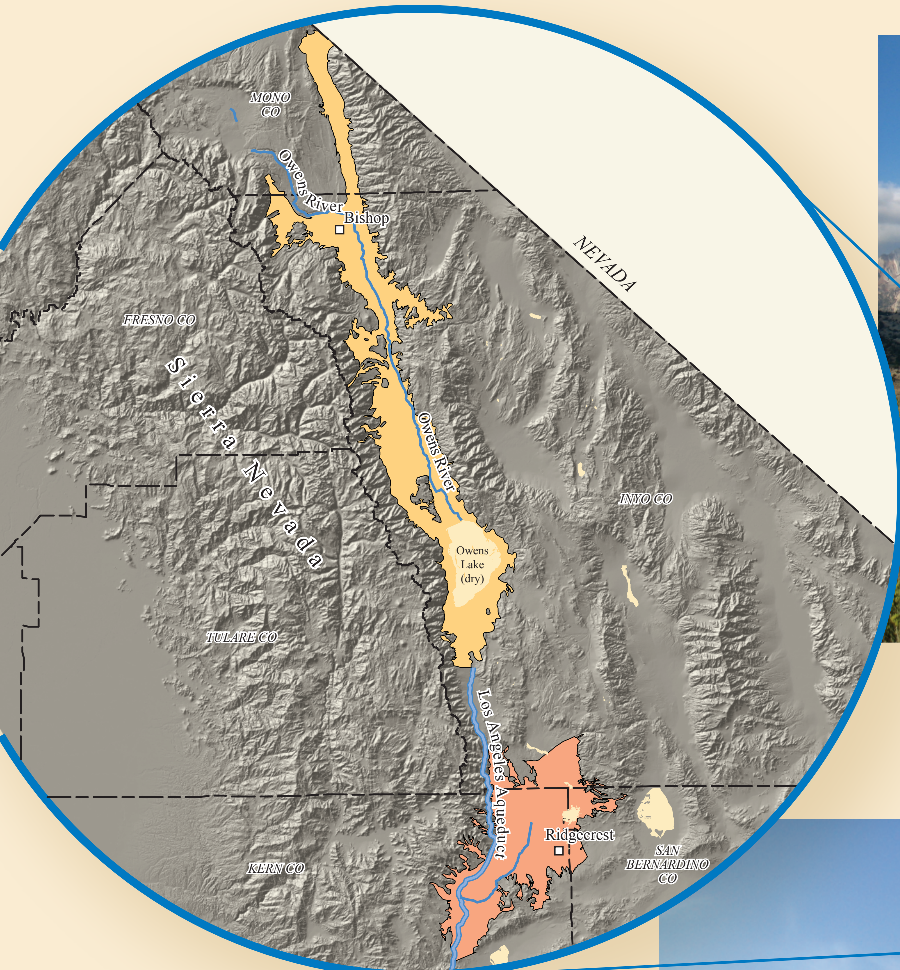
Prepared in cooperation with the California State Water Resources Control Board
A product of the California Groundwater Ambient Monitoring and Assessment (GAMA) Program

Ground-Water Quality Data in the Owens and Indian Wells Valleys Study Unit, 2006: Results from the California GAMA Program



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Top: Owens Valley, California, 2006. (Photograph taken by Cathy Munday, U.S. Geological Survey.)
Bottom: Observation well, Alabama Hills near Lone Pine , California, 2006. (Photograph taken by Michael Wright, U.S. Geological Survey.)

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By Jill N. Densmore, Miranda S. Fram, and Kenneth Belitz

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U.S. Department of the Interior
KEN SALAZAR, Secretary

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Suggested citation:
Densmore, J.N., Fram, M.S., and Belitz, Kenneth, 2009, Ground-water quality data in the Owens and Indian Wells Valleys study unit, 2006: Results from the California GAMA program: U.S. Geological Survey Data Series 427, 86 p. Available at *http://pubs.usgs.gov/ds/427*

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Abbreviations and Acronyms

(Additional information or clarification given in parentheses)

AB	Assembly Bill (California State Assembly)
AL-US	Action level (USEPA)
CAS	Chemical Abstract Service (American Chemical Society)
CSU	combined standard uncertainty
E	estimated or having a higher degree of uncertainty
GAMA	Groundwater Ambient Monitoring and Assessment program
GPS	Global Positioning System
HAL-US	Lifetime Health Advisory Level (USEPA)
HPLC	high-performance liquid chromatography
LRL	laboratory reporting level
LSD	land-surface datum
LT-MDL	long-term method detection level
MCL-US	maximum contaminant level (USEPA)
MCL-CA	maximum contaminant level (CDPH)
MDL	method detection limit
MRL	minimum reporting level
MU	method uncertainty
N	Normal
na	not available
nc	sample not collected
NL-CA	California notification level (CDPH)
NRP	National Research Program (USGS)
NWIS	National Water Information System (USGS)
OIW	OWENS Study Unit: Indian Wells Valley study area
OV	OWENS Study Unit: Owens Valley study area
PCFF-GAMA	portable computer field forms program designed for GAMA sampling
QC	quality control
RPD	relative percent difference
RSD	relative standard deviation
RSD5-US	risk-specific dose at 10^{-5} (USEPA)
SMCL-CA	secondary maximum contaminant level (CDPH)
SMCL-US	secondary maximum contaminant level (USEPA)
TT-US	treatment technique (USEPA)
US	United States
V	analyte detected in sample and an associated blank thus data are not included in ground-water quality assessment
VPDB	Vienna Pee Dee Belemnite
VSMOW	Vienna Standard Mean Ocean Water

Organizations

CDPH	California Department of Public Health
CDWR	California Department of Water Resources
USEPA	U.S. Environmental Protection Agency
LLNL	Lawrence Livermore National Laboratory
MWH	Montgomery Watson Harza
NAWQA	National Water Quality Assessment (USGS)
NWQL	National Water Quality Laboratory
SWRCB	State Water Resources Control Board
USGS	U.S. Geological Survey

Chemical Names

DO	dissolved oxygen
DOC	dissolved organic carbon
HCl	hydrochloric acid
MTBE	methyl *tert*-butyl ether
NDMA	*N*-nitrosodimethylamine
PCE	tetrachloroethene
SC	specific conductance
TCE	trichloroethene
1,2,3-TCP	trichloropropane
TDS	total dissolved solids
VOC	volatile organic compound

Units of Measure

cm^3 STP g^{-1}	cubic centimeters at standard temperature and pressure (0 degrees Celsius and 1 atmosphere of pressure)
L	liter
mg	milligram
mg/L	milligrams per liter
mi	mile
mL	milliliter
µg/L	micrograms per liter (parts per billion)
µm	micrometer
pCi/L	picocurie per liter
permil	parts per thousand
$\delta^{i}E$	delta notation, the ratio of a heavier isotope of an element (^{i}E) to the more common lighter isotope of that element, relative to a standard reference material, expressed in per mil
pmc	percent modern carbon

Notes

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L). Milligrams per liter is equivalent to parts per million (ppm) and micrograms per liter is equivalent to parts per billion (ppb).

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Ground-Water Quality Data in the Owens and Indian Wells Valleys Study Unit, 2006: Results from the California GAMA Program

By Jill N. Densmore, Miranda S. Fram, and Kenneth Belitz

Abstract

Ground-water quality in the approximately 1,630 square-mile Owens and Indian Wells Valleys study unit (OWENS) was investigated in September—December 2006 as part of the Priority Basin Project of Groundwater Ambient Monitoring and Assessment (GAMA) Program. The GAMA Priority Basin Project was developed in response to the Groundwater Quality Monitoring Act of 2001 and is being conducted by the U.S. Geological Survey (USGS) in collaboration with the California State Water Resources Control Board (SWRCB).

The Owens and Indian Wells Valleys study was designed to provide a spatially unbiased assessment of raw ground-water quality within OWENS study unit, as well as a statistically consistent basis for comparing water quality throughout California. Samples were collected from 74 wells in Inyo, Kern, Mono, and San Bernardino Counties. Fifty-three of the wells were selected using a spatially distributed, randomized grid-based method to provide statistical representation of the study area (grid wells), and 21 wells were selected to evaluate changes in water chemistry in areas of interest (understanding wells).

The ground-water samples were analyzed for a large number of synthetic organic constituents [volatile organic compounds (VOCs), pesticides and pesticide degradates, pharmaceutical compounds, and potential wastewater-indicator compounds], constituents of special interest [perchlorate, *N*-nitrosodimethylamine (NDMA), and 1,2,3-trichloropropane (1,2,3-TCP)], naturally occurring inorganic constituents [nutrients, major and minor ions, and trace elements], radioactive constituents, and microbial indicators. Naturally occurring isotopes [tritium, and carbon-14, and stable isotopes of hydrogen and oxygen in water], and dissolved noble gases also were measured to help identify the source and age of the sampled ground water.

This study evaluated the quality of raw ground water in the aquifer in the OWENS study unit and did not attempt to evaluate the quality of treated water delivered to consumers. Water supplied to consumers typically is treated after withdrawal from the ground, disinfected, and blended with other waters to maintain acceptable water quality. Regulatory thresholds apply to treated water that is served to the consumer, not to raw ground water. However, to provide some context for the results, concentrations of constituents measured in the raw ground water were compared with regulatory and non-regulatory health-based thresholds established by the U.S. Environmental Protection Agency (USEPA) and California Department of Public Health (CDPH) and non-regulatory thresholds established for aesthetic concerns (secondary maximum contamination levels, SMCL-CA) by CDPH.

VOCs and pesticides were detected in samples from less than one-third of the grid wells; all detections were below health-based thresholds, and most were less than one-one hundredth of threshold values. All detections of perchlorate and nutrients in samples from OWENS were below health-based thresholds.

Most detections of trace elements in ground-water samples from OWENS wells were below health-based thresholds. In samples from the 53 grid wells, three constituents were detected at concentrations above USEPA maximum contaminant levels: arsenic in five samples, uranium in four samples, and fluoride in one sample. Two constituents were detected at concentrations above CDPH notification levels (boron in nine samples and vanadium in one sample), and two were above USEPA lifetime health advisory levels (molybdenum in three samples and strontium in one sample). Most of the samples from OWENS wells had concentrations of major elements, TDS, and trace elements below the non-enforceable standards set for aesthetic concerns. Samples from nine grid wells had concentrations of manganese, iron, or TDS above the SMCL-CAs.

