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NATIONAL WATER-QUALITY ASSESSMENT PROGRAM
SOURCE WATER-QUALITY ASSESSMENT

Concentration Data for Anthropogenic Organic Compounds in Ground Water, Surface Water, and Finished Water of Selected Community Water Systems in the United States, 2002–05

Data Series 268

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By Janet M. Carter, Gregory C. Delzer, James A. Kingsbury, and Jessica A. Hopple

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Foreword

The U.S. Geological Survey (USGS) is committed to providing the Nation with accurate and timely scientific information that helps enhance and protect the overall quality of life and that facilitates effective management of water, biological, energy, and mineral resources (*http://www.usgs.gov/*). Information on the quality of the Nation's water resources is critical to assuring the long-term availability of water that is safe for drinking and recreation and suitable for industry, irrigation, and habitat for fish and wildlife. Population growth and increasing demands for multiple water uses make water availability, now measured in terms of quantity and quality, even more essential to the long-term sustainability of our communities and ecosystems.

The USGS implemented the National Water-Quality Assessment (NAWQA) Program in 1991 to support national, regional, and local information needs and decisions related to water-quality management and policy (*http://water.usgs.gov/nawqa*). Shaped by and coordinated with ongoing efforts of other Federal, State, and local agencies, the NAWQA Program is designed to answer: What is the condition of our Nation's streams and ground water? How are the conditions changing over time? How do natural features and human activities affect the quality of streams and ground water, and where are those effects most pronounced? By combining information on water chemistry, physical characteristics, stream habitat, and aquatic life, the NAWQA Program aims to provide science-based insights for current and emerging water issues and priorities.

From 1991–2001, the NAWQA Program completed interdisciplinary assessments in 51 of the Nation's major river basins and aquifer systems, referred to as Study Units (*http://water.usgs.gov/nawqa/studyu.html*). Baseline conditions were established for comparison to future assessments, and long-term monitoring was initiated in many of the basins. During the next decade, 42 of the 51 Study Units will be reassessed so that 10 years of comparable monitoring data will be available to determine trends at many of the Nation's streams and aquifers. The next 10 years of study also will fill in critical gaps in characterizing water-quality conditions, enhance understanding of factors that affect water quality, and establish links between *sources* of contaminants, the *transport* of those contaminants through the hydrologic system, and the potential *effects* of contaminants on humans and aquatic ecosystems.

The USGS aims to disseminate credible, timely, and relevant science information to inform practical and effective water-resource management and strategies that protect and restore water quality. We hope this NAWQA publication will provide you with insights and information to meet your needs, and will foster increased citizen awareness and involvement in the protection and restoration of our Nation's waters.

The USGS recognizes that a national assessment by a single program cannot address all water-resource issues of interest. External coordination at all levels is critical for a fully integrated understanding of watersheds and for cost-effective management, regulation, and conservation of our Nation's water resources. The NAWQA Program, therefore, depends on advice and information from other agencies—Federal, State, interstate, Tribal, and local—as well as nongovernmental organizations, industry, academia, and other stakeholder groups. Your assistance and suggestions are greatly appreciated.

Robert M. Hirsch
Associate Director for Water

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Multiply	By	To obtain
	Length	
kilometer (km)	0.6214	mile (mi)

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Acronyms

<	less than
AOC	anthropogenic organic compound
BTEX	benzene, toluene, ethylbenzene, and xylenes
CWS	community water system
DEET	N,N-diethyl-*meta*-toluamide
E	estimated
GC/MS	gas chromatography-mass spectrometry
HPLC/MS	high performance liquid chromatography-mass spectrometry
LRL	laboratory reporting level
LT–MDL	long-term method detection level
NAWQA	National Water-Quality Assessment
NWQL	National Water Quality Laboratory
QC	quality control
R	removed
SPE	solid phase extraction
SWQA	Source Water-Quality Assessment
USGS	U.S. Geological Survey
VOC	volatile organic compound

Definitions

Terms for which definitions are provided below are presented in boldface type when first used in the text

Community water system (CWS)	A public water system with 15 or more connections and serving 25 or more year-round residents and thus is subject to U.S. Environmental Protection Agency regulations enforcing the Safe Drinking Water Act. A community water system serves a residential population, such as a municipality, mobile home park, or nursing home.
Finished water	Water is "finished" when it has passed through all the processes in a water treatment plant and is ready to be delivered to consumers.
Principal aquifer	A regionally extensive aquifer or aquifer system that has the potential to be used as a source of potable water.
Source water	Source water is the raw (ambient) water collected at the supply well or surface-water intake prior to water treatment used to produce finished water.
Source Water-Quality Assessment (SWQA)	An assessment activity of the U.S. Geological Survey's National Water-Quality Assessment Program that focuses on characterizing the quality of source water and finished water of aquifers and major rivers used by some of the larger community water systems in the United States.

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Concentration Data for Anthropogenic Organic Compounds in Ground Water, Surface Water, and Finished Water of Selected Community Water Systems in the United States, 2002–05

By Janet M. Carter, Gregory C. Delzer, James A. Kingsbury, and Jessica A. Hopple

Abstract

The National Water-Quality Assessment Program of the U.S. Geological Survey began implementing Source Water-Quality Assessments (SWQAs) in 2001 that focus on characterizing the quality of source water and finished water of aquifers and major rivers used by some of the larger community water systems (CWSs) in the United States. As used for SWQA studies, source water is the raw (ambient) water collected at the supply well prior to water treatment (for ground water) or the raw (ambient) water collected from the river near the intake (for surface water), and finished water is the water that is treated and ready to be delivered to consumers. Finished water is collected before entering the distribution system.

SWQA studies are conducted in two phases, and the objectives of SWQA studies are twofold: (1) to determine the occurrence and, for rivers, seasonal changes in concentrations of a broad list of anthropogenic organic compounds (AOCs) in aquifers and rivers that have some of the largest withdrawals for drinking-water supply (phase 1), and (2) for those AOCs found to occur most frequently in source water, characterize the extent to which these compounds are present in finished water (phase 2). These objectives were met for SWQA studies by collecting ground-water and surface-water (source) samples and analyzing these samples for 258 AOCs during phase 1. Samples from a subset of wells and surface-water sites located in areas with substantial agricultural production in the watershed were analyzed for 19 additional AOCs, for a total of 277 compounds analyzed for SWQA studies. The 277 compounds were classified according to the following 13 primary use or source groups: (1) disinfection by-products; (2) fumigant-related compounds; (3) fungicides; (4) gasoline hydrocarbons, oxygenates, and oxygenate degradates; (5) herbicides and herbicide degradates; (6) insecticides and insecticide degradates; (7) manufacturing additives; (8) organic synthesis compounds; (9) pavement- and combustion-derived compounds; (10) personal care and domestic use products; (11) plant- or animal-derived biochemicals; (12) refrigerants and propellants; and (13) solvents. Source and finished water samples were collected during phase 2 and analyzed for constituents that were detected frequently during phase 1.

This report presents concentration data for AOCs in ground water, surface water, and finished water of CWSs sampled for SWQA studies during 2002–05. Specifically, this report presents the analytical results of samples collected during phase 1 including (1) samples from 221 wells that were analyzed for 258 AOCs; (2) monthly samples from 9 surface-water sites that were analyzed for 258 AOCs during phase 1; and (3) samples from a subset of the wells and surface-water sites located in areas with substantial agricultural production that were analyzed for 3 additional pesticides and 16 pesticide degradates. Samples collected during phase 2 were analyzed for selected AOCs that were detected most frequently in source water during phase 1 sampling; analytical results for phase 2 are presented for (1) samples of source water and finished water from 94 wells; and (2) samples of source water and finished water samples that were collected monthly and during selected flow conditions at 8 surface-water sites. Results of quality-assurance/quality-control samples collected for SWQA studies during 2002–05 also are presented.

Introduction

In 1991, the U.S. Geological Survey (USGS) began the National Water-Quality Assessment (NAWQA) Program to (1) provide a nationally consistent description of current water-quality conditions for the 51 largest and most important aquifers and river basins across the Nation; (2) define long-term trends in water quality; and (3) identify, describe, and explain, as possible, the major factors that affect observed water-quality conditions and trends (Gilliom and others, 1995). This information, which is obtained on a continuing basis, is being made available to water managers, policy makers, and the general public to provide an improved scientific basis for evaluating the effectiveness of water-quality management programs and for predicting the likely effects of contemplated changes in land and water-management practices. The first decade of the Program focused on describing current water-quality conditions.

Beginning in 2001, the Program began its second decade of intensive assessment activities, returning to 42 (14 in 2001, 2004, and 2007, respectively) of the 51 original aquifers and river basins studied, termed Study Units. In addition to providing a description of current water-quality conditions, these studies place increased emphasis on the latter two goals of the Program—trends and understanding. In addition, a new assessment activity during the second decade of NAWQA is **Source Water-Quality Assessments** (SWQAs) that focus on characterizing the quality of source water and finished water of aquifers and major rivers used by some of the larger **community water systems** (CWSs) in the United States. As used in this study, **source water** is the raw (ambient) water collected at the supply well prior to water treatment (for ground water) or the raw (ambient) water collected from the river near the intake (for surface water), and **finished water** is the water that is treated and ready to be delivered to consumers. Finished water is collected before entering the distribution system. Finished water from ground-water supplies may have been blended with water from several ground-water sources, but was not blended with water from any surface-water sources. Finished water from surface-water supplies typically was not blended with any additional surface-water or ground-water sources.

SWQA studies are intended to complement drinking-water monitoring required by Federal, State, and local programs, which focus primarily on post-treatment compliance monitoring. Through SWQA studies, NAWQA is increasing its emphasis on characterizing the water quality of rivers and aquifers that are major sources of drinking water and will allow results from other NAWQA sites to be put into context with the source of water used for water supply. Additionally, the quality of source water for a large number of compounds not regulated in drinking water also will be determined. SWQA studies will continue to collaborate with other agencies and organizations involved with supplying and managing drinking water. To help accomplish this, USGS staff maintain a close working relationship with CWS personnel that are utilizing the source waters investigated.

