0.7	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Methyl butyl ketone	–	–	–	–	–	–	–	–	–	–	–	–	–
Methyl ethyl ketone	4,000	0	0	0	0	–	–	–	–	–	–	–	–
Methyl isobutyl ketone	–	–	–	–	–	–	–	–	–	–	–	–	–
Methyl methacrylate	10,000	ND	ND	ND	ND	–	–	–	–	–	–	–	–
Methyl *tert*-butyl ether	–	–	–	–	–	–	–	–	–	–	–	–	–
Naphthalene	100	0	0	0	0	–	–	0	0	0.02	0	140, HRL	–
n-Propylbenzene	–	–	–	–	–	–	–	–	–	–	–	–	–

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[HBSL, Health-Based Screening Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; CRC5, cancer risk concentration corresponding to a 10^{-5} (1 in 100,000) cancer risk; MCL*, Maximum Contaminant Level (administrative stay); HRL, Health Reference Level; LHA, Lifetime Health Advisory, MCL, Maximum Contaminant Level]

Contaminant	HBSL (µg/L)	National USGS GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)								National USEPA GW studies including public wells or public water systems, from most to least recent (years that most samples were collected)			
		This study—assessment of multiple contaminant groups (1993–2007)		Assessment of organic contaminants (2002–2005)[1]		Assessment of pesticides (1992–2001)[2]		Assessment of VOCs (1991–2001)[3]		Unregulated contaminant monitoring program (1988–1992, Round 1, 1993–1997, Round 2)[4]			Pesticides survey (1998–1999)[5]
		Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark (percent of wells)	Human-health benchmark value (µg/L), type	Concentration > 0.1 HBSL (percent of wells)	Concentration > HBSL (percent of wells)	Concentration > benchmark, Round 1 (percent of PWSs)	Concentration > benchmark, Round 2 (percent of PWSs)	Human-health benchmark value (µg/L), type	Concentration > benchmark (estimated national percent of CWS wells)
Sample water type		**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Source**	**Finished**	**Finished**	**Finished**	**Finished**
Volatile organic compounds—Continued													
1,1,1.2-Tetrachloroethane	70	0	0	ND	ND	–	–	–	–	0	0	70, LHA	–
1,1,2,2-Tetrachloroethane	0.3	ND	ND	ND	ND	–	–	–	–	0.05	0	2, LHA	–
Tetrahydrofuran	–	–	–	–	–	–	–	–	–	–	–	–	–
1,2,3,4-Tetramethylbenzene	–	–	–	–	–	–	–	–	–	–	–	–	–
1,2,3,5-Tetramethylbenzene	–	–	–	–	–	–	–	–	–	–	–	–	–
1,2,3-Trichlorobenzene	–	–	–	ND	ND	–	–	–	–	–	–	–	–
Trichlorofluoromethane	2,000	0	0	0	0	–	–	0	0	0.01	0	175, LHA	–
1,2,3-Trichloropropane	40	0	0	ND	ND	–	–	0	0	0.01	0	40, MCL	–
Trichlorotrifluoroethane	200,000	0	0	0	0	–	–	0	0	–	–	–	–
1,2,3-Trimethylbenzene	–	–	–	–	–	–	–	–	–				–
1,2,4-Trimethylbenzene	–	–	–	–	–	–	–	–	–	–	–	–	–
1,3,5-Trimethylbenzene	–	–	–	–	–	–	–	–	–	–	–	–	–
Vinyl bromide	–	–	–	–	–	–	–	–	–	–	–	–	–
Trace elements—Not listed because unregulated trace elements were analyzed in this study, but not in any of the other listed studies													
Other contaminants —Not listed because concentrations were not compared to human-health benchmarks in any of the listed studies													

Appendix 19. Comparison among percentages of public wells or public water systems with concentrations greater than human-health benchmarks for unregulated contaminants analyzed in selected national-scale public-well studies.—Continued

[HBSL, Health-Based Screening Level; µg/L, micrograms per liter; USGS, U.S. Geological Survey; GW, groundwater; USEPA, U.S. Environmental Protection Agency; VOC, volatile organic compound; >, greater than; PWS, public water system; CWS, community water system; –, not analyzed or not available; ND, not detected; CRC5, cancer risk concentration corresponding to a 10^{-5} (1 in 100,000) cancer risk; MCL*, Maximum Contaminant Level (administrative stay); HRL, Health Reference Level; LHA, Lifetime Health Advisory, MCL, Maximum Contaminant Level]

[1] Data from Hopple and others (2009).