Introduction

Ground water comprises nearly half of the water used for public supply in California (Hutson and others, 2004). To assess the quality of ground water in aquifers used for drinking-water supply and establish a program for monitoring trends in ground-water quality, the California State Water Resource Control Board (SWRCB), in collaboration with the U.S. Geological Survey (USGS) and Lawrence Livermore National Laboratory (LLNL), implemented a statewide Groundwater Ambient Monitoring and Assessment (GAMA) Program (*http://www.waterboards.ca.gov/gama*). The GAMA program consists of three projects: Priority Basin Project, conducted by the USGS (*http://ca.water.usgs.gov/gama/*); Voluntary Domestic Well Assessment, conducted by the SWRCB; and Special Studies, conducted by LLNL.

The SWRCB initiated the GAMA program in response to the Ground-Water Quality Monitoring Act of 2001 (Sections 10780-10782.3 of the California Water Code, Assembly Bill 599). AB 599 is a public mandate to assess and monitor the quality of ground water used as public supply for municipalities in California. The project is a comprehensive assessment of statewide ground-water quality designed to help better understand and identify risks to ground-water resources and to increase the availability of information about ground-water quality to the public. As part of the AB 599 process, the USGS, in collaboration with the SWRCB, developed the monitoring plan for the project (Belitz and others, 2003; State Water Resources Control Board, 2003). A key aspect of the project is interagency collaboration and cooperation with local water agencies and well owners. Local participation in the project is entirely voluntary.

The GAMA Priority Basin Project is unique because the data collected during the study include analyses for an extensive number of chemical constituents at very low concentrations, analyses that normally are not available. A broader understanding of ground-water composition will be especially useful for providing an early indication of changes in water quality and for identifying the natural and human factors affecting water quality. Additionally, the GAMA Priority Basin Project will analyze a broader suite of constituents than required by the California Department of Public Health (CDPH). An understanding of the occurrence and distribution of these constituents is important for the long-term management and protection of ground-water resources.

Hydrologic, geologic, and climatic conditions that exist in California must be considered in an assessment of ground-water quality. Belitz and others (2003) partitioned the state into 10 hydrogeologic provinces, each with distinctive hydrologic, geologic, and climatic characteristics (*fig. 1*), and representative regions in all 10 provinces were included in the project design. Eighty percent of California's approximately 16,000 public-supply wells are located in ground-water basins within these hydrologic provinces. These ground-water basins, defined by the California Department of Water Resources, generally consist of relatively permeable, unconsolidated deposits of alluvial or volcanic origin (California Department of Water Resources, 2003). Ground-water basins were prioritized for sampling on the basis of the number of public-supply wells in the basin with secondary consideration given to municipal ground-water use, agricultural pumping, the number of leaking underground fuel tanks, and pesticide applications within the basins (Belitz and others, 2003). Some adjacent ground-water basins with similar characteristics, but with relatively few public-supply wells were combined and assigned high priority so that all of the hydrogeologic provinces would be represented in the subset of basins sampled. The 116 priority basins were grouped into 35 study units. Some areas not in the defined ground-water basins were included in several of the study units to achieve representation of the 20 percent of public-supply wells not located in the ground-water basins.

Three types of water-quality assessments are being conducted with the data collected in each study unit: (1) Status: assessment of the current quality of the ground-water resource, (2) Trends: detection of changes in ground-water quality, and (3) Understanding: identification of the natural and human factors affecting ground-water quality (Kulongoski and Belitz, 2004). This report is one of a series of reports presenting status of current water-quality conditions in each study unit (Wright and others, 2005; Bennett and others, 2006; Kulongoski and others, 2006; Fram and Belitz, 2007; Kulongoski and Belitz, 2007; Dawson and others, 2008; Ferrari and others, 2008; Landon and Belitz, 2008; Shelton and others, 2008; Schmitt and others, 2008; Mathany and others, 2008). Subsequent reports will address the trends and understanding aspects of the water-quality assessments.

The Owens and Indian Wells Valleys GAMA study unit, hereafter referred to as the OWENS study unit, consists of two ground-water basins (*fig. 1*). The OWENS study unit was considered high priority, to provide representation of the Basin and Range hydrogeologic province (Belitz and others, 2003).

Shaded relief derived from U.S. Geological Survey National Elevation Dataset, 2006.
Albers Equal Area Conic Projection

Provinces from Belitz and others, 2003.

Figure 1. The hydrogeologic provinces of California with the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study unit outlined.

Purpose and Scope

The purposes of this report are: (1) to describe the study design and study methods, (2) to present the results of quality-control tests, and (3) to present the analytical results for ground-water samples collected in the OWENS study unit. Ground-water samples were analyzed for organic, inorganic, and microbial constituents, field parameters, and isotopic tracers. The chemical and microbial data presented in this report were evaluated by comparison to State and Federal drinking water regulatory standards, other health-based thresholds, and thresholds set for aesthetic purposes that are established by the U.S. Environmental Protection Agency (USEPA) or the California Department of Public Health (CDPH). The data presented in this report are intended to characterize the quality of untreated ground-water resources within the study unit, not the treated drinking water delivered to consumers by water purveyors. Discussions of the factors that influence the distribution and occurrence of the constituents detected in ground-water samples will be the subject of subsequent publications.

Hydrogeologic Setting

The Owens and Indian Wells Valleys (OWENS) study unit covers approximately 1,630 mi^2 in Inyo, Kern, Mono, and San Bernardino Counties in the high desert region of California (*fig. 2*). OWENS lies within the Basin and Range hydrogeologic province and is composed of two California Department of Water Resources (CDWR) ground-water basins: Owens Valley and Indian Wells Valley (*fig. 1*) (California Department of Water Resources, 2003).

Owens Valley Study Area

The Owens Valley is a long, narrow valley along the east flank of the Sierra Nevada Mountains in east-central California. The Owens Valley ground-water basin lies within the Owens Valley drainage basin, which is bounded by the Sierra Nevada Mountains on the west, the Inyo and the White Mountains on the east, the Coso Range on the south, and the volcanic tablelands around Long Valley caldera on the north (California Department of Water Resources, 2004a) (*fig. 2*). The Sierra Nevada and the Inyo and White Mountains rise more than 9,000 ft above the valley floor and include Mount Whitney, the highest mountain in the conterminous United States. The valley ranges in altitude from about 4,500 ft north of Bishop to about 3,500 ft above NAVD 88 at Owens Lake (dry). The valley is characterized by high desert rangeland.

The valley floor is underlain by valley fill primarily eroded from the surrounding bedrock mountains. The valley fill consists of unconsolidated to moderately consolidated alluvial-fan, transition-zone, glacial and talus, and fluvial and lacustrine deposits. The valley fill also is interlayered with recent volcanic and pyroclastic rocks. The valley fill is as much as 4,000-ft thick between Bishop and Big Pine, thins to about 1,000–1,500-ft thick beneath “the narrows” located just south of Big Pine, and is as much as 8,000-ft thick beneath Owens Lake (dry) (Danskin, 1988; California Department of Water Resources, 2004a).

The climate in the Owens Valley is controlled primarily by the Sierra Nevada (*fig. 2*). Precipitation from moisture-laden air masses originates over the Pacific Ocean and moves eastward. The orographic effect of the Sierra Nevada causes a rain shadow to form east of the crest; thus, precipitation on the valley floor and on the Inyo and the White Mountains and the Coso Range is much less than that west of the crest. Average annual precipitation ranges from more than 30 in. at the crest of the Sierra Nevada, to about 7–14 in. in the Inyo and White Mountains, to about 5 in. on the valley floor (Hollett and others, 1991). A summary of historical records for the Bishop Airport and Independence stations from the National Weather Service for 1971–2000 shows maximum mean monthly air temperatures of 100ºF during the summer and minimum mean monthly air temperatures of 22ºF during the winter (National Oceanic and Atmospheric Administration, 2007).

Indian Wells Valley Study Area

The Indian Wells Valley ground-water basin is a structural and topographic depression in the southwestern part of the Basin and Range Province, about 25 mi south of the Owens Valley (Berenbrock and Schroeder, 1994; California Department of Water Resources, 2004b). Indian Wells Valley is bounded on the west by the southern terminus of the Sierra Nevada, on the north by a low ridge of volcanic rocks and the Coso Range, on the east by the Argus Range, and on the south by the El Paso Mountains (*fig. 2*). The valley is a closed, internally drained basin that is bounded and cross-cut by faults. The surrounding mountains and hills slope steeply to the broad valley floor, which then slopes gently towards the lowest point in China Lake (dry), a 19-mi^2 playa in the east-central part of the valley. Most of the 300-mi^2 valley floor ranges in altitude from 2,150 to 2,400 ft above sea level.