SWQA studies are conducted in two phases, and the objectives of SWQA studies are twofold: (1) to determine the occurrence and, for rivers, seasonal changes in concentrations of a broad list of anthropogenic organic compounds (AOCs) in aquifers and rivers that have some of the largest withdrawals for drinking-water supply (phase 1), and (2) for those AOCs found to occur most frequently in source water, characterize the extent to which these compounds are present in finished water (phase 2). These objectives were met for SWQA studies by collecting ground-water and surface-water (source) samples and analyzing these samples for anthropogenic organic compounds during phase 1. Source and finished water samples were collected during phase 2 and analyzed for constituents that were detected frequently during phase 1.

During 2002–05, water-quality was monitored for 15 ground-water SWQAs and 9 surface-water SWQAs. The ground-water and surface-water samples collected during phase 1 were analyzed for 258 AOCs. Samples from a subset of wells and surface-water sites located in areas with substantial agricultural production in the watershed also were analyzed for 3 additional pesticides and 16 pesticide degradates for a total of 277 compounds analyzed for SWQA studies. During phase 2, samples of source water and finished water were collected from a subset of the ground-water and surface-water sites. These samples were analyzed for selected AOCs that were detected most frequently or occurred at relatively higher concentrations during phase 1 sampling.

Purpose and Scope

The purpose of this report is to present concentration data for AOCs in ground water, surface water, and finished water of CWSs sampled for SWQA studies during 2002–05. No interpretations of the concentration data are included in this report. Specifically, this report presents the analytical results of samples collected during phase 1 including (1) samples from 221 wells that were analyzed for 258 AOCs; (2) monthly samples from 9 surface-water sites that were analyzed for 258 AOCs; and (3) samples from a subset of the wells and surface-water sites located in areas with substantial agricultural production that were analyzed for 3 additional pesticides and 16 pesticide degradates. Samples collected during phase 2 were analyzed for selected AOCs that were detected most frequently in source water during phase 1 sampling; analytical results for phase 2 are presented for (1) samples of source water and finished water from 94 wells; and (2) samples of source water and finished water samples that were collected monthly and during selected flow conditions at 8 surface-water sites. Results of quality-assurance/quality-control samples collected for SWQA studies during 2002–05 also are presented.

Acknowledgments

The authors thank the many CWS personnel who helped coordinate sample collection and provided permission to sample. Study Unit personnel are thanked for collecting the samples. Jack Barbash, David Bender, and Dana Kolpin are thanked for their help in compiling information for the primary use or source groups for the AOCs.

Study Design

This section of the report describes the criteria used for selection of sampling sites during phases 1 and 2 of the SWQA studies. In addition, sample collection, analytical methods, and quality-assurance activities used to characterize the quality of compounds monitored are described.

Selection of Ground-Water Sites

During 2002–05, water quality from ground-water SWQAs was monitored in 13 NAWQA Study Units with two of these Study Units having two SWQA studies—Georgia-Florida Coastal Plain (GAFL) and Upper Mississippi River Basin (UMIS)—for a total of 15 ground-water SWQAs (fig. 1; table 1). For each ground-water SWQA, about 15 CWS wells were selected for a total of 221 wells sampled during phase 1.

The selection process for CWS wells considered several criteria. The wells selected withdraw water from a **principal aquifer** (table 1), or an area representative of an important regional water-supply aquifer (other aquifer), and ground water represents a substantial portion of drinking water in the area. Additionally, ground water used by the selected CWSs was potentially vulnerable to anthropogenic contamination because of large ground-water withdrawal rates from the aquifer and the proximity of wells to urban areas. Finally, the wells sampled fit into a national network of wells that collectively cover a variety of environmental settings such as agriculture, urban, and mixed.

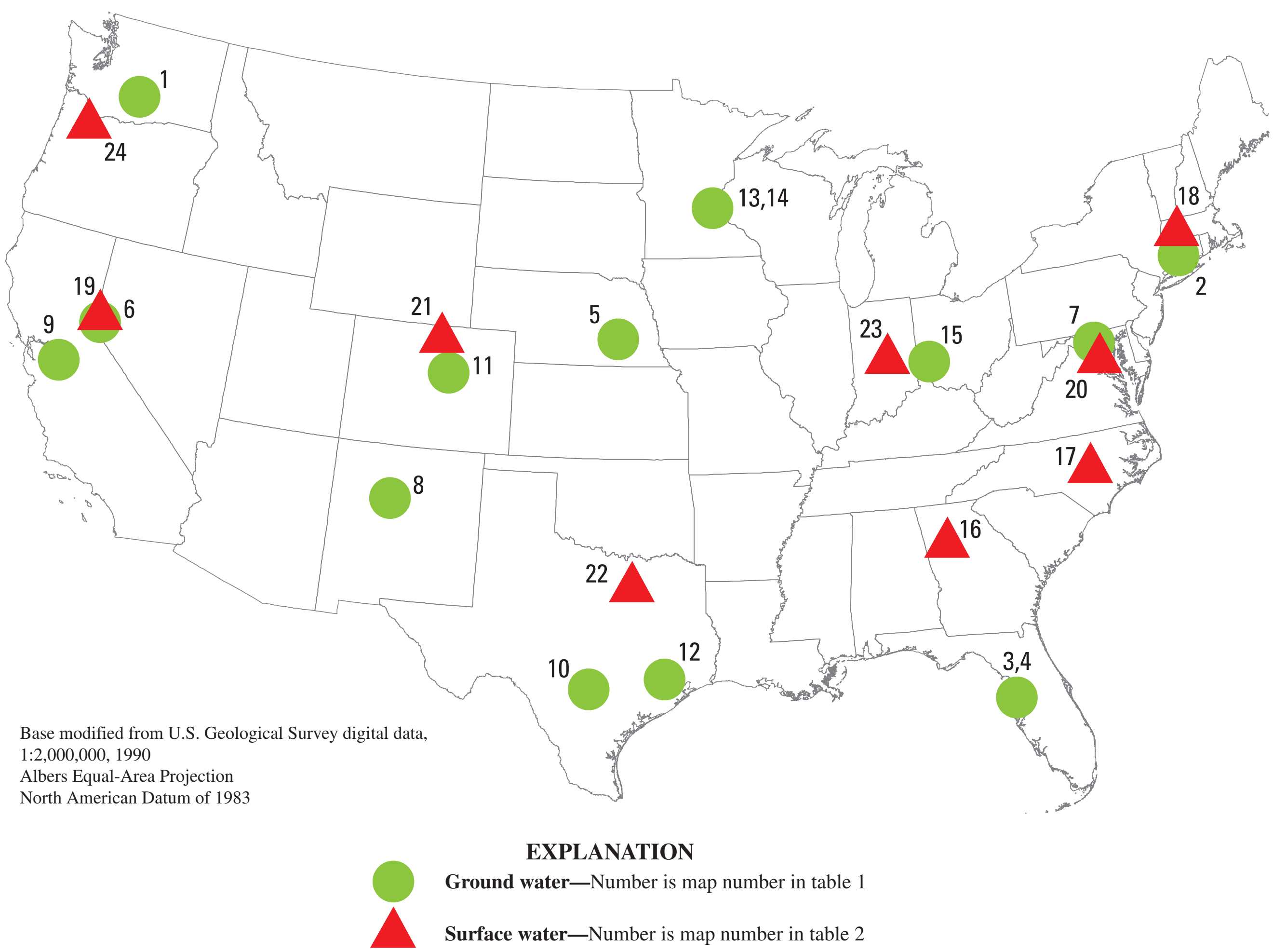

Figure 1. Location of Source Water-Quality Assessment studies for which samples were collected during 2002–05.

Table 1. Principal aquifers sampled for ground-water Source Water-Quality Assessment studies during 2002–05.

Map number (shown on figure 1)	Source Water-Quality Assessment study (Study Unit abbreviation)	Principal aquifer[1]
1	Central Columbia Plateau/Yakima River Basin (CCYK)	Columbia Plateau basin-fill and basaltic-rock aquifers[2].
2	Connecticut, Housatonic, and Thames River Basins (CONN)	Glacial deposits aquifer system.
3	Georgia-Florida Coast Plain (GAFL)	Floridan aquifer system (unconfined unit).
4	Georgia-Florida Coast Plain (GAFL)	Floridan aquifer system (semiconfined unit).
5	High Plains Regional Ground Water Study (HPGW)	High Plains aquifer.
6	Nevada Basin and Range (NVBR)	Basin and Range basin-fill aquifers.
7	Potomac River Basin and Delmarva Peninsula (PODL)	Piedmont and Blue Ridge crystalline-rock aquifers.
8	Rio Grande Valley (RIOG)	Rio Grande aquifer system.
9	San Joaquin-Tulare Basins (SANJ)	Central Valley aquifer system.
10	South-Central Texas (SCTX)	Edwards-Trinity aquifer system.
11	South Platte River Basin (SPLT)	Denver Basin aquifer system.
12	Trinity River Basin (TRIN)	Coastal Lowlands aquifer system.
13	Upper Mississippi River Basin (UMIS)	Glacial deposits aquifer system.
14	Upper Mississippi River Basin (UMIS)	Cambrian-Ordovician aquifer system (Prairie du Chien-Jordan aquifer).
15	White and Great and Little Miami River Basins (WHMI)	Glacial deposits aquifer system.

[1]U.S. Geological Survey, 2003.

[2]Principal aquifer consists of a combination of aquifers.