[2] Data from Gilliom and others (2006) and P.E. Stackelberg, U.S. Geological Survey, written commun., May 2009.

[3] Data from Zogorski and others (2006).

[4] Data from U.S. Environmental Protection Agency (2001c).

[5] Data from U.S. Environmental Protection Agency (1990).

[6] Low end of HBSL range corresponding to a 10^{-6} (1 in 1 million) cancer risk. The HBSL range corresponds to a 10^{-6} to 10^{-4} cancer risk range.

[7] The USEPA Office of Water recommends that the concentration of any combination of two or more of the three aldicarb compounds should not be greater than 7 µg/L because of similar mode of action.

[8] Percentage of CWS wells with concentrations greater than benchmarks is based on USEPA LHA of 4,000 µg/L.

[9] Concentrations of *cis*-permethrin were compared to the HBSL range (4–400 µg/L) for permethrin, CAS number 52645-53-1.

[10] Percentage of CWS wells with concentrations greater than benchmarks is based on USEPA LHA of 100 µg/L.

[11] Sum of concentrations from *cis*-1,3- and *trans*-1,3-dichloropropene were compared to the HBSL range (0.3–30 µg/L) for the mixed isomer of 1,3-dichloropropene, CAS number 542-75-6.

Appendix 20. Comparison among contaminants on the third Contaminant Candidate List, those analyzed in public-well samples collected by the NAWQA Program, 1993–2007, and those analyzed for the Unregulated Contaminant Monitoring Program.

[NAWQA, National Water-Quality Assessment; USEPA, U.S. Environmental Protection Agency; CAS, Chemical Abstracts Service; USGS, U.S. Geological Survey; UCM, Unregulated Contaminant Monitoring; UCMR1, first UCM Rule monitoring cycle; UCMR2, second UCM Rule monitoring cycle]

Contaminant on third USEPA contaminant candidate list (CCL3) [1]	CAS registry number	Analyzed in this USGS NAWQA public-well study (1993–2007)	Analyzed in orginal USEPA UCM program (1988–1997) [2]	Analyzed in USEPA UCMR1 (2001–2005) [3]	Will be analyzed in USEPA UCMR2 (2008–2010) [4]
Acephate	30560-19-1	No	No	No	No
Acetaldehyde	75-07-0	No	No	No	No
Acetamide	60-35-5	No	No	No	No
Acetochlor	34256-82-1	Yes	No	Yes	Yes
Acetochlor ethanesulfonic acid (ESA)	187022-11-3	No	No	No	Yes
Acetochlor oxanilic acid (OA)	184992-44-4	No	No	No	Yes
Acrolein	107-02-8	No	No	No	No
Alachlor ethanesulfonic acid (ESA)	142363-53-9	No	No	No	Yes
Alachlor oxanilic acid (OA)	171262-17-2	No	No	No	Yes
Aniline	62-53-3	No	No	No	No
Bensulide	741-58-2	No	No	No	No
Benzyl chloride	100-44-7	No	No	No	No
1,3-Butadiene	106-99-0	No	No	No	No
1-Butanol	71-36-3	No	No	No	No
Butylated hydroxyanisole	25013-16-5	No	No	No	No
sec-Butylbenzene	135-98-8	Yes	Yes	No	No
Captan	133-06-2	No	No	No	No
Chlorate	14866-68-3	No	No	No	No
Chloromethane (Methyl chloride)	74-87-3	Yes	Yes	No	No
Clethodim	110429-62-4	No	No	No	No
Cobalt	7440-48-4	Yes	No	No	No
Cumene hydroperoxide	80-15-9	No	No	No	No
Cyanotoxins [5]	--	No	No	No	No
1,1-Dichloroethane	75-34-3	Yes	Yes	No	No
Dicrotophos	141-66-2	No	No	No	No
Dimethipin	55290-64-7	No	No	No	No
Dimethoate	60-51-5	No	No	No	Yes
1,3-Dinitrobenzene	99-65-0	No	No	No	Yes
1,4-Dioxane	123-91-1	No	No	No	No
Disulfoton	298-04-4	Yes	No	Yes	No
Diuron	330-54-1	Yes	No	Yes	No
Equilenin	517-09-9	No	No	No	No
Equilin	474-86-2	No	No	No	No
Erythromycin	114-07-8	No	No	No	No
Estradiol (17-beta estradiol)	50-28-2	No	No	No	No
17alpha-Estradiol	57-91-0	No	No	No	No
Estriol	50-27-1	No	No	No	No
Estrone	53-16-7	No	No	No	No
Ethinyl Estradiol (17-alpha ethynyl estradiol)	57-63-6	No	No	No	No
Ethoprop	13194-48-4	Yes	No	No	No
Ethylene glycol	107-21-1	No	No	No	No
Ethylene oxide	75-21-8	No	No	No	No
Ethylene thiourea	96-45-7	No	No	No	No
Fenamiphos	22224-92-6	No	No	No	No
Formaldehyde	50-00-0	No	No	No	No