The valley fill consists of unconsolidated deposits, including alluvium, alluvial fan, stream-terrace, playa, lacustrine and aeolian deposits. The unconsolidated deposits are

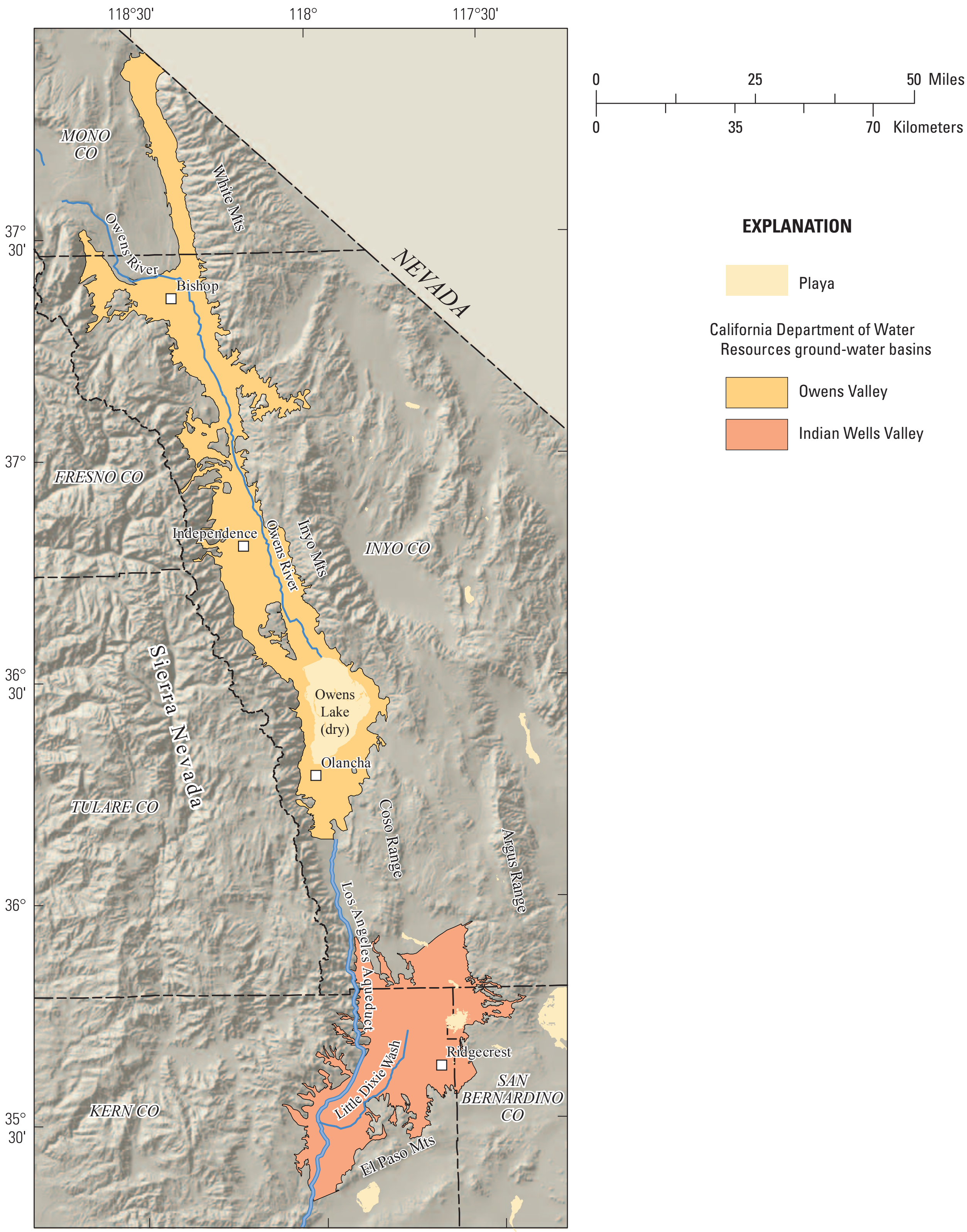

Figure 2. The Owens and Indian Wells Valleys GAMA study unit, showing the ground-water basins defined by the California Department of Water Resources, and major hydrologic features.

about 2,000-ft thick in the west-central part of the valley, and vary greatly in lithology in the central and eastern parts of the valley. In the southwestern part of the valley, the deposits are more uniform, consisting primarily of fine-to-coarse sand and small amounts of silt and clay. The unconsolidated deposits make up two main aquifers: the shallow and the deep aquifers. The shallow aquifer is as much as 300-ft thick, and overlies the deep aquifer in the eastern part of the valley. The shallow aquifer extends from China Lake westward to the center of the valley and from the area south of Airport Lake southward to the community of China Lake (Kunkel and Chase, 1969). The deep aquifer has a saturated thickness of up to 1,000 ft and is unconfined, except where it is overlain by the shallow aquifer. The deep aquifer is the primary source of ground water used for public supply because it generally has better water quality and higher well yields than the shallow aquifer (California Department of Water Resources, 2004b).

Indian Wells Valley is characterized as having an arid climate (Berenbrock and Schroeder, 1994). Average annual precipitation ranges from 4 to 6 in. on the valley floor. Most of the precipitation (including occasional snowfall) occurs during October–March, but rainfall can occur infrequently during the summer. A summary of historical records for the Inyokern station from the National Weather Service for 1948–2000 shows mean maximum monthly air temperatures of 103ºF during the summer and mean minimum monthly air temperatures of 30ºF during the winter (National Oceanic and Atmospheric Administration, 2007). Summers are characterized by hot days and warm nights, whereas winters are characterized by generally warm days and cool nights.

Methods

Methods used for the GAMA program were selected to achieve the following objectives: (1) design a sampling plan where data are suitable for statistical analysis; (2) collect samples in a consistent manner; (3) analyze samples using proven and reliable laboratory methods; (4) assure the quality of the ground-water data; and, (5) maintain data securely and with relevant documentation. The *appendix* of this report contains detailed descriptions of the sample collection protocols and analytical methods, the quality-assurance methods, and the results from the quality-control samples.

Study Design

The wells selected for sampling in this study followed two well selection strategies. Fifty-three “grid” wells were selected to provide a statistically unbiased, spatially distributed assessment of the quality of ground-water resources used for public drinking water supply. Twenty-one “understanding” wells were selected to provide a greater sampling density in several areas to address specific hydrogeologic questions in the study unit.

The 53 spatially distributed wells were selected using a randomized grid-based method (Scott, 1990). Initially, the Owens Valley and Indian Wells Valley study areas were defined by the areas of the respective CDWR ground-water basins (California Department of Water Resources, 2003). However, both study areas contained relatively few public-supply wells, and these wells were not evenly distributed. To minimize the number of cells without any wells, the boundaries of both study areas were revised before the study areas were divided into equal-area grid cells. The Owens Valley study area was redefined to include only the alluvial material; bedrock areas and the Owens Lake (dry) were excluded. The study area was then divided into sixty 20-mi^2 grid cells (*fig. 3*). In the Indian Wells Valley study area, a 1.8-mi (3 km) buffer was drawn around the mapped wells from the CDRH and USGS databases. The area encompassed by the buffer was then divided into twenty 10 mi^2 grid cells (*fig. 4*).

Initial target wells were obtained from statewide databases maintained by the USGS and the CDPH. An attempt was made to select one well per grid cell; however, some grid cells did not contain accessible wells that could be sampled. Forty of the 60 grid cells in Owens Valley study area contained a well that was selected for sampling. Thirteen of the 20 grid cells in the Indian Wells Valley study area contained a well that was selected for sampling. If a grid cell contained more than one public-supply well, each well in that grid cell randomly was assigned a rank. The highest ranked well that met basic sampling criteria, (for example, sampling point located prior to chlorination, capability to pump for several hours, and available well-construction information) and for which permission to sample could be obtained, then was sampled. If a grid cell contained no accessible public-supply wells, then domestic, irrigation, and monitoring wells were assessed for sampling. An attempt was made to select wells with depths and screened intervals similar to those in public-supply wells in the area. For three cells that contained no wells, a well just outside the cell boundary in an adjacent cell, but more than half a cell’s distance from the well representing the adjacent cell, was selected to represent the cell. In this fashion, a well was selected for each cell to provide a spatially distributed, randomized monitoring network for each study area. Wells sampled as part of the grid-well network hereafter are referred to as “grid wells”.

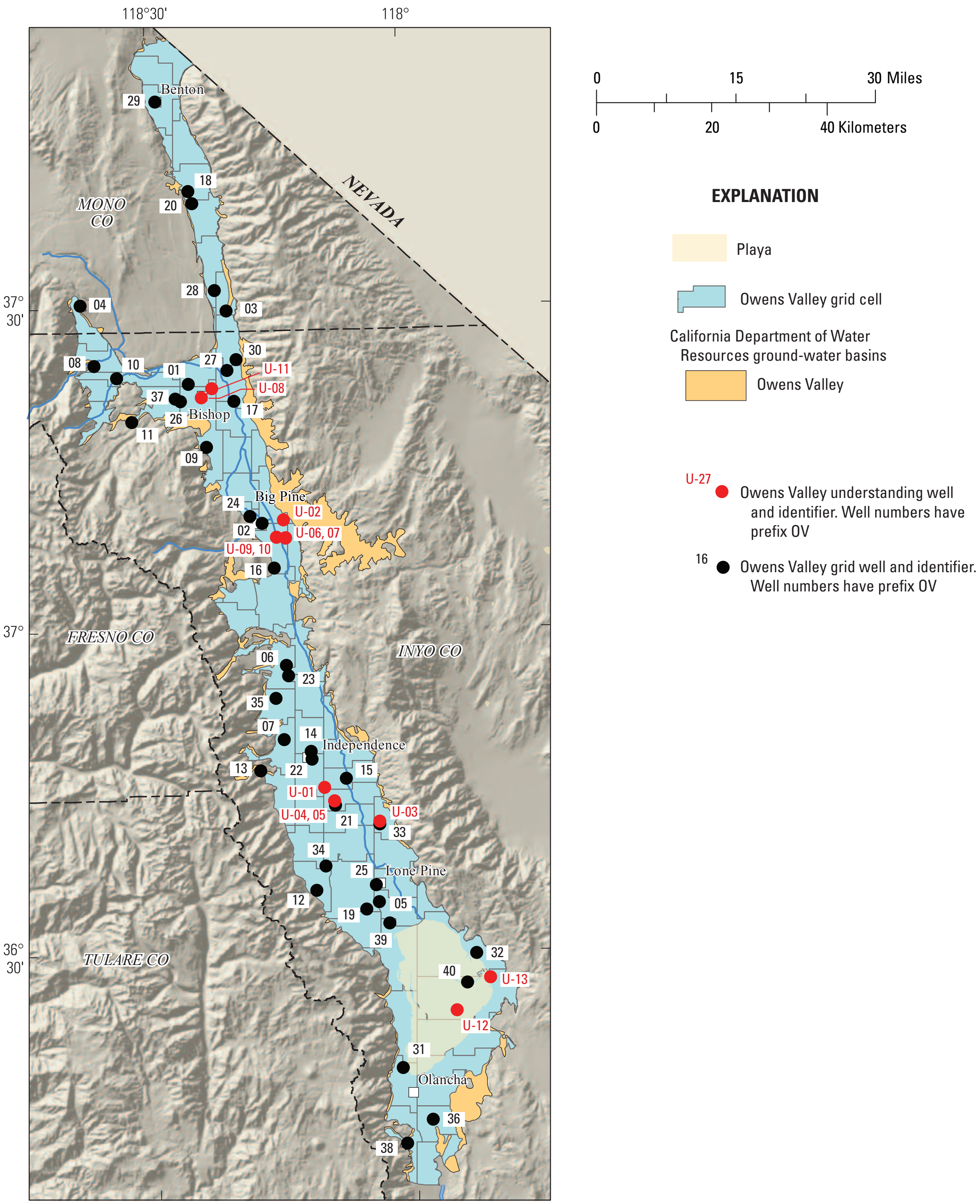

Figure 3. The Owens Valley study area with the distribution of study area grid cells and the location of sampled grid cell wells in the Owens and Indian Wells Valleys GAMA study unit, California.