Within an SWQA study area, the highest producing wells typically were selected for sampling because these wells have the largest contributing areas, which may increase the potential for contamination. Annual production data were used to characterize withdrawals for the CWS wells. In some cases, annual production data for individual wells were not available, so production volume for a well field or pumping center was used. The top quartile of individual CWS wells or pumping centers in a study area was characterized, and 15 CWS wells were randomly selected from those in the top quartile. For areas where the top quartile did not contain enough wells or pumping centers for random selection of 15 to occur, a larger group of wells (for example the upper one-half) was used. Wells sampled were at least 1 kilometer apart to ensure that the contributing areas for wells did not overlap.

In certain aquifer systems, some of the highest-producing CWS wells were located near surface-water bodies, which could result in induced infiltration of surface water to the wells. Efforts were made to avoid selection of CWS wells under the influence of surface water. Similarly, CWS wells in coastal or bay areas with induced infiltration from seawater, and wells used for injection and subsequent withdrawal of artificial recharge also were avoided because water from these types of wells does not represent recharge from the land surface.

Phase 1 sampling activities monitored AOC concentrations in the source water of about 15 CWS wells per SWQA study for a total of 221 CWS wells. Phase 2 sampling was a focused activity that monitored concentrations in samples from a subset of the phase 1 wells for those AOCs found to occur most frequently or at relatively higher concentrations during phase 1. During phase 2, source water and finished water were monitored for 94 of the 221 CWS wells sampled during phase 1. Finished water from 57 of the 94 sites sampled during phase 2 were blended with water from other ground-water wells prior to distribution and sampling, and water from 37 were not blended. Only one set of source-water samples was collected from the Rio Grande Valley (RIOG) SWQA study; thus, phase 1 and phase 2 samples for this study are the same.

Selection of Surface-Water Sites

During 2002–05, water quality from surface-water SWQAs was monitored in nine NAWQA Study Units (fig. 1; table 2). During phase 1, one site was selected for each SWQA and sampled monthly for about 1 year. During phase 2, source water and finished water were sampled for eight of the surface-water SWQAs.

Several criteria were used in selecting a surface-water CWS site for SWQA monitoring. Source-water sites were selected on free-flowing stream reaches rather than on reservoirs to remain consistent with and to be able to compare results with other surface-water sites sampled by the NAWQA Program. In some cases, reservoirs were upstream from the surface-water CWS sites, but the closest reservoir is about 12 river miles upstream from the CWS intake. Additionally, CWSs selected for this study were single-source systems, with little or no blending of other source waters. Land use in the watershed and the type of water treatment used by the CWSs were not considerations in site selection.

The SWQA surface-water sites represent a range in size (table 2) and are fairly well distributed across the United States (fig. 1). Eight of the nine CWSs are categorized as large or very large water systems, meaning that they provide water to more than 10,001 and 100,001 people, respectively (U.S. Environmental Protection Agency, 2006a). One site, Running Gutter Creek, Massachusetts, is a small CWS that serves fewer than 3,300 people.

Table 2. Rivers sampled for surface-water Source Water-Quality Assessment studies during 2002–05.

Map number (shown on figure 1)	Source Water-Quality Assessment study (Study Unit abbreviation)	River	System size[1]
16	Apalachicola-Chattahoochee-Flint River Basins (ACFB)	Chattahoochee River, Georgia	Very large.
17	Albemarle-Pamlico Drainage Basin (ALBE)	Neuse River, North Carolina	Large.
18	Connecticut, Housatonic, and Thames River Basins (CONN)	Running Gutter Creek, Massachusetts	Small.
19	Nevada Basin and Range (NVBR)	Truckee River, Nevada	Very large.
20	Potomac River Basin and Delmarva Peninsula (PODL)	Potomac River, Maryland	Very large.
21	South Platte River Basin (SPLT)[2]	Cache la Poudre River, Colorado	Very large.
22	Trinity River Basin (TRIN)	Elm Fork Trinity River, Texas	Very large.
23	White and Great and Little Miami River Basins (WHMI)	White River, Indiana	Very large.
24	Willamette Basin (WILL)	Clackamas River, Oregon	Large.

[1]System size is defined by U.S. Environmental Protection Agency (2006a) as follows: small, serving fewer than 3,300 people; large, serving between 10,001 and 100,001 people; and very large, serving more than 100,001 people.

[2]No source-water or finished-water samples from this site were collected during phase 2.

Compounds Monitored

The 277 AOCs analyzed for SWQA studies were categorized into the following 13 compound groups on the basis of their primary use or source (table 3): (1) disinfection by-products; (2) fumigant-related compounds; (3) fungicides; (4) gasoline hydrocarbons, oxygenates, and oxygenate degradates, (5) herbicides and herbicide degradates; (6) insecticides and insecticide degradates; (7) manufacturing additives; (8) organic synthesis compounds; (9) pavement- and combustion-derived compounds; (10) personal care and domestic use products; (11) plant- or animal-derived biochemicals; (12) refrigerants and propellants; and (13) solvents. Selected information for the compounds analyzed for SWQA studies is presented in Appendix 1.

Table 3. Primary use or source groups for compounds analyzed for ground-water and surface-water Source Water-Quality Assessment studies.

[BTEX: benzene, toluene, ethylbenzene, and xylenes]

Primary use or source group	Description	Number of compounds in group
Disinfection by-products	Trihalomethanes, (poly) haloacetic acids and other compounds that are produced from the transformation of organic compounds during the disinfection of water and wastewater through chlorination, ozonation, or other chemical methods.	4
Fumigant-related compounds	Chemicals that may be present in commercial fumigant products, which produce a gas, vapor, fumes, or smoke intended to destroy, repel, or control unwanted organisms such as insects, bacteria, or rodents. These include fumigant active ingredients, as well as their degradates and their manufacturing by-products.	9
Fungicides	Pesticides that are used to kill unwanted fungi.	7
Gasoline hydrocarbons, oxygenates, and oxygenate degradates	Gasoline hydrocarbons are straight, branched, and (or) cyclic organic compounds that are highly volatile, contain only carbon and hydrogen atoms, and are common ingredients in gasoline and other petroleum products. Among these compounds, BTEX compounds are among those present in the highest proportions in gasoline. Oxygenates, such as methyl *tert*-butyl ether (MTBE), are compounds that contain only carbon, hydrogen, and oxygen atoms and are commonly added to gasoline to improve the efficiency of combustion. Oxygenate degradates are formed during the production, storage, release, and (or) use of gasoline oxygenates or following their release into the environment.	27
Herbicides and herbicide degradates	Pesticides designed to kill unwanted plants (herbicides) and compounds produced from the transformation of the parent herbicide following application (degradates).	82
Insecticides and insecticide degradates	Pesticides designed to kill unwanted insects (insecticides) and compounds produced from the transformation of the parent insecticide following application (degradates).	51
Manufacturing additives	Compounds used in commercial formulations of chemical products in order to improve the effectiveness of the product, including plasticizers (to increase the flexibility of plastics), fire retardants, corrosion inhibitors, and pesticide adjuvants.	7
Organic synthesis compounds	Chemicals that are used as precursors in the manufacture of other organic compounds. Chloroethylene (vinyl chloride), for example, is an organic synthesis compound used to produce polyvinyl chloride (PVC) plastics.	18
Pavement- and combustion-derived compounds	Organic substances, such as polynuclear aromatic hydrocarbons (PAHs), that are derived from either (1) the materials used to construct and seal parking lots and other paved surfaces, or (2) the combustion of other non-halogenated organic compounds, most commonly gasoline, oil, coal, and other fossil fuels.	5
Personal care and domestic use products	Compounds that are present in commercial products sold for personal or residential use, such as fragrances, pharmaceuticals, insect repellents, dyes, detergents, disinfectants, shampoos, and chemicals used in fire extinguishers.	26
Plant- or animal-derived biochemicals	Naturally occurring compounds that are produced by plants or animals, either through direct biosynthesis or through the metabolic alteration of compounds ingested or taken up from other sources. These compounds are predominantly unsaturated solid alcohols of the steroid group naturally occurring in fatty tissues of plants and animals and present in animal fecal material.	5
Refrigerants and propellants	Volatile compounds that are used for commercial or domestic refrigeration, as blowing agents in the manufacture of packaging and other highly porous materials, or for dispensing other substances from spray cans and other aerosol delivery devices.	3
Solvents	Compounds that are used to dissolve other substances. Two of the more common solvents are trichloroethene (TCE) and tetrachloroethene (perchloroethene, PCE).	33
Total number of compounds		277

Sample Collection and Analytical Methods

Ground-water, surface-water, and quality-control samples were collected using established USGS protocols (Koterba and others, 1995; U.S. Geological Survey, 1997–2006). Ground-water samples were collected at the wellhead before any treatment such as chlorination. Surface-water samples were collected monthly with additional samples collected during selected flow conditions when water quality may change quickly or when large concentrations were likely to occur. These samples were collected at a single depth integrated point as close as practical to the drinking-water intake and processed following standard USGS sampling protocols (U.S. Geological Survey, 1997–2006).

During phase 2, a finished-water sample that corresponded to each ground-water and surface-water source-water sample was collected following all of the treatment steps prior to the water entering the water treatment plants' distribution systems. These samples typically were collected where samples are collected for compliance monitoring. The finished-water samples were collected several hours or as much as 2 days after the source-water samples to try to account for the residence time in the treatment plants. Finished-water samples typically contain free chlorine, which has been documented to degrade certain organic compounds that may be present in the water samples (Munch, 1995). Therefore, a dechlorination reagent (ascorbic acid) and, for certain samples, pH buffers (Trizma) were added to finished-water samples during sample collection to stabilize them prior to analyses. The effect of these dechlorination reagents on the laboratory analysis was evaluated, and results indicated that analytical methodologies were not affected by the addition of these reagents (Mark Sandstrom, U.S. Geological Survey National Water Quality Laboratory, written commun., 2007). Finished-water sample results are not necessarily representative of drinking-water quality at the tap because samples were collected prior to distribution and thus do not account for the additional contact time water has with disinfectants in the distribution system.