Appendix 20. Comparison among contaminants on the third Contaminant Candidate List, those analyzed in public-well samples collected by the NAWQA Program, 1993–2007, and those analyzed for the Unregulated Contaminant Monitoring Program.—Continued

[NAWQA, National Water-Quality Assessment; USEPA, U.S. Environmental Protection Agency; CAS, Chemical Abstracts Service; USGS, U.S. Geological Survey; UCM, Unregulated Contaminant Monitoring; UCMR1, first UCM Rule monitoring cycle; UCMR2, second UCM Rule monitoring cycle]

Contaminant on third USEPA contaminant candidate list (CCL3) [1]	CAS registry number	Analyzed in this USGS NAWQA public-well study (1993–2007)	Analyzed in orginal USEPA UCM program (1988–1997) [2]	Analyzed in USEPA UCMR1 (2001–2005) [3]	Will be analyzed in USEPA UCMR2 (2008–2010) [4]
Germanium	7440-56-4	No	No	No	No
Halon 1011 (bromochloromethane)	74-97-5	Yes	Yes	No	No
HCFC-22	75-45-6	No	No	No	No
alpha-Hexachlorocyclohexane	319-84-6	Yes	No	No	No
Hexane	110-54-3	No	No	No	No
Hydrazine	302-01-2	No	No	No	No
3-Hydroxycarbofuran	16655-82-6	Yes	Yes	No	No
Mestranol	72-33-3	No	No	No	No
Methamidophos	10265-92-6	No	No	No	No
Methanol	67-56-1	No	No	No	No
2-Methoxyethanol	109-86-4	No	No	No	No
Methyl bromide (Bromomethane)	74-83-9	Yes	Yes	No	No
N-Methyl-2-pyrrolidone	872-50-4	No	No	No	No
Methyl *tert*-butyl ether	1634-04-4	Yes	No	Yes	No
4,4'-Methylenedianiline	101-77-9	No	No	No	No
Metolachlor	51218-45-2	Yes	Yes	No	Yes
Metolachlor ethanesulfonic acid (ESA)	171118-09-5	No	No	No	Yes
Metolachlor oxanilic acid (OA)	152019-73-3	No	No	No	Yes
Molinate	2212-67-1	Yes	No	Yes	No
Molybdenum	7439-98-7	Yes	No	No	No
Nitrobenzene	98-95-3	No	No	Yes	No
Nitroglycerin	55-63-0	No	No	No	No
N-Nitrosodiethylamine (NDEA)	55-18-5	No	No	No	Yes
N-Nitrosodimethylamine (NDMA)	62-75-9	No	No	No	Yes
N-Nitroso-di-n-propylamine (NDPA)	621-64-7	No	No	No	Yes
N-Nitrosodiphenylamine	86-30-6	No	No	No	No
N-nitrosopyrrolidine (NPYR)	930-55-2	No	No	No	Yes
Norethindrone (19-Norethisterone)	68-22-4	No	No	No	No
Oxirane, methyl-	75-56-9	No	No	No	No
Oxydemeton-methyl	301-12-2	No	No	No	No
Oxyfluorfen	42874-03-3	No	No	No	No
Perchlorate	14797-73-0	No	No	Yes	No
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	No	No	No	No
Permethrin	52645-53-1	Yes [6]	No	No	No
PFOA (perfluorooctanoic acid)	335-67-1	No	No	No	No
Profenofos	41198-08-7	No	No	No	No
2-Propen-1-ol	107-18-6	No	No	No	No
n-Propylbenzene	103-65-1	Yes	Yes	No	No
Quinoline	91-22-5	No	No	No	No
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	No	No	Yes	Yes
Strontium	7440-24-6	Yes	No	No	No
Tebuconazole	107534-96-3	No	No	No	No
Tebufenozide	112410-23-8	No	No	No	No
Tellurium	13494-80-9	No	No	No	No
Terbufos	13071-79-9	Yes	No	Yes	No