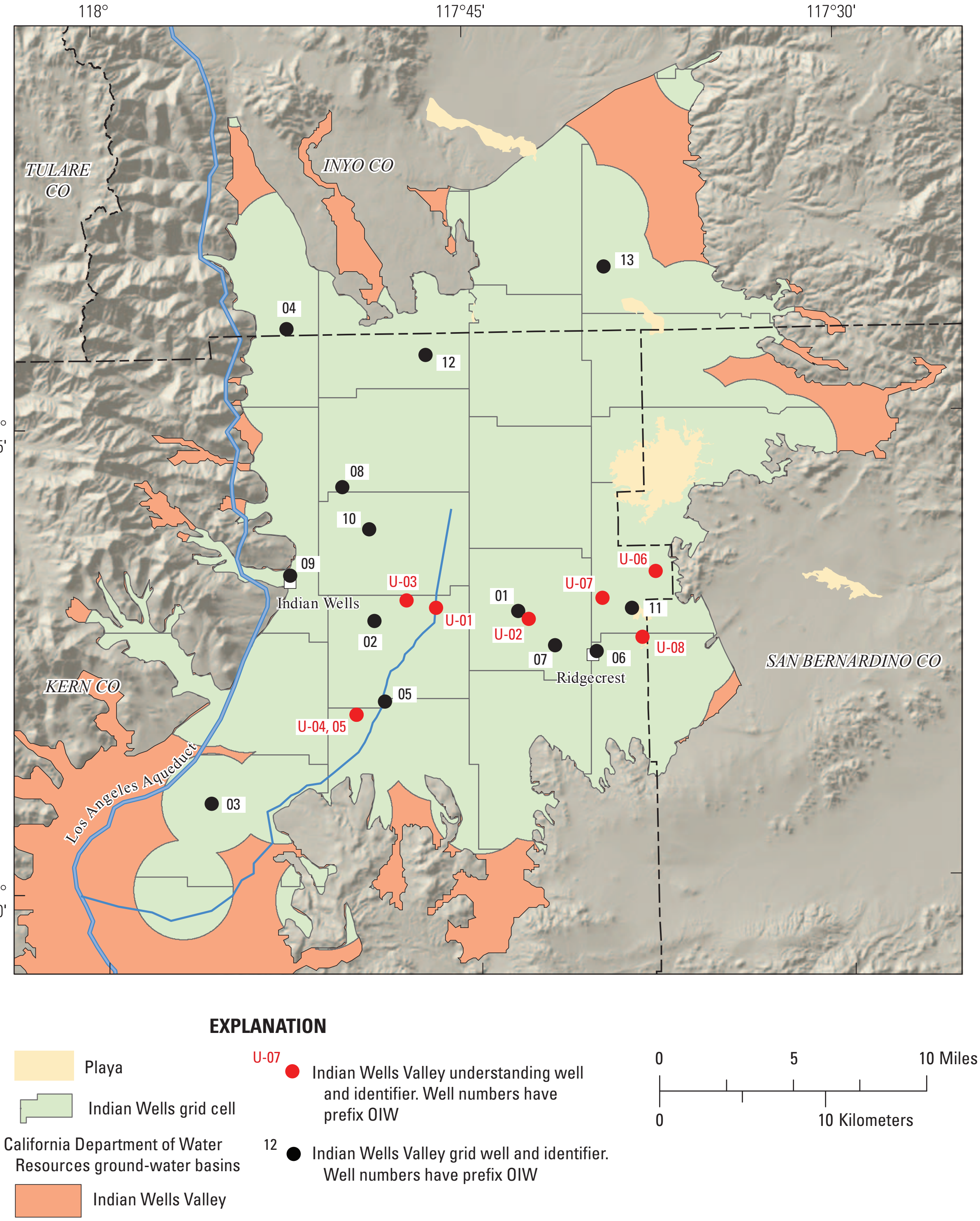

Figure 4. The Indian Wells Valley study area with the distribution of study area grid cells and the location of sampled grid cell wells in the Owens and Indian Wells Valleys GAMA study unit, California.

Twenty-one additional “understanding” wells were sampled to obtain a better understanding of the factors affecting water quality in the OWENS study unit. These factors included evaluating the contribution of aquifers at different depths to the water supply (by sampling of the monitoring wells that were perforated at different depths), and the source and movement of ground water along flow paths. These additional wells sampled as part of these studies for better understanding, hereafter referred to as “understanding wells”, were not included in the statistical characterization of water quality in the OWENS study unit because inclusion of these wells would have caused overrepresentation of certain cells.

Grid wells sampled as part of the OWENS study unit were numbered with the following prefixes based on study area: The Owens Valley study area wells have the prefix “OV” (*fig. 3*), and the Indian Wells Valley study area wells have the prefix “OIW” (*fig. 4*). Additional understanding wells sampled in the OWENS study unit to ascertain ground-water quality in areas of interest are designated as “OVU” (*fig. 3*) or “OIWU” (*fig. 4*), depending on the study area (“U” indicating “understanding”).

Table 1 provides the GAMA alphanumeric identification number for each well, along with the date sampled, sampling schedule, and well-construction information. Ground-water samples were collected from 36 public-supply wells, 7 domestic wells, 7 irrigation wells, 2 artesian wells, 1 well used for fish aquaculture, and 21 monitoring wells, from September to December 2006.

Well locations and identifications were verified in the field using GPS, 1:24,000 scale USGS topographic maps, comparison with existing well information in USGS and CDPH databases, and information provided by well owners. Driller’s logs, if available, were obtained. Well information was recorded by hand on field sheets and electronically using specialized software on field laptop computers. All available well information was verified and then entered into the USGS National Water Information System (NWIS). Well owner information is confidential. Well location information and all chemical data currently are inaccessible from the NWIS public website.

The wells in the OWENS study unit were sampled using a tiered analytical approach. All wells were sampled for a standard set of constituents, including VOCs, pesticides and pesticide degradates, perchlorate, nutrients, major ions, trace elements, chromium (VI), arsenic and iron species, stable isotopes of hydrogen and oxygen in water, dissolved noble gases, tritium, and helium isotopes. This standard set of constituents was termed the “fast” schedule (*table 2*). Wells on the “intermediate” schedule were sampled for all the constituents on the fast schedule, plus NDMA, 1,2,3-TCP, wastewater-indicator compounds, dissolved organic carbon, and several isotopic tracers (uranium isotopes, strontium and boron isotopic ratios and carbon-14). Wells on the “slow” schedule were sampled for all the constituents on the “intermediate” schedule, plus gasoline oxygenates and degradates, pharmaceutical compounds, radioactive constituents, and microbial constituents (*table 2*). In the OWENS study unit, 15 wells were sampled using the fast schedule, 50 wells were sampled using the intermediate schedule, and 9 wells were sampled using the slow schedule.

Sample Collection and Analysis

Samples were collected in accordance with the protocols established by the USGS National Water Quality Assessment (NAWQA) program (Koterba and others, 1995) and the USGS National Field Manual (U.S. Geological Survey, variously dated). These sampling protocols ensure that a representative sample of ground water is collected at each site and that the samples are collected and handled in a way that minimizes the potential for contamination of samples. The methods used for sample collection are described in the *appendix*.

Tables 3A–K list the compounds analyzed in each constituent class. Raw (untreated) ground-water samples were analyzed for 85 VOCs (*table 3A*), 8 gasoline oxygenates and degradates (*table 3B*), 63 pesticide and pesticide degradates (*table 3C*), 71 potential wastewater-indicator compounds (*table 3D*), 14 pharmaceutical compounds (*table 3E*), 3 constituents of special interest [*N*-nitrosodimethylamine (NDMA), 1,2,3-trichloropropane (TCP), and perchlorate] (*table 3F*), 5 nutrients and dissolved organic carbon (DOC) (*table 3G*), 10 major and minor ions and dissolved solids and 25 trace elements (*table 3H*), arsenic, chromium, and iron species (*table 3I*), stable isotopes of oxygen and hydrogen of water, strontium, boron, and carbon isotopes, and 10 radioactive constituents, including tritium and carbon-14 (*table 3J*), five dissolved noble gases and tritium/helium age dates (*table 3K*), and four microbial constituents (*table 3L*). General water-quality indicators that were determined in the field are dissolved oxygen (DO), pH, specific conductance (SC), alkalinity, and temperature. In total, more than 300 constituents were analyzed for in this study. The methods used for sample analysis are described in the *appendix*.

Data Reporting

The methods and conventions used for reporting the data are described in the *appendix*. Five VOCs analyzed in this study were measured by more than one method at the NWQL; only the results from the preferred method are reported. Five other constituents—1,2,3-TCP, arsenic, iron, and chromium concentrations, and tritium activities—were measured by more than one laboratory; both sets of results are reported.

Quality Assurance

The quality-assurance and quality-control procedures used for this study followed the protocols used by the USGS NAWQA program (Koterba and others, 1995) and described in the USGS National Field Manual (U.S. Geological Survey, variously dated). The NWQL quality-assurance plan is described in Maloney (2005) and Pirkey and Glodt (1998). Quality-control (QC) samples collected in the OWENS study included source-solution blanks, field blanks, replicates, and matrix and surrogate spikes. QC samples were collected to evaluate bias and variability of the water-chemistry data that may have resulted from sample collection, processing, storage, transportation, and laboratory analysis. The quality-assurance methods anf quality-control results are described in the *appendix*.