Samples were analyzed using five USGS approved analytical methods at the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, and described by Zaugg and others (1995), Lindley and others (1996), Connor and others (1998), Furlong and others (2001), Sandstrom and others (2001), Zaugg and others (2002), and Madsen and others (2003). These methods include both gas chromatography-mass spectrometry (GC/MS) and high performance liquid chromatography-mass spectrometry (HPLC/MS) analytical techniques. Samples collected for volatile organic compound (VOC) analyses using schedules 2020 and 4024 (Appendix 1) were chilled upon collection. Samples collected for analyses using schedule 2020 also were preserved using 1:1 hydrochloric acid. VOC sample sets were analyzed by purge and trap GC/MS (Connor and others, 1998; Rose and Sandstrom, 2003). Samples for analyses of pesticides and other semi-volatile compounds were filtered in the field through a 0.7-micron baked glass fiber filter and chilled. These samples were extracted at the NWQL on solid phase extraction (SPE) cartridges to concentrate the analytes from the filtered samples. SPE cartridges were then eluted with a solvent and the extracts were analyzed by either GC/MS or HPLC/MS methods (Zaugg and others, 1995; Lindley and others, 1996; Furlong and others, 2001; Sandstrom and others, 2001; Zaugg and others, 2002; Madsen and others, 2003). At a subset of sites, an additional sample was collected for the analysis of 3 herbicides and 16 herbicide degradates. These additional samples were analyzed using HPLC/MS by the Organic Geochemistry Research Group Laboratory, in Lawrence, Kansas (Lee and Strahan, 2003).

AOC concentrations detected below the lowest daily standard, and/or for information-rich methods, concentrations detected below the long-term method detection level (LT–MDL), are reported as estimated concentrations (Childress and others, 1999). The laboratory report level (LRL) generally is equal to twice the yearly determined LT–MDL (Childress and others, 1999). The LT–MDL is a detection level derived by determining the standard deviation or a minimum of 24 MDL spike-sample measurements over an extended time. LT–MDL data are collected on a continuous basis to assess year-to-year variations in the LT–MDL. The chance of falsely reporting a concentration at or greater than the LT–MDL for a sample that did not contain the analyte is predicted to be less than or equal to 1 percent (Childress and others, 1999). Also, at low concentrations, especially concentrations less than the LRL, the variability of detection is high, false negatives are more likely, and greater variability in reported concentrations is expected (Martin, 2002). Concentrations greater than the LRL sometimes are reported as estimated concentrations for some AOCs because of the variability in the analytical method, poor recovery, or by loss processes such as water-matrix interferences that result in false-negative errors. Concentrations are censored and reported as less than (<) the LRL when the compound was not detected.

Quality Assurance

Quality-assurance/quality-control samples collected for SWQA studies include equipment blanks, field blanks, source solution blanks, and replicate samples. Equipment blanks evaluate the cleanliness of sampling equipment and typically are collected before the environmental sample is collected. Field blanks are collected near sampling sites and evaluate potential sample contamination from sampling equipment, cleaning procedures, and the atmosphere. Source solution blanks are used to determine the presence or absence of compounds in the water used to clean equipment and process field blanks. The various blank samples also provide information on contamination and (or) concentration loss during shipment. Replicate samples measure the combined precision of sampling and laboratory analyses.

Data from all source-water, finished-water, and quality-control (QC) samples collected by each SWQA study area were reviewed to evaluate potential bias (primarily systematic contamination) and variability associated with sample collection, processing, transportation, and analysis. A review of the QC data along with the associated environmental data is important because the relatively small number of samples collected in each study area generally is not adequate to characterize the full magnitude of potential bias on an individual SWQA basis. A larger data set that covers the entire period of sample collection for SWQA studies provides greater insight to possible systematic errors that bias sample results. These QC reviews were completed on an annual basis. If QC data indicated that results for environmental data were biased as a result of systematic contamination, environmental data were removed from the data set.

Phenol was detected frequently in both field and laboratory blanks and at concentrations comparable to concentrations measured in environmental samples. Phenol was removed from the data set, and no phenol concentrations are included in this report. Studies conducted by the NWQL (Mark Sandstrom, USGS National Water Quality Laboratory, oral commun., 2005) indicated that samples can be contaminated if N,N-diethyl-*meta*-toluamide (DEET) is used by sampling personnel. The frequent detection of DEET in field blanks caused uncertainty in the quality of DEET concentrations in environmental samples; thus, concentrations for DEET were removed for this report by coding concentrations with an “R.” Three compounds—benzophenone, isophorone, and *para*-nonylphenol—were detected frequently in field blanks due to the presence of these compounds in the pH buffer (Trizma) obtained from the vendor. Because the quality of data for benzophenone, isophorone, and *para*-nonylphenol is not fully understood, concentrations for these three compounds also were removed for this report by coding concentrations with an “R.”

For compounds detected in 50 percent or more of an individual Study Unit’s field blank samples, all environmental and quality-control data for that Study Unit were removed for this report by coding concentrations with an “R.” After these concentrations were removed, compounds detected in 5 percent or more of all field blank samples were evaluated, and all detections of those compounds in environmental samples that were less than or equal to the highest blank concentration were censored by coding environmental concentrations with a “C<” in the remark columns and by changing the concentration to the highest blank concentration.

Concentration Data

Concentration data for the AOCs are presented in *Appendix 2* for the ground-water SWQAs and in *Appendix 3* for the surface-water SWQAs. The quality-assurance/quality-control data associated with the ground-water and surface-water SWQAs also are presented in Appendixes 2 and 3, respectively. The concentration data are presented in two formats: (1) Microsoft Excel spreadsheets, and (2) tab-delimited text files. The concentration data are presented by the primary use or source groups as defined in table 3. Concentrations for each of the 13 groups are presented either as a separate worksheet within the Excel spreadsheets, or as individual files for the tab-delimited text files.

Data are presented within each worksheet or text file in a similar order. First, the source-water (ground-water or surface-water) and finished-water samples are presented (sample type: regular), followed by quality-assurance/quality-control samples (sample types: equipment blanks, field blanks, source solution blanks, replicates, and spikes). The sample medium indicates whether the regular sample was of ground water (source water), surface water (source water), or finished water and whether the quality-assurance/quality-control samples were associated with ground water (source water), surface water (source water), or finished water.

The concentrations presented in Appendixes 2 and 3 are not rounded; concentrations are presented as received from the laboratories, with the following exceptions: (1) concentrations for benzophenone, isophorone, DEET, and *para*-nonylphenol (total) were removed by coding concentrations with an “R” in the remark columns; (2) concentrations for phenol are not included; (3) for compounds detected in 50 percent or more of an individual Study Unit’s field blank samples, all environmental and quality-control data for that Study Unit were removed for this report by coding concentrations with an “R;” and after removal of those data, (4) compounds detected in 5 percent or more of all field blank samples were evaluated, and all detections of those compounds in environmental samples that were less than or equal to the highest blank concentration were censored by coding environmental concentrations with a “C<” in the remark columns and by changing the concentration to the highest blank concentration. The remark columns indicate whether a concentration was too low to be quantified (reported as a less than (<) value), censored (C), estimated (E), or removed (R).