Appendix 20. Comparison among contaminants on the third Contaminant Candidate List, those analyzed in public-well samples collected by the NAWQA Program, 1993–2007, and those analyzed for the Unregulated Contaminant Monitoring Program.—Continued

[NAWQA, National Water-Quality Assessment; USEPA, U.S. Environmental Protection Agency; CAS, Chemical Abstracts Service; USGS, U.S. Geological Survey; UCM, Unregulated Contaminant Monitoring; UCMR1, first UCM Rule monitoring cycle; UCMR2, second UCM Rule monitoring cycle]

Contaminant on third USEPA contaminant candidate list (CCL3) [1]	CAS registry number	Analyzed in this USGS NAWQA public-well study (1993–2007)	Analyzed in orginal USEPA UCM program (1988–1997) [2]	Analyzed in USEPA UCMR1 (2001–2005) [3]	Will be analyzed in USEPA UCMR2 (2008–2010) [4]
Terbufos sulfone	56070-16-7	No	No	No	Yes
1,1,1,2-Tetrachloroethane	630-20-6	Yes	Yes	No	No
Thiodicarb	59669-26-0	No	No	No	No
Thiophanate-methyl	23564-05-8	No	No	No	No
Toluene diisocyanate	26471-62-5	No	No	No	No
o-Toluidine	95-53-4	No	No	No	No
Tribufos	78-48-8	No	No	No	No
1,2,3-Trichloropropane	96-18-4	Yes	Yes	No	No
Triethylamine	121-44-8	No	No	No	No
Triphenyltin hydroxide (TPTH)	76-87-9	No	No	No	No
Urethane	51-79-6	No	No	No	No
Vanadium	7440-62-2	Yes	No	No	No
Vinclozolin	50471-44-8	No	No	No	No
Ziram	137-30-4	No	No	No	No

[1] Data from U.S. Environmental Protection Agency (2010a).

[2] Data from U.S. Environmental Protection Agency (2001c).

[3] Data from U.S. Environmental Protection Agency (2006d).

[4] Data from U.S. Environmental Protection Agency (2010g).

[5] Toxins naturally produced and released by cyanobacteria (“blue-green algae”). Various studies suggest three cyanotoxins for consideration: Anatoxin-a, Microcystin-LR, and Cylindrospermopsin.

[6] *cis*-Permethrin was analyzed by NAWQA, CAS registry number 54774-45-7.

Appendix 21. Comparison of findings from this national-scale public-well study to findings from a national-scale domestic-well study.

[proposed AMCL for radon; proposed Alternative Maximum Contaminant Level of 4,000 picocuries per liter (pCi/L); proposed MCL for radon; proposed Maximum Contaminant Level of 300 pCi/L; VOC, volatile organic compound; NA, not analyzed; –, not calculated]