Water-Quality Results

Comparison Thresholds

Concentrations in ground-water samples were compared with CDPH and USEPA drinking-water health-based thresholds and thresholds established for aesthetic purposes (U.S. Environmental Protection Agency, 2006; California Department of Public Health, 2007). The chemical and microbial data presented in this report are meant to characterize the quality of the untreated ground-water resources within the OWENS study unit and are not intended to represent the treated drinking water delivered to consumers by water purveyors. In addition, in several cases, ground-water samples were collected from monitoring wells that are not used for public supply, to provide adequate spatial distribution of sampling sites within the study unit. The chemical and microbial composition of treated drinking water may differ from untreated ground water because treated drinking water may be subjected to disinfection, filtration, mixing with other waters, and exposure to the atmosphere prior to its delivery to consumers.

The following thresholds were used for comparisons:

MCL–Maximum Contaminant Level. Legally enforceable standards that apply to public water systems and are designed to protect public health by limiting the levels of contaminants in drinking water. National MCLs are established by the USEPA with which states are required to comply. Individual states may choose to set more stringent standards. CDPH has established MCLs for additional constituents not regulated by the USEPA, as well as lowered the threshold concentration for a number of constituents with MCLs established by the USEPA. In this report, a threshold set by the USEPA and adopted by CDPH is labeled “MCL-US”, and one set by CDPH that is more stringent from the MCL-US is labeled “MCL-CA”. CDPH is notified when constituents are detected at concentrations exceeding MCL-US or MCL-CA thresholds in samples collected for the GAMA Priority Basin Project.

AL–Action Level. Legally enforceable standards that apply to public water systems and are designed to protect public health by limiting the levels of copper and lead in drinking water. Detections of copper or lead above thresholds trigger requirements for mandatory water treatment to reduce the corrosiveness of water to water pipes. The action levels established by the USEPA and CDPH are the same, thus, these thresholds are labeled “AL-US” in this report.

SMCL–Secondary Maximum Contaminant Level. Non-enforceable standards applied to constituents that affect the aesthetic qualities of drinking water, such as taste, odor, and color. Both the USEPA and CDPH define SMCLs, but unlike MCLs, SMCLs established by CDPH are not required to be at least as stringent as those established by USEPA. SMCLs established by CDPH are used in this report (SMCL-CA) for all constituents that have SMCL-CA values. The SMCL-US is used for pH and specific conductance because no SMCL-CA has been defined.

NL–Notification Level. Health-based notification levels established by CDPH for some of the constituents in drinking water that lack MCLs (NL-CA). If a constituent is detected above its NL-CA, State law requires timely notification of local governing bodies and recommends consumer notification.

HAL–Lifetime Health Advisory Level. The maximum concentration of a constituent at which its presence in drinking water is not expected to cause any adverse carcinogenic effects for a lifetime of exposure. HALs are established by the USEPA (HAL-US) and are calculated assuming consumption of 2 liters of water per day over a 70-year lifetime by a 154 pound adult and that 20 percent of a person’s exposure comes from drinking water.

RSD5–Risk-Specific Dose. The concentration of a constituent in drinking water corresponding to an excess estimated lifetime cancer risk of 1 in 100,000. RSD5 is an acronym for risk-specific dose at 10^{-5}. RSD5s are calculated by dividing the 10^{-4} cancer risk concentrations established by the USEPA by 10 (RSD5-US).

For constituents with MCLs, detections in ground-water samples were compared with the MCL-US or MCL-CA. Constituents with SMCLs were compared with the SMCL-CA. For chloride, sulfate, specific conductance, and total dissolved solids, CDPH defines a "recommended" and an "upper" SMCL-CA; detections of these constituents in ground-water samples were compared with both levels. The SMCL-US for these constituents corresponds to the recommended SMCL-CA. Detected concentrations of constituents that lack MCLs and SMCLs were compared with NL-CAs. For constituents that lack an MCL, SMCL, or NL-CA, detected concentrations were compared with the HAL-US. For constituents that lack an MCL, SMCL, NL-CA, or HAL-CA, detected concentrations were compared with the RSD5-US. Note that this hierarchy of selection of comparison thresholds means that for constituents that have multiple types of established thresholds, the threshold used for comparison purposes may not be the one with the lowest concentration. The comparison thresholds used in this report are listed in *tables 3A–K* for all constituents and in *tables 4–13* for constituents detected in ground-water samples from the OWENS study unit. Not all constituents analyzed for this study have established thresholds available.

Detections of constituents at concentrations greater than the selected comparison thresholds are noted in *tables 4–13*. In this study, fluoride, arsenic, uranium, boron, molybdenum, strontium, and vanadium were detected at concentrations higher than health-based thresholds. These detections occurred in 17 of the 53 grid wells and 8 of the 21 understanding wells. Total dissolved solids, iron, or manganese were detected at concentrations above thresholds set for aesthetic concerns in 9 of the grid wells and 10 of the understanding wells.

Ground-Water-Quality Data

Results of analyses of raw, untreated ground-water samples from the OWENS study unit are presented in *tables 4–13*. Ground-water samples were analyzed for up to 156 synthetic/organic constituents (VOCs and pesticides), of which 140 were not detected in any of the samples (*tables 3A–C*). The summary tables (*tables 4–13*) present only the compounds that were detected, and list only samples that had at least one compound detected. For organic constituent classes that were analyzed at all of the grid wells, the tables include the number of wells at which each constituent was detected, the frequency at which it was detected (in relation to the number of grid wells), and the total number of constituents detected at each well. Results from the understanding wells are presented in the tables, but these results were excluded from the detection frequency calculations to avoid statistically over-representing the areas in the vicinity of the understanding wells.

Table 4 includes water-quality indicators measured in the field and at the NWQL. *Tables 5–13* present the results of ground-water analyses organized by the compound types and classes:

- Organic constituents
    - VOCs and gasoline oxygenates and degradates (*table 5*)
    - Pesticides and pesticide degradates (*table 6*)
- Constituents of special interest (*table 7*)
- Inorganic constituents
    - Nutrients and dissolved organic carbon (*table 8*)
    - Major and minor ions (*table 9*)
    - Trace elements (*table 10*)
    - Arsenic, iron, and chromium speciation (*table 11*)
- Inorganic tracer constituents
    - Stable-isotope ratios and tritium and carbon-14 activities (*table 12*)
- Radioactive constituents (*table 13*)

There is no summary table for microbial indicators because there were no detections of these constituents in ground-water samples from OWENS. Results for dissolved noble gas and tritium/helium age dates, strontium and boron isotopes, pharmaceutical compounds, and potential wastewater-indicator constituents are not presented in this report; they will be included in subsequent publications.

Field Parameters

Field and laboratory measurements of dissolved oxygen, pH, specific conductance, alkalinity, and associated parameters are presented in *table 4*. Dissolved oxygen and alkalinity are used as indicators of natural processes that control water chemistry. Dissolved oxygen is a measure of the amount oxygen that is available for chemical reactions. Alkalinity is a measure of the buffering capacity of the system. The pH value indicates the acidity or basicity of the water, and is a useful indicator of the status of equilibrium reactions in which the water participates. Specific conductance is the electrical conductance of the water for a unit length and cross section at a specified temperature. Specific conductance is proportional to the amount of dissolved ions in the water. Samples from six grid wells had pH values outside of the SMCL-US range for pH, measured in the field. Samples from ten grid wells had specific conductance values above the recommended SMCL-CA. Specific conductance values for three of these samples also were above the upper SMCL-CA, but all three wells were monitoring wells.

Organic Constituents

Volatile organic compounds (VOCs) are present in paints, solvents, fuels, fuel additives, refrigerants, fumigants, and disinfected water, and are characterized by their tendency to evaporate. VOCs generally persist longer in ground water than in surface water because ground water is isolated from the atmosphere.

Analytical results for volatile organic compounds (VOCs) are presented in *table 5*. Of the 85 VOCs analyzed (*tables 3A*, *B*), 10 were detected in ground-water samples, with 6 of these compounds detected in grid wells; all detections were below health-based thresholds, and most were less than one-one hundredth of the threshold values. None of the VOCs were detected in 10 percent or more of the grid wells sampled. Eleven of the fifty-three grid wells had detections of 1 VOC each.

Analytical results for pesticides and pesticide degradates are presented in *table 6*. Of the 63 pesticides and pesticide degradates analyzed (*table 3C*), 5 were detected in ground-water samples, with 4 of these compounds detected in grid wells; all detections were below health-based thresholds, and most were less than one thousandth of the threshold values (*table 6*). None of the pesticides (or pesticide degradates) sampled for were detected in 10 percent or more of the wells sampled. Four of the fifty-three grid wells had detections of at least one pesticide or pesticide degradate.

Constituents of Special Interest

Perchlorate, 1,2,3-TCP, and NDMA are constituents of special interest in California because they recently have been found in water supplies (California Department of Public Health, 2007a,b). Perchlorate was detected in three grid wells and in one understanding well; the concentrations were less than one-fourth of the NL-CA (*table 7*). 1,2,3-Trichloropropane and NDMA were not detected in any samples.

Inorganic Constituents

Most inorganic constituents (nutrients, major ions, and trace elements) occur naturally in ground water. Their concentrations also can be influenced by human activities.

Nutrients, such as nitrogen and phosphorus, and the dissolved organic carbon present in ground water can affect biological activity in aquifers and in surface-water bodies that receive ground-water discharge. Nitrogen is present in several forms—ammonia, nitrite, or nitrate—depending on the oxidation-reduction state of the ground water. High concentrations of nitrate can adversely affect human health, particularly the health of infants. All concentrations of nitrate, nitrite, and ammonia measured in samples from OWENS wells were below health-based thresholds (*table 8*).

CDPH has established non-enforceable thresholds (SMCL-CA) that are based on aesthetic or technical properties, rather than health-based concerns, for TDS, the major ions chloride and sulfate, and several trace elements. Chloride, sulfate, and TDS concentrations measured in samples from most OWENS wells were below the recommended SMCL-CAs (*table 9*). Samples from three grid wells had TDS concentrations above the upper SMCL-CA; one of these samples also had chloride concentration above the upper SMCL-CA. All three of these wells were monitoring wells and are not used for public supply.

Iron and manganese are trace elements whose concentrations are affected by the oxidation-reduction state of the ground water. Precipitation of minerals containing iron or manganese may cause orange or black staining of surfaces. Concentrations of manganese and iron in OWENS wells typically were low. Samples from seven grid wells had concentrations of manganese above the SMCL-CA, and iron also was above the SMCL-CA in one of these wells (*table 11*). Of the understanding wells, six wells had concentrations of manganese above the SMCL-US, and iron also was above the SMCL-CA in two of these wells.