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Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Disinfection by-products	
SH2020	Bromodichloromethane	32101	75–27–4	Trihalomethane, organic synthesis, fire extinguishers	Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2020	Bromoform	32104	75–25–2	Trihalomethane, solvent, pharmaceutical manufacturing, organic synthesis, fire extinguishers, heavy liquid for mineral separations, reagent for graphite ore extraction	Bender and others, 1999; Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006; Zogorski and others, 2006.
SH2020	Chloroform	32106	67–66–3	Trihalomethane, fumigant, solvent, anaerobic degradate of carbon tetrachloride, used in synthesis of refrigerants, extractant, chemical intermediate	Egli and others, 1988; Bender and others, 1999; Scorecard, 2006; Zogorski and others, 2006.
SH2020	Dibromochloromethane	32105	124–48–1	Trihalomethane, organic synthesis, chemical intermediate for manufacture of aerosol propellants, refrigerant, pesticides, fire extinguishing agent	Bender and others, 1999; U.S. National Library of Medicine, 2006; Zogorski and others, 2006.
				Fumigant-related compounds	
SH2020	1,2-Dibromo-3-chloropropane (DBCP)	82625	96–12–8	Organic synthesis, nematocide	Budavari, 1989; Zogorski and others, 2006.
SH2020	1,2-Dibromoethane (EDB)	77651	106–93–4	Anti-knock compound in gasoline, former pesticide, solvent, waterproofing preparations, dyes, and pharmaceuticals	Budavari, 1989; National Oceanic and Atmospheric Administration, 2005; Scorecard, 2006; U.S. National Library of Medicine, 2006; Zogoski and others, 2006.
SH2020	1,2-Dichloropropane	34541	78–87–5	Dry-cleaning solvent, chemical intermediate, stain remover	Budavari, 1989, 1996; Tesoriero and others, 2001; Zogorski and others, 2006.
SH2020	1,3-Dichloropropane	77173	142–28–9	Fumigant contaminant	Bender and others, 1999.
SH2020	1,4-Dichlorobenzene (*p*-dichlorobenzene)	34571	106–46–7	Deodorizer, moth killer, manufacture of dyes, chemical intermediate	Bender and others, 1999; Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006.
SH2020	2,2-Dichloropropane	77170	594–20–7	Fumigant contaminant	Cohen and others, 1983; Bender and others, 1999.
SH2020	*cis*-1,3-Dichloropropene	34704	10061–01–5	Solvent, chemical intermediate	Bender and others, 1999; Zogorski and others, 2006.
SH2020	*trans*-1,3-Dichloropropene	34699	10061–02–6	Solvent, chemical intermediate	Bender and others, 1999; Zogorski and others, 2006.
SH2020	Bromomethane (methyl bromide)	34413	74–83–9	Solvent, chemical intermediate	Bender and others, 1999; Zogorski and others, 2006.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Fungicides	
SH2060	Benomyl	50300	17804–35–2	--	Furlong and others, 2001; Wood, 2006.
SH2060	Chlorothalonil	49306	1897–45–6	--	Furlong and others, 2001.
SH2003	Iprodione	61593	36734–19–7	--	Sandstrom and others, 2001; Wood, 2006.
SH2003	Metalaxyl	61596	57837–19–1	--	Furlong and others, 2001; Glassmeyer and others, 2005; Wood, 2006.
SH2003	Myclobutanil	61599	88671–89–0	--	Sandstrom and others, 2001; Wood, 2006.
SH1433	Pentachlorophenol	34459	87–86–5	Wood preservative, herbicide, insecticide, plant growth regulator	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; Wood, 2006.
SH2060	Propiconazole	50471	60207–90–1	--	Furlong and others, 2001; Wood, 2006.
				Gasoline hydrocarbons, oxygenates, and oxygenate degradates	
SH2020	1,2,3,4-Tetramethylbenzene	49999	488–23–3	Petroleum hydrocarbon	Cozzarelli and others, 1994.
SH2020	1,2,3,5-Tetramethylbenzene	50000	527–53–7	Petroleum hydrocarbon	Cozzarelli and others, 1990.
SH2020	1,2,3-Trimethylbenzene	77221	526–73–8	Gasoline hydrocarbon, pesticide adjuvant	Wiedemeier and others, 1996; U.S. Environmental Protection Agency, 2006b.
SH2020	1,2,4-Trimethylbenzene	77222	95–63–6	Petroleum hydrocarbon, pesticide adjuvant, chemical intermediate	Cozzarelli and others, 1990; Wiedemeier and others, 1996; U.S. Environmental Protection Agency, 2006b; U.S. National Library of Medicine, 2006.
SH2020	1,3,5-Trimethylbenzene	77226	108–67–8	Used in synthesis of Ethanox 330, gasoline hydrocarbon	Wiedemeier and others, 1996; U.S. National Library of Medicine, 2006.
SH2020	1-Ethyl-2-methylbenzene	77220	611–14–3	Petroleum hydrocarbon	Cozzarelli and others, 1990; Zogorski and others, 2006.
SH1433	1-Methylnaphthalene	62054	90–12–0	Polynuclear aromatic hydrocarbon, pesticide adjuvant, wall coverings, gasoline and diesel fuel component	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH1433	2,6-Dimethylnaphthalene	62055	581–42–0	Polynuclear aromatic hydrocarbon, diesel fuel component, pesticide adjuvant, insecticide	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH1433	2-Methylnaphthalene	62056	91–57–6	Polynuclear aromatic hydrocarbon, pesticide adjuvant, sealants, adhesives, wall coverings, gasoline and diesel fuel component	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
Gasoline hydrocarbons, oxygenates, and oxygenate degradates—Continued					
SH2020	Benzene	34030	71–43–2	Gasoline hydrocarbon, organic synthesis	Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2020	Diisopropyl ether (DIPE)	81577	108–20–3	Gasoline oxygenate, solvent	Bender and others, 1999.
SH2020	Ethyl *tert*-butyl ether (ETBE)	50004	637–92–3	Gasoline oxygenate	Bender and others, 1999.
SH2020	Ethylbenzene	34371	100–41–4	Gasoline hydrocarbon, organic synthesis, solvent, pesticide adjuvant	Bender and others, 1999; U.S. National Library of Medicine, 2006; U.S. Environmental Protection Agency, 2006b.
SH2020	Isopropylbenzene	77223	98–82–8	Organic synthesis, building materials, solvent, gasoline hydrocarbon, intermediate in production of plastics	Bender and others, 1999; Glassmeyer and others, 2005.
SH2020	*m*- & *p*-Xylene	85795	106–42–3; 108–38–3	Gasoline hydrocarbon, solvent, organic synthesis	U.S. National Library of Medicine, 2006; Zogorski and others, 2006.
SH2020	Methyl *tert*-butyl ether (MTBE)	78032	1634–04–4	Gasoline oxygenate	Bender and others, 1999.
SH2020	Naphthalene	34696	91–20–3	Polynuclear aromatic hydrocarbon, petroleum hydrocarbon, pesticide adjuvant, combustion product, disinfectant, antiseptic, mouthwash, throat lozenges, slimicides, manufacture of synthetic fibers, fumigant, moth repellant	Bender and others, 1999; Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006.
SH2020	*n*-Butylbenzene	77342	104–51–8	Solvent, organic synthesis	Bender and others, 1999; U.S. National Library of Medicine, 2006; Zogorski and others, 2006.
SH2020	*o*-Xylene	77135	95–47–6	Gasoline hydrocarbon, pesticide adjuvant, organic synthesis, solvent	Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2020	*p*-Isopropyltoluene (*p*-cymene)	77356	99–87–6	Organic synthesis, solvent, heat transfer agent, wood office furniture	Bender and others, 1999; Scorecard, 2006; U.S. National Library of Medicine, 2006.
SH2020	*sec*-Butylbenzene	77350	135–98–8	Gasoline hydrocarbon, solvent, organic synthesis, plasticizer	Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2020	Styrene	77128	100–42–5	Organic synthesis, manufacture of styrofoam, building materials, adhesives	Bender and others, 1999; Scorecard, 2006; U.S. National Library of Medicine, 2006; Zogorski and others, 2006
SH4024	*tert*-Amyl alcohol (2-methyl-2-butanol)	77073	75–85–4	Gasoline oxygenate	U.S. Geological Survey, 2007.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Gasoline hydrocarbons, oxygenates, and oxygenate degradates—Continued	
SH2020	*tert*-Amyl methyl ether (TAME)	50005	994–05–8	Gasoline oxygenate	Bender and others, 1999.
SH4024	*tert*-Butyl alcohol	77035	75–65–0	Gasoline oxygenate; methyl *tert*-butyl ether (MTBE) degradate	Pankow and others, 1996; Bradley and others, 2001; U.S. Geological Survey, 2007.
SH2020	*tert*-Butylbenzene	77353	98–06–6	Organic synthesis	Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2020	Toluene	34010	108–88–3	Solvent consumer products, pesticide adjuvant	Bender and others, 1999; U.S. Environmental Protection Agency, 2006b.
				Herbicides and herbicide degradates	
SH2060	2,4–D	39732	94–75–7	--	Furlong and others, 2001.
SH2060	2,4–D methyl ester	50470	1928–38–7	--	Furlong and others, 2001.
SH2060	2,4–DB	38746	94–82–6	--	Furlong and others, 2001.
SH2003	2,6-Diethylaniline	82660	579–66–8	Herbicide (mostly alachlor) degradate	Zaugg and others, 1995; Hladik and others, 2005.
SH2003	2-Chloro-2,6-diethylacetanilide	61618	6967–29–9	Herbicide (mostly alachlor) degradate	Sandstrom and others, 2001; Hladik and others, 2005.
SH2003	2-Ethyl-6-methylaniline	61620	24549–06–2	Herbicide (acetochlor or metolachlor) degradate	Sandstrom and others, 2001; Hladik and others, 2005.
SH2060	2-Hydroxyatrazine	50355	2163–68–0	Herbicide (atrazine) degradate	Furlong and others, 2001.
SH2060	3(4-Chlorophenyl)-1-methyl urea	61692	5352–88–5	Herbicide degradate	Furlong and others, 2001.
SH2003	3,4-Dichloroaniline	61625	95–76–1	Herbicide (diuron) degradate	Sandstrom and others, 2001.
SH2003	4-Chloro-2-methylphenol	61633	1570–64–5	Herbicide (MCPA) degradate	Sandstrom and others, 2001.
SH2003	Acetochlor	49260	34256–82–1	--	Lee and Strahan, 2003.
LCPD	Acetochlor ethane sulfonic acid (ESA)	61029	--	Herbicide (acetochlor) degradate	Lee and Strahan, 2003.
LCPD	Acetochlor oxanilic acid	61030	--	Herbicide (acetochlor) degradate	Lee and Strahan, 2003.
LCPD	Acetochlor sulfynilacetic acid	62847	--	Herbicide (acetochlor) degradate	Lee and Strahan, 2003.
LCPD	Acetochlor/metolachlor ethane sulfonic acide (ESA) 2nd Amide	62850	--	Herbicide (acetochlor or metolachlor) degradate	Lee and Strahan, 2003.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
			Herbicides and herbicide degradates—Continued		
SH2060	Acifluorfen	49315	50594–66–6	--	Furlong and others, 2001.
SH2003	Alachlor	46342	15972–60–8	--	Zaugg and others, 1995.
LCPD	Alachlor ethane sulfonic acid (ESA) 2nd amide	62849	--	Herbicide (alachlor) degradate	Lee and Strahan, 2003.
LCPD	Alachlor ethane sulfonic acid (ESA)	50009	--	Herbicide (alachlor) degradate	Lee and Strahan, 2003.
LCPD	Alachlor oxanilic acid	61031	--	Herbicide (alachlor) degradate	Lee and Strahan, 2003.
LCPD	Alachlor sulfynilacetic acid	62848	140939–16–8	Herbicide (alachlor) degradate	Lee and Strahan, 2003.
SH2003	Atrazine	39632	1912–24–9	--	Zaugg and others, 1995; Glassmeyer and others, 2005.
SH2003	Benfluralin	82673	1861–40–1	--	Zaugg and others, 1995.
SH2060	Bensulfuron-methyl	61693	83055–99–6	--	Furlong and others, 2001.
SH2060	Bentazon	38711	25057–89–0	--	Furlong and others, 2001.
SH2060	Bromacil	04029	314–40–9	--	Furlong and others, 2001; Glassmeyer and others, 2005.
SH2060	Bromoxynil	49311	1689–84–5	--	Furlong and others, 2001.
SH2060	Chloramben, methyl ester	61188	7286–84–2	--	Furlong and others, 2001.
SH2060	Chlorimuron-ethyl	50306	90982–32–4	--	Furlong and others, 2001.
SH2060	Clopyralid	49305	1702–17–6	--	Furlong and others, 2001.
SH2060	Cycloate	04031	1134–23–2	--	Furlong and others, 2001.
SH2003	Dacthal	82682	1861–32–1	--	Zaugg and others, 1995.
SH2060	Dacthal monoacid	49304	887–54–7	Herbicide (dacthal) degradate	Furlong and others, 2001.
SH2003	Deethylatrazine (DEA)	04040	6190–65–4	Herbicide (atrazine) degradate	Zaugg and others, 1995.
SH2060	Deethyldeisopropyl-atrazine (DDA)	04039	3397–62–4	Herbicide (atrazine) degradate	Furlong and others, 2001.
SH2060	Deisopropylatrazine (DIA)	04038	1007–28–9	Herbicide (atrazine) degradate	Furlong and others, 2001.
SH2060	Dicamba	38442	1918–00–9	--	Furlong and others, 2001.
SH2060	Dichlorprop	49302	120–36–5	--	Furlong and others, 2001.