Criterion	Domestic-well study (DeSimone, 2009)	This public-well study
Study details		
Number of wells (one sample collected from each well)	2,167	932
Number of principal aquifers in which samples were collected (out of 62)	30	30
Number of states in which samples were collected	48	41
Date range that samples were collected	1991–2004	1993–2007
Number of properties and contaminants analyzed	219	221
Findings for individual contaminants with respect to human-health benchmarks		
Percentage of samples that contained one or more contaminants with a concentration greater than a human-health benchmark, when radon activities were compared to the proposed AMCL	22.6	22.1
Percentage of samples that contained one or more contaminants with a concentration greater than one-tenth of a human-health benchmark, when radon activities were compared to the proposed MCL (includes the percentage of samples with concentrations greater than benchmarks above)	93.9	79.9
Percentage of samples with naturally occurring inorganic contaminants with concentrations greater than human-health benchmarks in at least 1 percent of samples		
Radon (low end of range: radon activities compared to proposed AMCL; high end of range: radon activities compared to proposed MCL)	4.4 to 64.6	0.6 to 54.7
Radium-226 plus radium-228	2.3	18.8
Arsenic	6.8	9.9
Gross alpha-particle radioactivity—uncorrected	5.3	4.8
Manganese	5.2	4.6
Strontium	7.3	3.0
Boron	1.3	2.8
Uranium	1.7	0.8
Fluoride	1.2	0.5
Percentage of samples with contaminants of primarily anthropogenic origin with concentrations greater than human-health benchmarks in at least 1 percent of samples		
Dieldrin	0.4	3.0
Nitrate	4.4	1.9
Perchloroethene	0.1	1.0
Percentage of samples with concentrations of organic contaminants greater than human-health benchmarks	0.8	4.5
Percentage of samples with concentrations of organic contaminants greater than one-tenth of human-health benchmarks (includes the percentage of samples with concentrations greater than benchmarks above)	3.0	9.8
Findings for individual contaminants with respect to detection frequency		
Percentage of samples in which organic contaminants (pesticide compounds or VOCs) were detected using no common assessment level	60.1	64.4
Pesticide compounds	29.4	40.7
VOCs	49.4	60.0

Appendix 21. Comparison of findings from this national-scale public-well study to findings from a national-scale domestic-well study.—Continued

[proposed AMCL for radon; proposed Alternative Maximum Contaminant Level of 4,000 picocuries per liter (pCi/L); proposed MCL for radon; proposed Maximum Contaminant Level of 300 pCi/L; VOC, volatile organic compound; NA, not analyzed; –, not calculated]

Criterion	Domestic-well study (DeSimone, 2009)	This public-well study
Findings for individual contaminants with respect to detection frequency—Continued		
Most frequently detected organic contaminants at a common assessment level of 0.02 micrograms per liter, and detection frequency, in percent		
Chloroform	17.9	41.2
Perchloroethene	5.5	18.2
Methyl *tert*-butyl ether	5.4	14.8
Trichloroethene	2.1	13.0
1,1,1-Trichloroethane	3.8	9.7
Bromodichloromethane	1.9	9.6
Atrazine	5.6	8.9
Deethylatrazine	6.7	7.6
Simazine	1.1	2.9
Chloromethane	5.7	2.5
Percentage of samples with detections of fecal-indicator microorganisms		
Escherichia coli	7.9	2.4
Total coliform	33.5	10.5
Coliphage	NA	2.4
Percentage of samples with at least one contaminant at a level or concentration outside of the ranges recommended for the aesthetic quality of water		
pH	16.3	20.2
Total dissolved solids	14.8	16.7
Iron	19.1	16.8
Manganese	21.3	14.6
Sodium (high end of taste threshold)	–	19.2
Results for contaminant mixtures		
Number of wells included in the analysis of mixtures	1,389	383
Percentage of samples with two or more contaminants with concentrations greater than human-health benchmarks	4.0	4.2
Percentage of samples with two or more contaminants with concentrations greater than one-tenth of human-health benchmarks	72.8	83.8
The most common inorganic contaminants in mixtures with concentrations greater than one-tenth of human-health benchmarks were nitrate, arsenic, radon, and uranium (and strontium in public-well samples)	yes	yes
Some of the most common organic contaminants in mixtures were atrazine, deethylatrazine, chloroform (and perchloroethene in public-well samples)	yes	yes
Number of unique mixtures with concentrations greater than human-health benchmarks that were detected in at least one sample	85	21
Number of unique mixtures with concentrations greater than one-tenth of human-health benchmarks that were detected in at least 5 percent of samples	43	68
Number of unique mixtures with concentrations greater than one-tenth of human-health benchmarks plus any organic contaminant detection that were detected in at least 10 percent of samples	8	125

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