Health-based thresholds exist for 18 of the 25 trace elements and one of the minor ions analyzed in this study. Of these 19 elements, six trace elements (arsenic, boron, molybdenum, strontium, vanadium, and uranium; *table 10*) and one minor ion (fluoride; *table 9*) were detected above health-based threshold levels. All of these elements can enter ground water by dissolution of natural deposits. Ten of the 53 grid wells had concentrations of arsenic (5 wells), uranium (4 wells) or fluoride (1 well) above the MCL-US thresholds (*table 10*). Three of the ten were monitoring wells. Twelve of the 53 grid wells had concentrations of at least one trace element above the NL-CA or HAL-US thresholds: boron (9 wells), molybdenum (3 wells), vanadium (1 well), strontium (1 well) (*table 10*). Three of the twelve were monitoring wells.

Arsenic, iron, and chromium occur in different species, depending on the oxidation-reduction state of the groundwater. The oxidized and reduced species have different solubilities in ground water and may have different effects on human health. The relative proportions of the oxidized and reduced species of each element also are used to aid in interpretation of the oxidation-reduction state of the aquifer. Concentrations of total iron, total arsenic, and total chromium, and the concentrations of either the reduced or the oxidized species of each element are shown on *table 11*. The concentration of the other species can be calculated by the difference. The concentrations of arsenic, iron, and chromium on *table 11* may differ from those reported on *table 10* because different analytical methods were used (see *appendix*). The concentrations reported in *table 10* are considered to be more accurate.

Inorganic Tracer Constituents

The stable isotopes of oxygen and hydrogen and the activities of tritium and carbon-14 are useful tracers of natural processes affecting ground-water composition. Hydrogen and oxygen stable-isotope ratios of water (*table 12*) can aid in interpreting the source of the ground water. The stable-isotope ratios of water are affected by the altitude, latitude, and temperature of precipitation, as well as by the extent of evaporation of surface water or soil water.

Tritium and carbon-14 can provide information about the age of the ground water. Tritium (*table 12*), a radioactive isotope of hydrogen, is part of the water molecule and is not affected by reactions other than radioactive decay. Low levels of tritium are produced continuously by cosmic ray bombardment of the atmosphere. However, a large amount of tritium was released to the atmosphere as a result of atmospheric testing of nuclear weapons between 1952 and 1963. Because of this influx, tritium is an excellent tracer of water recharged since the early 1950's. Helium isotope ratios can be used in conjunction with tritium concentrations to estimate more exact ages for young ground water. Helium isotope analyses were not completed in time for inclusion in this report; data will be presented in a subsequent report.

Carbon-14 (*table 12*), a radioactive isotope of carbon, is incorporated into dissolved carbonate species in water. Low levels of carbon-14 are produced continuously by interaction of cosmic radiation with the Earth's atmosphere, and incorporated into atmospheric carbon dioxide. Because carbon-14 decays with a half-life of 5,730 years, low activities of carbon-14, relative to modern values, in ground water generally indicate the presence of ground water that is several thousand years old.

Tritium is the only one of the inorganic tracer constituents analyzed for this study with a health-based threshold. All measured tritium activities in samples from OWENS wells were less than one one-thousandth of the MCL-CA (*table 12*).

Radioactive Constituents

Radioactivity is the release of energy or energetic particles during changes in the structure of the nucleus of an atom. Most of the radioactivity in ground water comes from decay of naturally occurring isotopes of uranium and thorium that are present in minerals in the sediments or fractured rocks of the aquifer. Both uranium and thorium decay in a series of steps, eventually forming stable isotopes of lead. Radium-226, radium-228, and radon-222 are radioactive isotopes formed as part of the uranium and thorium decay series. In each step in the decay series, one radioactive element turns into a different radioactive element by emitting two protons and two neutrons (an alpha particle) or an electron (a beta particle) from its nucleus. For example, radium-226 emits an alpha particle and, therefore, turns into radon-222. Radium-228 decays to form actinium-228 by emission of a beta particle. The alpha and beta particles emitted during radioactive decay are hazardous to human health because these energetic particles may damage cells. Radiation damage to cell DNA may increase the risk of getting cancer.

Activity often is used instead of concentration for reporting the presence of radioactive constituents. Activity of radioactive constituents in ground water is measured in units of picocuries per liter (pCi/L). One picocurie is approximately equal to two atoms decaying per minute. The number of atoms decaying is equal to the number of alpha or beta particles emitted.

Seven OWENS grid wells were sampled for the radioactive constituents of radon, radium, and of gross-alpha and gross-beta radiation (*tables 13A, B, C*). Activities of radon-222 in samples from all seven wells were above the proposed MCL-US, although none also were above the proposed alternative MCL (*table 13C*). The alternative MCL-US will apply if the State or local water agency has an approved multimedia mitigation program to address radon levels in indoor air (U.S. Environmental Protection Agency, 1999a). Activities of uranium isotopes were measured in samples from 40 wells; one sample had a total uranium activity above the MCL-CA (*table 13A*). For this ground-water sample, uranium, which was measured in µg/L, also was above the MCL-US (*table 11*). The other three samples with uranium concentrations above the MCL-US were not analyzed for uranium isotopes.

Future Work

Future reports will present analyses of the data presented in this report using a variety of statistical, qualitative, and quantitative approaches to assess the natural and human factors affecting ground-water quality. Water-quality data contained in the CDPH and USGS NWIS databases, and water-quality data available from other State and local water agencies will be compiled, evaluated, and used in combination with the data presented in this report.

Summary

Ground-water quality in the approximately 1,000-mi^2 Owens and Indian Wells Valleys (OWENS) study was sampled and evaluated during September–December 2006 as part of the Priority Basin Project of Groundwater Ambient Monitoring and Assessment (GAMA) Program. The California State Water Resources Control Board (SWRCB), in collaboration with the U.S. Geological Survey (USGS) and the Lawrence Livermore National Laboratory, implemented the GAMA Program (*http://www.waterboards.ca.gov/gama/*) beginning in 2004. The Priority Basin Project was designed by the SWRCB and the USGS in response to the Ground-Water Quality Monitoring Act of 2001. The project is a comprehensive assessment of statewide ground-water quality designed to identify and characterize risks to ground-water resources, and to increase the availability of information about ground-water quality to the public. The OWENS study unit was the fourteenth study unit sampled as part of the project.

The OWENS study unit lies within the Basin and Range hydrogeologic province and is composed of two ground-water basins, as defined by the California Department of Water Resources. The 74 wells sampled as part of this study are located in Inyo, Kern, Mono, and San Bernardino Counties in the high desert region of California. Fifty-three wells were selected by using a randomized grid approach to achieve a statistically unbiased representation of ground water used for public drinking-water supplies. An additional 21 wells were selected to provide additional sampling density to help understand processes affecting ground-water quality. Ground-water samples were analyzed for VOCs, pesticides and pesticide degradates, pharmaceutical compounds, wastewater-indicator compounds, nutrients, major and minor ions, trace elements, radioactivity, and microbial indicators. Naturally occurring isotopes (stable isotopes of hydrogen and oxygen, and activities of tritium and carbon-14) and dissolved noble gases also were measured to provide data that will be used to help interpret the source and age of the sampled ground water. This report describes the study design and methods used, presents the results of the quality-control tests, and presents water-quality results for ground-water samples collected during September–December 2006.

This study evaluated the quality of ground water in the OWENS study unit and did not attempt to evaluate the quality of water delivered to consumers. In several cases, ground-water samples were collected from monitoring and other wells that are not used for public supply, to provide adequate spatial distribution. Water supplied to consumers typically is treated after withdrawal from the ground, disinfected, and blended with other waters to maintain acceptable water quality. Regulatory thresholds apply to treated water that is served to the consumer, not to raw ground water. However, to provide some context for the results, concentrations of constituents measured in the raw ground water were compared with health-based thresholds established by the U.S. Environmental Protection Agency (USEPA) and California Department of Public Health (CDPH).

Most constituents detected in ground-water samples from OWENS wells were found at concentrations below drinking-water regulatory and non-regulatory thresholds. One or more organic compounds (VOCs and/or pesticides) were detected in 13 of the 53 grid wells; all detections were below health-based thresholds, and most were less than 1/100th of the threshold values. Of the 19 trace and minor elements and 6 radioactive constituents with health-based thresholds, seven were detected at concentrations or activities above existing thresholds in grid wells: arsenic (5 wells), uranium (4 wells), and fluoride (1 well) above the MCL-US thresholds; uranium activity (1 well) above the MCL-CA threshold; boron (9 wells) and vanadium (1 well) above NL-CA thresholds; and molybdenum (3 wells) and strontium (1 well) above HAL-US thresholds. These detections occurred in 17 of the 53 grid wells. Nine of the 53 grid wells had concentrations of constituents with non-enforceable SMCL-CA thresholds above threshold values: manganese in 7 wells, iron in 1 well, and TDS (upper threshold) in 3 wells.

Future reports will present evaluation of the data presented in this report using a variety of statistical, qualitative, and quantitative approaches to assess the natural and human factors affecting ground-water quality.

Acknowledgements

The authors thank the following cooperators for their support: the State Water Resources Control Board (SWRCB), California Department of Public Health, California Department of Water Resources, and Lawrence Livermore National Laboratory. We also thank the cooperating well owners and water purveyors for their generosity in allowing the USGS to collect samples from their wells. Two reviewers, Jan Stepek (SWRCB) and Leigh Justel (USGS) provided comments to improve this work. Funding for this work was provided by State bonds authorized by Proposition 50 and administered by the SWRCB.

References

American Public Health Association, 1998, Standard methods for the examination of water and wastewater (20th ed.): Washington, D.C., American Public Health Association, American Water Works Association, and Water Environment Federation, p. 3–37—3–43.

American Society for Testing and Materials, 1998, Annual book of ASTM standards—water and environmental technology: Philadelphia, Pennsylvania, American Society for Testing and Materials, v. 11.02 (Water II), p. 664–666.

American Society for Testing and Materials, 2002, Standard test method for isotopic uranium in water by radiochemistry: American Society for Testing and Materials International, D 3972-02.