LCPD	Dimethenamid	61588	87674–68–8	--	Lee and Strahan, 2003.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
			Herbicides and herbicide degradates—Continued		
LCPD	Dimethenamid ethane sulfonic acid (ESA)	61951	--	Herbicide (dimethenamid) degradate	Lee and Strahan, 2003.
LCPD	Dimethenamid oxanilic acid	62482	--	Herbicide (dimethenamid) degradate	Lee and Strahan, 2003.
SH2060	Dinoseb	49301	88–85–7	Plant growth regulator	Furlong and others, 2001.
SH2060	Diphenamid	04033	957–51–7	--	Furlong and others, 2001.
SH2060	Diuron	49300	330–54–1	--	Furlong and others, 2001.
SH2060	Fenuron	49297	101–42–8	--	Furlong and others, 2001.
LCPD	Flufenacet	62481	142459–58–3	--	Lee and Strahan, 2003.
LCPD	Flufenacet ethane sulfonic acid (ESA)	61952	--	Herbicide (flufenacet) degradate	Lee and Strahan, 2003.
LCPD	Flufenacet oxanilic acid	62483	--	Herbicide (flufenacet) degradate	Lee and Strahan, 2003.
SH2060	Flumetsulam	61694	98967–40–9	--	Furlong and others, 2001.
SH2060	Fluometuron	38811	2164–17–2	--	Furlong and others, 2001.
SH2003	Hexazinone	04025	51235–04–2	--	Sandstrom and others, 2001.
SH2060	Imazaquin	50356	81335–37–7	--	Furlong and others, 2001.
SH2060	Imazethapyr	50407	81335–77–5	--	Furlong and others, 2001.
SH2060	Linuron	38478	330–55–2	--	Furlong and others, 2001.
SH2060	MCPA	38482	94–74–6	--	Furlong and others, 2001.
SH2060	MCPB	38487	94–81–5	--	Furlong and others, 2001.
SH2003	Metolachlor	39415	51218–45–2	--	Zaugg and others, 1995; Glassmeyer and others, 2005.
LCPD	Metolachlor ethane sulfonic acid (ESA)	61043	--	Herbicide (metolachlor) degradate	Lee and Strahan, 2003.
LCPD	Metolachlor oxanilic acid	61044	--	Herbicide (metolachlor) degradate	Lee and Strahan, 2003.
SH2003	Metribuzin	82630	21087–64–9	--	Zaugg and others, 1995.
SH2060	Metsulfuron methyl	61697	74223–64–6	--	Furlong and others, 2001.
SH2060	Neburon	49294	555–37–3	--	Furlong and others, 2001.
SH2060	Nicosulfuron	50364	111991–09–4	--	Furlong and others, 2001.
SH2060	Norflurazon	49293	27314–13–2	--	Furlong and others, 2001.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
			Herbicides and herbicide degradates—Continued		
SH2060	Oryzalin	49292	19044–88–3	--	Furlong and others, 2001.
SH2003	Pendimethalin	82683	40487–42–1	--	Zaugg and others, 1995.
SH2060	Picloram	49291	1918-02–1	--	Furlong and others, 2001.
SH2003	Prometon	04037	1610–18–0	--	Zaugg and others, 1995; Glassmeyer and others, 2005.
SH2003	Prometryn	04036	7287–19–6	--	Sandstrom and others, 2001.
LCPD	Propachlor	04024	1918–16–7	--	Lee and Strahan, 2003.
LCPD	Propachlor ethane sulfonic acid (ESA)	62766	--	Herbicide (propachlor) degradate	Lee and Strahan, 2003.
LCPD	Propachlor oxanilic acid	62767	--	Herbicide (propachlor) degradate	Lee and Strahan, 2003.
SH2060	Propham	49236	122–42–9	--	Furlong and others, 2001.
SH2003	Propyzamide	82676	23950–58–5	--	Zaugg and others, 1995.
SH2060	Siduron	38548	1982–49–6	--	Furlong and others, 2001.
SH2003	Simazine	04035	122–34–9	--	Zaugg and others, 1995.
SH2060	Sulfometuron-methyl	50337	74222–97–2	--	Furlong and others, 2001.
SH2060	Tebuthiuron	82670	34014–18–1	--	Furlong and others, 2001.
SH2060	Terbacil	04032	5902–51–2	--	Furlong and others, 2001.
SH2003	Terbuthylazine	04022	5915–41–3	--	Sandstrom and others, 2001.
SH2060	Triclopyr	49235	55335–06–3	--	Furlong and others, 2001.
SH2003	Trifluralin	82661	1582–09–8	--	Zaugg and others, 1995.
			Insecticides and insecticide degradates		
SH2003	1-Naphthol	49295	90–15–3	Herbicide (napropamide) and insecticide (carbaryl) degradate	Sandstrom and others, 2001.
SH2060	3-Hydroxycarbofuran	49308	16655–82–6	Insecticide (carbofuran) degradate	Furlong and others, 2001.
SH2060	3-Ketocarbofuran	50295	16709–30–1	Insecticide (carbofuran) degradate	Furlong and others, 2001.
SH2060	Aldicarb	49312	116–06–3	--	Furlong and others, 2001.
SH2060	Aldicarb sulfone	49313	1646–88–4	Insecticide (aldicarb) degradate	Furlong and others, 2001.
SH2060	Aldicarb sulfoxide	49314	1646–87–3	Insecticide (aldicarb) degradate	Furlong and others, 2001.
SH2003	Azinphos-methyl	82686	86–50–0	--	Zaugg and others, 1995.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Insecticides and insecticide degradates—Continued	
SH2003	Azinphos-methyl-oxon	61635	961–22–8	Insecticide (azinphos-methyl) degradate	Sandstrom and others, 2001.
SH2060	Bendiocarb	50299	22781–23–3	--	Furlong and others, 2001.
SH2060	Carbaryl	49310	63–25–2	--	Furlong and others, 2001; Glassmeyer and others, 2005.
SH2060	Carbofuran	49309	1563–66–2	--	Furlong and others, 2001.
SH2003	Chlorpyrifos	38933	2921–88–2	--	Zaugg and others, 1995; Glassmeyer and others, 2005.
SH2003	Chlorpyrifos, oxygen analog	61636	5598–15–2	Insecticide (chlorpyrifos) degradate	Sandstrom and others, 2001.
SH2003	*cis*-Permethrin	82687	54774–45–7	--	Zaugg and others, 1995.
SH2003	Cyfluthrin	61585	68359–37–5	--	Sandstrom and others, 2001.
SH2003	Cypermethrin	61586	52315–07–8	--	Sandstrom and others, 2001.
SH2003	Desulfinylfipronil	62170	--	Insecticide (fipronil) degradate	Madsen and others, 2003.
SH2003	Desulfinylfipronil amide	62169	--	Insecticide (fipronil) degradate	Madsen and others, 2003.
SH2003	Diazinon	39572	333–41–5	--	Zaugg and others, 1995; Sandstrom and others, 2001; Glassmeyer and others, 2005.
SH2003	Diazinon, oxygen analog	61638	962–58–3	Insecticide (diazinon) degradate	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Dichlorvos	38775	62–73–7	--	Zaugg and others, 1995; Sandstrom and others, 2001; Glassmeyer and others, 2005.
SH2003	Dicrotophos	38454	141–66–2	--	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Dieldrin	39381	60–57–1	--	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Dimethoate	82662	60–51–5	--	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Ethion	82346	563–12–2	--	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Ethion monoxon	61644	17356–42–2	Insecticide (ethion) degradate	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Fenamiphos	61591	22224–92–6	--	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Fenamiphos sulfone	61645	31972–44–8	Insecticide (fenamiphos) degradate	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Fenamiphos sulfoxide	61646	31972–43–7	Insecticide (fenamiphos) degradate	Zaugg and others, 1995; Sandstrom and others, 2001.
SH2003	Fipronil	62166	120068–37–3	--	Madsen and others, 2003.
SH2003	Fipronil sulfide	62167	120067–83–6	Insecticide (fipronil) degradate	Madsen and others, 2003.
SH2003	Fipronil sulfone	62168	120068–36–2	Insecticide (fipronil) degradate	Madsen and others, 2003.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
			Insecticides and insecticide degradates—Continued		
SH2003	Fonofos	04095	944–22–9	--	Zaugg and others, 1995.
SH2003	Fonofos, oxygen analog	61649	944–21–8	Insecticide (fonofos) degradate	Sandstrom and others, 2001.
SH2060	Imidacloprid	61695	138261–41–3	--	Furlong and others, 2001.
SH2003	Isofenphos	61594	25311–71–1	--	Sandstrom and others, 2001.
SH2003	Malaoxon	61652	1634–78–2	Insecticide (malathion) degradate	Sandstrom and others, 2001.
SH2003	Malathion	39532	121–75–5	--	Zaugg and others, 1995.
SH2003	Methidathion	61598	950–37–8	--	Sandstrom and others, 2001.
SH2060	Methiocarb	38501	2032–65–7	--	Furlong and others, 2001.
SH2060	Methomyl	49296	16752–77–5	--	Furlong and others, 2001.
SH2060	Oxamyl	38866	23135–22–0	--	Furlong and others, 2001.
SH2003	Paraoxon-methyl	61664	950–35–6	Insecticide (methyl parathion) degradate	Sandstrom and others, 2001.
SH2003	Parathion-methyl	82667	298–00–0	--	Zaugg and others, 1995.
SH2003	Phorate	82664	298–02–2	--	Zaugg and others, 1995.
SH2003	Phorate oxon	61666	2600–69–3	Insecticide (phorate) degradate	Sandstrom and others, 2001.
SH2003	Phosmet	61601	732–11–6	--	Sandstrom and others, 2001.
SH2003	Phosmet oxon	61668	3735–33–9	Insecticide (phosmet) degradate	Sandstrom and others, 2001.
SH2060	Propoxur	38538	114–26–1	--	Furlong and others, 2001.
SH2003	Terbufos	82675	13071–79–9	--	Zaugg and others, 1995.
SH2003	Terbufos-oxygen-analogue sulfone	61674	56070–15–6	Insecticide (terbufos) degradate	Sandstrom and others, 2001.
			Manufacturing additives		
SH1433	5–Methyl-1H-benzotriazole	62063	136–85–6	Corrosion inhibitor in de-icers/antifreeze, anti-fading agent for metals, antiseptic and anticoagulant agent, anti-fog for photography, ultraviolet-absorbers, photoconductor, copying systems, pharmaceuticals, pesticide products and other specialty chemicals, antioxidant	Zaugg and others, 2002; Glassmeyer and others, 2005; Chemicalland21, 2007.
SH1433	Bisphenol A	62069	80–05–7	Used in manufacture of plastic and polycarbonate resins	Zaugg and others, 2002; Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Manufacturing additives—Continued	
SH1433	Tri(2-butoxyethyl)phosphate	62093	78–51–3	Plasticizer, pesticide adjuvant, flame retardant	Zaugg and others, 2002; Glassmeyer and others, 2005; U.S. Environmental Protection Agency, 2006b.
SH1433	Tri(2-chloroethyl)phosphate	62087	115–96–8	Flame retardant, fire resistant cellulose plasticizer	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Tributyl phosphate	62089	126–73–8	Antifoaming agent and flame retardant	Zaugg and others, 2002.
SH1433	Triphenyl phosphate	62092	115–86–6	Plasticizer, flame retardant	Budavari, 1989; Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Tris(dichlorisopropyl) phosphate	62088	13674–87–8	Flame retardant, plasticizer	Zaugg and others, 2002; Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006.
				Organic synthesis compounds	
SH2020	1,1-Dichloropropene	77168	563–58–6	Solvent (pharmaceuticals)	Bender and others, 1999; Scorecard, 2006.
SH2020	1,2,3-Trichlorobenzene	77613	87–61–6	Termiticide, solvent	Budavari, 1989, 1996; Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2020	1,2,3-Trichloropropane	77443	96–18–4	Fumigant contaminant, paint and varnish remover	Agency for Toxic Substances and Disease Registry, 1992a; Tesoriero and others, 2001.
SH2020	3-Chloro-1-propene	78109	107–05–1	Fumigant contaminant	Cohen and others, 1983; U.S. National Library of Medicine, 2006.
SH2020	Acrylonitrile	34215	107–13–1	Fumigant, pesticide	Bender and others, 1999; Scorecard, 2006.
SH1433	Anthraquinone	62066	84–65–1	Bird repellant, serves as the basis for the production of a large number of acid and base dyes, vat dyes, disperse dyes, and reactive dyes additive in the soda and kraft chemical alkaline pulping processes in the paper pulping industry	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. National Library of Medicine, 2006.
SH1433	Carbazole	62071	86–74–8	Synthesis of dyes, combustion product	Budavari, 1989; Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006.
SH2020	Carbon disulfide	77041	75–15–0	Solvent, syntheses, fumigant, sulfate-reduction product	Budavari, 1989; Megonigal and others, 2004; Scorecard, 2006.
SH2020	Chloromethane	34418	74–87–3	Blowing agent/propellant, solvent, refrigerant	Budavari, 1989; U.S. National Library of Medicine, 2006.
SH2020	Ethyl methacrylate (ethyl 2-methyl-2-propanoate)	73570	97–63–2	Hairspray, used to make polymers, chemical intermediate	Scorecard, 2006; U.S. National Library of Medicine, 2006.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Organic synthesis compounds—Continued	
SH2020	Hexachlorobutadiene	39702	87–68–3	Used in rubber manufacture, solvent, pesticide (non-U.S.)	Bender and others, 1999; California Environmental Protection Agency, 1999.
SH2020	Iodomethane	77424	74–88–4	Microscopy, circuit board manufacture, fire extinguishers, proposed fumigant	Budavari, 1989; U.S. Environmental Protection Agency, 2006c.