Anderson, R.L., 1987, Practical statistics for analytical chemists: New York, Van Nostrand Reinhold Company, Inc., 315 p.

Appelo, C.A.J., and Postma, D., 2005, Geochemistry, groundwater, and pollution (2nd ed.): Leiden, Germany, A.A. Balkema Publishers, 649 p.

Ball, J.W., and McCleskey, R.B., 2003a, A new cation-exchange method for accurate field speciation of hexavalent chromium: U.S. Geological Survey Water-Resources Investigations Report 03–4018, 17 p.

Ball, J.W. and McClesky, R.B., 2003b, A new cation-exchange method for accurate field speciation of hexavalent chromium: Talanta, v. 61, p. 305–313.

Belitz, Kenneth, Dubrovsky, N.M., Burow, Karen, Jurgens, Bryant and Johnson, T., 2003, Framework for a groundwater quality monitoring and assessment program for California: U.S. Geological Survey Water-Resources Investigations Report 03–4166, 78 p.

Bennett V, G.L., Belitz, Kenneth, and Dawson, B.J. M, 2006, California GAMA Program: Ground-Water Quality Data in the Northern San Joaquin Basin Study Unit, 2005: U.S. Geological Survey Data Series 196, 122 p.

Berenbrock, Charles, and Schroeder, R.A., 1994, Groundwater flow and quality, and geochemical processes, in Indian Wells Valley, Kern, Inyo, and San Bernardino Counties, California, 1987–88: U.S. Geological Survey Water-Resources Investigations Report 93–4003, 59 p.

Brenton, R.W., and Arnett, T.L., 1993, Methods of analysis by the U.S. Geological Survey National Water-Quality Laboratory—determination of dissolved organic carbon by UV-promoted persulfate oxidation and infrared spectrometry: U.S. Geological Survey Open-File Report 92–480, 12 p.

Bushon, R.N., 2003, Fecal indicator viruses: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7.2, p. FIV-3–FIV-23. Accessed June 28, 2007, at *http://pubs.water.usgs.gov/twri9A7.2/*

California Department of Public Health, 2007a, California Code of Regulations. Title 22, Division 4 Environmental Health, Chapter 15 Domestic Water Quality and Monitoring Regulations. Register 2007, No. 4 (current as of January 26, 2007). Accessed February 10, 2007, at *http://www.cdph.ca.gov/certlic/drinkingwater/Pages/chemicalcontaminants.aspx*

California Department of Public Health, 2007b, Chemical contaminants in drinking water: Division of Drinking Water and Environmental Management. Accessed March 31, 2007, at *http://www.cdph.ca.gov/certlic/drinkingwater/Pages/chemicalcontaminants.aspx*

California Department of Water Resources, 2003, California's groundwater bulletin 118, 246 p. *http://www.groundwater.water.ca.gov/bulletin118/*

California Department of Water Resources, 2004a, California Department of Water resources, individual basin descriptions, Owens Valley, *http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/pdfs_desc/6-12.pdf* (accessed December 5, 2008).

California Department of Water Resources, 2004b, California Department of Water Resources, individual basin descriptions, Indian Wells Valley, *http://www.dpla2.water.ca.gov/publications/groundwater/bulletin118/basins/pdfs_desc/6-54.pdf* (accessed December 5, 2008).

Childress, C.J.O., Foreman, W.T., Connor, B.F. and Maloney, T.J., 1999, New reporting procedures based on long-term method detection levels and some considerations for interpretations of water-quality data provided by the U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Open-File Report 99–193, 19 p.

Connor, B.F., Rose, D.L., Noriega, M.C., Murtagh, L.K. and Abney, S.R., 1998, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory: Determination of 86 volatile organic compounds in water by gas chromatography/mass spectrometry, including detections less than reporting limits: U.S. Geological Survey Open-File Report 97–829, 78 p.

Coplen, T.B., Wildman, J.D., and Chen, J., 1991, Improvements in the gaseous hydrogen-water equilibrium technique for hydrogen isotope analysis: Analytical Chemistry, v. 63, p. 910–912.

Coplen, T.B., 1994, Reporting of stable hydrogen, carbon, and oxygen isotopic abundances: Pure and Applied Chemistry, v. 66, p. 273–276.

Coplen, T.B., Hopple, J.A., Bohlke, J.K., Peiser, H.S., Rieder, S.E., Krouse, H.R., Rosman, K.J.R., Ding, T., Vocke, R.D., Jr., Revesz, K.M., Lamberty, A., Taylor, P., and DeBierve, P., 2002, Compilation of minimum and maximum isotope ratios of selected elements in naturally occurring terrestrial materials and reagents: U.S. Geological Survey Water-Resources Investigations Report 01–4222, 98 p.

Danskin, W.R., 1998, Evaluation of the hydrologic system and selected water-management alternatives in the Owens Valley, California: U.S. Geological Survey Water-Supply Paper 2370-H. 175 p.

Dawson, B.J., Bennett, G.L., V, and Belitz, Kenneth, 2008, California GAMA Program: Ground-water quality data in the Southern Sacramento Valley study unit, California, 2005: U.S. Geological Survey Data Series 285, 93 p.

Donahue, D.J., Linick, T.W., and Jull, A.J.T., 1990, Ratio and background corrections for accelerator mass spectrometry radiocarbon measurements: Radiocarbon, v. 32, p. 135–142.

Eaton, G.F., Hudson, G.B., and Moran, J.E., 2004, Tritium-helium-3 age-dating of groundwater in the Livermore Valley of California: American Chemical Society ACS Symposium Series, v. 868, p. 235–245.

Epstein, S., and Mayeda, T.K., 1953, Variation of O-18 content of water from natural sources: Geochimica et Cosmochimica Acta, v. 4, p. 213–224.

Faires, L.M., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of metals in water by inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 92–634, 28 p.

Ferrari, M.J., Fram, M.S., and Belitz, Kenneth, 2008, Ground-water quality data in the Central Sierra study unit, 2006—Results from the California GAMA Program: U.S. Geological Survey Data Series 335, 60 p.

Fishman, M.J., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93–125, 217 p.

Fishman, M.J. and Friedman, L.C., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p.

Firestone, R.B., Shirley, V.S., Baglin, C.M., Chu, S.Y.F., and Zipkin, J., 1996, Table of isotopes (8th ed.): New York, John Wiley & Sons, 3168 p. Accessed on April 1, 2007, at *http://ie.lbl.gov/toipdf/toi20.pdf*

Fram, M.S., and Belitz, Kenneth, 2007, Ground-water quality data in the Southern Sierra study unit, 2006: Results from the California GAMA program: U.S. Geological Survey Data Series 301, 90 p.

Furlong, E.T., Anderson, B.D., Werner, S.L., Soliven, P.P., Coffey, L.J. and Burkhardt, M.R., 2001, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of pesticides in water by graphitized carbon-based solid-phase extraction and high-performance liquid chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01–4134, 73 p.

Garbarino, J.R., 1999, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of dissolved arsenic, boron, lithium, selenium, strontium, thallium, and vanadium using inductively coupled plasma-mass spectrometry: U.S. Geological Survey Open-File Report 99–093, 31 p.

Garbarino, J.R., and Damrau, D.L., 2001, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of organic plus inorganic mercury in filtered and unfiltered natural water with cold vapor–atomic fluorescence spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01–4132, 16 p.

Garbarino, J.R., Kanagy, J.R., and Cree, M.E., 2006, Determination of elements in natural-water, biota, sediment, and soil samples using collision/reaction cell inductively coupled plasma-mass spectrometry: U.S. Geological Survey Techniques and Methods, Book 5, Chap. B1, 88 p.

Grob, R.L, ed., 1995, Modern practice of gas chromatography (3rd ed.): New York, John Wiley & Sons, 888 p.

Hamlin, S.N., Belitz, Kenneth, Kraja, Sarah, and Dawson, B.J., 2002, Ground-water quality in the Santa Ana watershed, California: Overview and data summary: U.S. Geological Survey Water-Resources Investigations Report 02–4243, 137 p.

Hautman, D.P., Munch, D.J., Eaton, A.D., and Haghani, A.W., 1999, Method 314.0 Determination of perchlorate in drinking water using ion chromatography, revision 1.0: U.S. Environmental Protection Agency. Accessed June 22, 2004.

Hollett, K.J., Danskin, W.R., McCaffrey, W.F., and Walti, C.L., 1991, Geology and water resources of Owens Valley, California: U.S. Geological Survey Water-Supply Paper 2370-B, 77 p.

Hutson, S.S., Barber, N.L., Kenny, J.F., Linsey, K.S., Lumia, D.S., and Maupin, M.A., 2004, Estimated use of water in the United States in 2000: U.S. Geological Survey Circular 1268, 46 p.

Jull, A.J.T., Burr, G.S., McHargue, L.R., Lange, T.E., Lifton, N.A., Beck, J.W., Donahue, D.J., and Lal, D., 2004, New frontiers in dating of geological, paleoclimatic, and anthropological applications using accelerator mass spectrometric measurements of 14C and 10Be in diverse samples: Global and Planetary Change, v. 41, p. 309–323.

Kolpin, D.W., Furlong, E.T., Meyer, M.T., Thurman, E.M., Zaugg, S.D., Barber, L.B., and Buxton, H.T., 2002, Pharmaceuticals, hormones and other organic wastewater contaminants in U.S. streams, 1999–2000: Environmental Science & Technology, v. 36, no. 6, p. 1202–1211.

Koterba, M.T., Wilde, F.D., and Lapham, W.W., 1995, Ground-water data-collection protocols and procedures for the National Water-Quality Assessment Program: Collection and documentation of water-quality samples and related data: U.S. Geological Survey Open-File Report 95–399, 113 p.

Kulongoski, J.T. and Belitz, Kenneth, 2004, Ground-water ambient monitoring and assessment program: U.S. Geological Survey Fact Sheet 2004–3088, 2 p.

Kulongoski, J.T., Belitz, Kenneth, and Dawson, B.J., 2006, Ground-water quality data in the North San Francisco Bay Hydrologic Provinces, California, 2004: Results from the California Ground-Water Ambient Monitoring and Assessment (GAMA) Program: U.S. Geological Survey Data Series 167, 100 p.