SH2020	Methyl acrylate (methyl-2-propenoate)	49991	96–33–3	Manufacture of resins, paper, plastic	Budavari, 1989; U.S. National Library of Medicine, 2006.
SH2020	Methyl acrylonitrile (2-methyl-2-propenenitrile)	81593	126–98–7	Organic synthesis, polymer manufacture, chemical intermediate	Budavari, 1989; United Nations Environmental Programme, 2002; U.S. National Library of Medicine, 2006.
SH2020	Methyl methacrylate (methyl 2-methyl-2-propenoate)	81597	80–62–6	Manufacture of paint, paper, acrylic, chemical intermediate, pesticide adjuvant	U.S. National Library of Medicine, 2006; U.S. Environmental Protection Agency, 2006b; Spectrum Laboratories Inc., 2007.
SH2020	*trans*-1,4-Dichloro-2-butene	73547	110–57–6	Chemical intermediate	U.S. National Library of Medicine, 2006.
SH2020	Vinyl bromide	50002	593–60–2	Plastic manufacture, 1,2-dibromoethane degradate, flame retardant	Barbash and Reinhard, 1989; Bender and others, 1999.
SH2020	Vinyl chloride	39175	75–01–4	Polyvinyl chloride (PVC) manufacture, refrigerant, degradate of 1,2-dichloroethane (aerobic) and dichloroethylene (anaerobic)	Vogel and McCarty, 1985; Barbash and Reinhard, 1989; Bender and others, 1999.
				Pavement- and combustion-derived compounds	
SH1433	Anthracene	34221	120–12–7	Polynuclear aromatic hydrocarbon, used in dye production and production of plastic fibers, organic synthesis (anthraquinone), wood preservative	Lee and Strahan, 2003; Glassmeyer and others, 2005.
SH1433	Benzo[a]pyrene	34248	50–32–8	Polynuclear aromatic hydrocarbon, cancer research chemical	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Fluoranthene	34377	206–44–0	Polynuclear aromatic hydrocarbon, used on inside lining on iron water pipes and tanks, production of fluorescent dyes and pharmaceuticals, component of coal tar and asphalt	Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Pavement- and combustion-derived compounds—Continued	
SH1433	Phenanthrene	34462	85–01–8	Polynuclear aromatic hydrocarbon, manufacture of dyes, explosives, and drugs, used in research	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Pyrene	34470	129–00–0	Polynuclear aromatic hydrocarbon, used to synthesize benzo[a]pyrene, used as a starting material in the production of optical brighteners and dyes, research chemical, component of coal tar and asphalt	Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006.
				Personal care and domestic use products	
SH1433	3-*tert*-Butyl-4-hydroxy anisole (BHA)	62059	25013–16–5	Antioxidant, preservative, food packaging, and rubber and petroleum products	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	4-Cumylphenol	62060	599–64–4	Nonionic detergent metabolite	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	4-*n*-Octylphenol	62061	1806–26–4	Nonionic detergent metabolite	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	4-*tert*-Octylphenol	62062	140–66–9	Nonionic detergent metabolite	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Acetophenone	62064	98–86–2	Fragrance, flavorant, solvent for paint and varnish removal, plastics and resins	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. National Library of Medicine, 2006.
SH1433	Acetyl hexamethyl tetrahydronaphthalene (AHTN)	62065	21145–77–7	Widely used musk fragrance	Zaugg and others, 2002.
SH1433	Benzophenone	62067	119–61–9	Fixative in perfumes and soaps, hair mousse, inks, organic synthesis	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. National Library of Medicine, 2006.
SH2020	Bromochloromethane	77297	74–97–5	Fire extinguishing fluid, intermediate in pesticide manufacturing	Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2060	Caffeine	50305	58–08–2	Beverage ingredient, diuretic	Furlong and others, 2001; Glassmeyer and others, 2005.
SH1433	Camphor	62070	76–22–2	Flavorant and odorant, used in manufacture of plastics, as plasticizer for cellulose esters and ethers, in lacquers and varnishes, in explosives, in pyrotechnics, in embalming fluid, in manufacture of cymene, in camphorated parachlorophenol, paregoric, and flexible collodion	Budavari, 1989; Zaugg and others, 2002; U.S. National Library of Medicine, 2004; Glassmeyer and others, 2005.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
			Personal care and domestic use products—Continued		
SH1433	Cotinine	62005	486–56–6	Primary nicotine metabolite, nonprescription drug	Kolpin and others, 2002; Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	*d*-Limonene	62073	5989–27–5	Antimicrobial, fragrance	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Hexadydrohexamethyl-cyclopentabenzopyran (HHCB)	62075	1222–05–5	Widely used musk fragrance	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Indole	62076	120–72–9	Pesticide adjuvant, coffee ingredient, fragrance	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH1433	Isoborneol	62077	124–76–5	Flavorant, fragrance, disinfection ingredient	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. National Library of Medicine, 2006.
SH1433	Isoquinoline	62079	119–65–3	Flavors and fragrances	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Menthol (5-methyl-2-[1-methylethyl] cyclohexanol)	62080	89–78–1	Cigarettes, cough drops, linament, mouthwash	Zaugg and others, 2002.
SH1433	Methyl salicylate	62081	119–36–8	Analgesic, decongestant, toilet and window cleaner	Kolpin and others, 2002; Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006.
SH1433	N,N-diethyl-*meta*-toluamide (DEET)	62082	134–62–3	Insect repellent	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Nonylphenol diethoxy-late (total) (NP2EO)	62083	26027–38–2	Nonionic detergent metabolite	Zaugg and others, 2002.
SH1433	Octylphenol diethoxylate (total) (OP2EO)	61705	26636–32–8	Nonionic detergent metabolite	Zaugg and others, 2002.
SH1433	Octylphenol monoethoxylate (total) (OP1EO)	61706	26636–32–8	Nonionic detergent metabolite	Zaugg and others, 2002.
SH1433	*para*-Nonylphenol, total (mixture of isomers)	62085	84852–15–3	Surfactant intermediate	Zaugg and others, 2002; CambridgeSoft Corporation, 2004; Glassmeyer and others, 2005.
SH1433	Phenol	34466	108–95–2	Disinfectant	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Triclosan	62090	3380–34–5	Antimicrobial, preservative for cosmetics and detergents preparations	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Triethyl citrate	62091	77–93–0	Cosmetics, pharmaceuticals, plasticizer	Zaugg and others, 2002; Glassmeyer and others, 2005; U.S. National Library of Medicine, 2006.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Plant- or animal-derived biochemicals	
SH1433	3-*beta*-Coprostanol	62057	360–68–9	Fecal indicator (carnivores)	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	3-Methyl-1(H)-indole (Skatole)	62058	83–34–1	In animal waste, stench in feces, in coal tar	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	*beta*-Sitosterol	62068	83–46–5	Plant sterol	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	*beta*-Stigmastanol	62086	19466–47–8	Plant sterol	Zaugg and others, 2002; Glassmeyer and others, 2005.
SH1433	Cholesterol	62072	57–88–5	Fecal indicator, plant sterol	Zaugg and others, 2002; Glassmeyer and others, 2005.
				Refrigerants and propellants	
SH2020	1,1,2-Trichloro-1,2,2-trifluoroethane (CFC–113)	77652	76–13–1	Electroplating, degreasing, adhesives, textiles, pesticide adjuvant	Bender and others, 1999; CambridgeSoft Corporation, 2004; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH2020	Dichlorodifluoromethane (CFC–12)	34668	75–71–8	Insulation, inhalers, insecticide, pesticide adjuvant	Bender and others, 1999; CambridgeSoft Corporation, 2004; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH2020	Trichlorofluoromethane (CFC–11)	34488	75–69–4	Hairspray, inhalers, insecticide, pesticide adjuvant	Bender and others, 1999; CambridgeSoft Corporation, 2004; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
				Solvents	
SH2020	1,1,1,2-Tetrachloroethane	77562	630–20–6	Solvent for varnish	Bender and others, 1999; Scorecard, 2006.
SH2020	1,1,1-Trichloroethane	34506	71–55–6	Electronics, pharmaceutical manufacture, degreaser; pesticide adjuvant, fumigant	Bender and others, 1999; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH2020	1,1,2,2-Tetrachloroethane	34516	79–34–5	Manufacture of solvents, insecticide, pesticide adjuvant	Bender and others, 1999; Scorecard, 2006; U.S Environmental Protection Agency, 2006b.
SH2020	1,1,2-Trichloroethane	34511	79–00–5	Aerosol paints, manufacture solvent	Bender and others, 1999; Scorecard, 2006.
SH2020	1,1-Dichloroethane	34496	75–34–3	Lubricant, cleaner; anaerobic 1,1,1-trichloroethane degradate	Klecka and others, 1990; Bender and others, 1999; Scorecard, 2006.
SH2020	1,1-Dichloroethene	34501	75–35–4	1,1,1-trichloroethane degradate (aerobic); pharm solvent	Haag and Mill, 1988; Bender and others, 1999; Scorecard, 2006.
SH2020	1,2,4-Trichlorobenzene	34551	120–82–1	Manufacture of solvents; insecticide	Bender and others, 1999; Scorecard, 2006.
SH2020	1,2-Dichlorobenzene (*o*-dichlorobenzene)	34536	95–50–1	Disinfectant, deodorant, consumer solvent	Bender and others, 1999; Scorecard, 2006.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Solvents—Continued	
SH2020	1,2-Dichloroethane (ethylene dichloride)	32103	107–06–2	Fumigant, manufacture of solvents, anti-knock compound in gasoline	Bender and others, 1999; National Oceanic and Atmospheric Administration, 2005; Scorecard, 2006.
SH2020	1,3-Dichlorobenzene (*m*-dichlorobenzene)	34566	541–73–1	Organic synthesis, fumigant	Bender and others, 1999.
SH2020	2-Chlorotoluene	77275	95–49–8	Pesticide adjuvant	Bender and others, 1999; U.S. Environmental Protection Agency, 2006b.
SH2020	2-Hexanone	77103	591–78–6	Organic synthesis	Agency for Toxic Substances and Disease Registry, 1992b; Spectrum Laboratories Inc., 2007.
SH2020	4-Chlorotoluene	77277	106–43–4	Pesticide adjuvant	Bender and others, 1999; U.S. Environmental Protection Agency, 2006b.
SH2020	Acetone (2-propanone)	81552	67–64–1	Organic synthesis, chemical intermediate, pesticide adjuvant	Budavari, 1989; U.S. Environmental Protection Agency, 2006b.
SH2020	Bromobenzene	81555	108–86–1	Organic synthesis, additive to oil	Bender and others, 1999; U.S. National Library of Medicine, 2006.
SH2020	Carbon tetrachloride	32102	56–23–5	Fumigant, solvent	Bender and others, 1999; Scorecard, 2006.
SH2020	Chlorobenzene	34301	108–90–7	Disinfectant, herbicide, building materials, solvent	Budavari, 1989; Bender and others, 1999; Scorecard, 2006.
SH2020	Chloroethane	34311	75–00–3	Refrigerant, anaerobic degradation of 1,1,1-trichloroethane and 1,1-dichloroethane, manufacture of tetraethyl lead	Klecka and others, 1990; Bender and others, 1999; Lorah and Olsen, 1999.
SH2020	*cis*-1,2-Dichloroethene	77093	156–59–2	Trichloroethene degradate (anaerobic)	Bender and others, 1999; Lorah and Olsen, 1999.
SH2020	Dibromomethane	30217	74–95–3	Organic synthesis (pesticide manufacture), heavy liquid for mineral separations, fire extinguishers	Bender and others, 1999.
SH2020	Diethyl ether (1,1'-oxybisethane)	81576	60–29–7	Detergent, solvent, pharmaceuticals, cosmetics	Budavari, 1989; Scorecard, 2006.
SH2020	Hexachloroethane	34396	67–72–1	Lubricant, dry cleaning solvent	Budavari, 1989; Scorecard, 2006.
SH1433	Isophorone	34409	78–59–1	Herbicide, adjuvant, solvent	Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b; U.S. National Library of Medicine, 2006.
SH4024	Methyl acetate	77032	79–20–9	Aerosol paints	Scorecard, 2006.

Appendix 1. Compounds analyzed in Source Water-Quality Assessment studies by primary use or source groups.—Continued

[USGS, U.S. Geological Survey; CASRN, Chemical Abstracts Service Registry Number; --, no additional information]

USGS analytical schedule	Compound name	Parameter code	CASRN	Secondary uses or sources	References for use and source information
				Solvents—Continued	
SH2020	Methyl ethyl ketone (MEK)	81595	78–93–3	Adjuvant, solvent, cleaners, polyvinyl chloride (PVC) glue and primer	Bender and others, 1999; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH2020	Methyl isobutyl ketone (MIBK) (4-methyl-2-pentanone)	78133	108–10–1	Solvent, personal care products, insecticide, pesticide adjuvant, polyvinyl chloride (PVC) glue	Budavari, 1989; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH2020	Methylene chloride	34423	75–09–2	Solvent, personal care products, insecticide, rodenticide, fumigant, dog repellent, anaerobic degradation of carbon tetrachloride, polyvinyl chloride (PVC) glue substitute	Egli and others, 1988; Bender and others, 1999; Scorecard, 2006.
SH2020	*n*-Propylbenzene	77224	103–65–1	Insulation, flooring manufacture	Bender and others, 1999; Scorecard, 2006.
SH1433	*p*-Cresol	62084	106–44–5	Paint/varnish removal, solvent, disinfectant, chemical intermediate for synthetic resins	Budavari, 1989; Zaugg and others, 2002; Glassmeyer and others, 2005; Scorecard, 2006.
SH2020	Perchloroethene (PCE) (tetrachloroethene)	34475	127–18–4	Fumigant, solvent	Bender and others, 1999; Glassmeyer and others, 2005; Scorecard, 2006.
SH2020	Tetrahydrofuran (1,4-epoxybutane)	81607	109–99–9	Adjuvant, cleaners, solvent, polyvinyl chloride (PVC) glue and primer	Budavari, 1989; Scorecard, 2006; U.S. Environmental Protection Agency, 2006b.
SH2020	*trans*-1,2-Dichloroethene	34546	156–60–5	Trichloroethene degradate	Bender and others, 1999; Lorah and Olsen, 1999.
SH2020	Trichloroethene (TCE)	39180	79–01–6	Fumigant, solvent, anaerobic perchloroethene degradate	Vogel and McCarty, 1985; Bender and others, 1999; Scorecard, 2006.

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