Kulongoski, J.T., and Belitz, Kenneth, 2007, Ground-water quality data in the Monterey Bay and Salinas Valley Basins, California, 2005—Results from the California GAMA Program: U.S. Geological Survey Data Series 258, 98 p.

Kunkel, Fred, and Chase, G.H., 1969, Geology and ground water in Indian Wells Valley, California: U.S. Geological Survey Open-File Report, 84 p.

Landon, M.K., and Belitz, Kenneth, 2008, Ground-water quality data in the Central Eastside San Joaquin Basin 2006–-Results from the California GAMA Program: U.S. Geological Survey Data Series 325, 88 p.

Lane, S.L., Flanagan, Sarah, and Wilde, F.D., 2003, Selection of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A2. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/Chapter2/Ch2_contents.html*

Lewis, M.E., 2006, Dissolved oxygen (ver. 2.1): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.2. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/Chapter6/Ch6_contents.html*

Lindley, C.E., Stewart, J.T., and Sandstrom, M.W., 1996, Determination of low concentrations of acetochlor in water by automated solid-phase extraction and gas chromatography with mass selective detection: Journal of AOAC International, v. 79, no. 4, p. 962–966.

Madsen, J.E., Sandstrom, M.W., and Zaugg, S.D., 2003, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—A method supplement for the determination of fipronil and degradates in water by gas chromatography/mass spectrometry: U.S. Geological Survey Open-File Report 02–462, 11 p.

Maloney, T.J., 2005, Quality management system, U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Open-File Report 2005–1263, *http://pubs.usgs.gov/of/2005/1263/pdf/OFR2005-1263.pdf*.

Mathany, T.M., Land, M.T., and Belitz, Kenneth, 2008, Ground-water quality data in the Coastal Los Angeles Basin study unit: Results from the California GAMA Program: U.S. Geological Survey Data-Series 387, 98 p.

McCleskey, R.B., Nordstrom, D.K., and Ball, J.W., 2003, Metal interferences and their removal prior to the determination of As(T) and As(III) in acid mine waters by hydride generation atomic absorption spectrometry: U.S. Geological Survey Water-Resources Investigations Report 03–4117, 20 p.

McLain, B., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory - determination of chromium in water by graphite furnace atomic absorption spectrophotometry: U.S. Geological Survey Open-File Report 93-449, 16 p.

Moran, J.E., Hudson, G.B., Eaton, G.F., and Leif, R., 2002, A contamination vulnerability assessment for the Livermore-Amador and Niles Cone Groundwater Basins UCRL-AR-148831, 25 p.

Mueller, D.K., and Titus, C.J., 2005, Quality of nutrient data from streams and ground water sampled during water years 1992–2001: U.S. Geological Survey Scientific Investigations Report 2005–5106, 27 p.

Myers, D.N., 2004, Fecal indicator bacteria (ver. 1.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7.1. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/Chapter7/7.1.html*

National Oceanic and Atmospheric Administrations, 2007, data for the Bishop Airport station URL: *http://cdo.ncdc.noaa.gov/climatenormals/clim20/ca/040822.pdf* and from the Independence station URL: *http://cdo.ncdc.noaa.gov/climatenormals/clim20/ca/044232.pdf*; (accessed March 22, 2007) data for the Inyokern station URL: *http://cdo.ncdc.noaa.gov/climatenormals/clim20/ca/044278.pdf*; (accessed May 17, 2007.

Patton, C.J., and Kryskalla, J.R., 2003, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—evaluation of alkaline persulfate digestion as an alternative to Kjeldahl digestion for determination of total and dissolved nitrogen and phosphorous in water: U.S. Geological Survey Water-Resources Investigations Report 03–4174, 33 p.

Pirkey, K.D., and Glodt, S.R., 1998, Quality control at the U.S. Geological Survey National Water Quality Laboratory: U.S. Geological Survey Fact-Sheet FS-026-98, 4 p., *http://pubs.er.usgs.gov/usgspubs/fs/fs02698*

Radtke, D.B., Davis, J.V., and Wilde, F.D., 2005, Specific electrical conductance (ver. 1.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.3. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/Chapter6/Ch6_contents.html*

Rose, D.L. and Sandstrom, M.W., 2003, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of gasoline oxygenates, selected degradates, and BTEX in water by heated purge and trap/gas chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 03–4079, 31 p.

Rounds, S.A., 2006, Alkalinity and acid neutralizing capacity (ver. 3): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.6. Accessed June 28, 2007 at *http://water.usgs.gov/owq/FieldManual/Chapter6/section6.6/*

Sandstrom, M.W., Stroppel, M.E., Foreman, W.T. and Schroeder, M.P., 2001, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—determination of moderate-use pesticides and selected degradates in water by C-18 solid-phase extraction and gas chromatography/mass spectrometry: U.S. Geological Survey Water-Resources Investigations Report 01–4098, 70 p.

Schmitt, S.J., Fram, M.S., Milby-Dawson, B.J., and Belitz, Kenneth, 2008, Ground-water quality data in the Middle Sacramento Valley study unit, 2006—results from the California GAMA Program: U.S. Geological Survey Data-Series 385, 100 p.

Scott, J.C., 1990, Computerized stratified random site selection approaches for design of a ground-water quality sampling network: U.S. Geological Survey Water-Resources Investigations Report 90–4101, 109 p.

Shelton, J.L., Pimentel, Isabel, Fram, M.S., and Belitz, Kenneth, 2008, Ground-water quality in the Kern County subbasin study unit, 2006—results from the California GAMA Program: U.S. Geological Survey Data Series 337, 75 p.

State Water Resources Control Board, 2003, A comprehensive groundwater quality monitoring program for California: Assembly Bill 599 Report to the Governor and Legislature, March 2003, 100 p. *http://www.waterboards.ca.gov/gama/docs/final_ab_599_rpt_to_legis_7_31_03.pdf*

Stookey, L.L., 1970, FerroZine - a new spectrophotometric reagent for iron: Analytical Chemistry, v. 42, p. 779–781.

Thatcher, L.L., Janzer, V.J., and Edwards, K.W., 1977, Methods for the determination of radioactive substances in water: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A5, 95 p.

Timme, P. J., 1995, National Water Quality Laboratory 1995 services catalog: U.S. Geological Survey Open-File Report 95–352, 120 p.

To, T.B., Nordstrom, D.K., Cunningham, K.M., Ball, J.W., and McCleskey, R.B., 1998, New method for the direct determination of dissolved Fe(III) concentration in acid mine waters: Environmental Science and Technology, v. 33, p. 807–813.

U.S. Environmental Protection Agency, 1980, Prescribed procedures for measurement of radioactivity in drinking water (EPA/600/4-80-032), 6 p.

U.S. Environmental Protection Agency, 1995, Method 524.2, Measurement of purgeable organic compounds in water by capillary column gas chromatography/mass spectrometry: U.S. Environmental Protection Agency EPA/600/R-95-131. Available at *http://www.nemi.gov/*

U.S. Environmental Protection Agency, 1996, Method 8270C—Semivolatile organic compounds by gas chromatography/mass spectrometry (rev. 3). Available at *http://www.nemi.gov/*

U.S. Environmental Protection Agency, 1999a, National Primary Drinking Water Regulations, Radon-222: Federal Register, v. 64, no. 211, p. 59,245–59,294.

U.S. Environmental Protection Agency, 1999b, Method 1625 revision B - semivolatile organic compounds by isotope dilution GC/MS, 40 CFR Part 136, Appendix A. Available at *http://www.nemi.gov/*

U.S. Environmental Protection Agency, 2001, Method 1601—Male-specific (F+) and somatic Coliphage in water by two-step enrichment procedure—April 2000 Draft: U.S. Environmental Protection Agency EPA 821-R-00-009. Available at *http://www.nemi.gov/*

U.S. Environmental Protection Agency, 2002a, Guidelines for establishing procedures for the analysis of pollutants: U.S. Code of Federal Regulations, Title 40, 136 p.

U.S. Environmental Protection Agency, 2002b, Method 1604—Total coliforms and Escherichia coli in water by membrane filtration using a simultaneous detection technique (MI medium): U.S. Environmental Protection Agency EPA 821-R-02-024. Available at *http://www.nemi.gov/*

U.S. Environmental Protection Agency, 2004, National primary drinking water regulations—Analytical method for uranium: U.S. Code of Federal Regulations, Title 40, part 141, revised as of June 2004, p. 31008–31013.

U.S. Environmental Protection Agency, 2006, 2006 Edition of the Drinking Water Standards and Health Advisories: Office of Water EPA 822-R-06-013. Available at *http://www.epa.gov/waterscience/criteria/drinking/dwstandards.pdf*

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1–A9, available online at *http://water.usgs.gov/owq/FieldManual/*

Weiss, R.F., 1968, Piggyback sampler for dissolved gas studies on sealed water samples: Deep Sea Research, v. 15, p. 721–735.

Wilde, F.D., ed., 2004, Cleaning of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/chapter3/Ch3_contents.html*

Wilde, F.D., 2006, Temperature (ver. 2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.1. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/Chapter6/6.1_contents.html*

Wilde, F.D., Busenberg, E., and Radtke, D.B., 2006, pH (ver. 1.3): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.4. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/Chapter6/6.4_contents.html*

Wilde, F.D., and Radtke, D.B., 2005, General information and guidelines (ver. 1.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6.0. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/Chapter6/6.0_contents.html*

Wilde, F.D., Radtke, D.B., Gibs, J., and Iwatsubo, R.T., 1999, Collection of water samples: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/chapter4/html/Ch4_contents.html*

Wilde, F.D., Radtke, D.B., Gibs, J., and Iwatsubo, R.T., 2004, Processing of water samples: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5. Accessed June 28, 2007, at *http://water.usgs.gov/owq/FieldManual/chapter5/html/Ch5_contents.html*

Wright, M.T., Belitz, Kenneth and Burton, C.A., 2005, California GAMA Program; Ground-water quality in the San Diego Drainages hydrogeologic province, California, 2004: U.S. Geological Survey Data Series 129, 102 p.

Zaugg, S.D., Sandstrom, M.W., Smith, S.G., and Fehlberg, K.M., 1995, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of pesticides in water by C-18 solid-phase extraction and capillary-column gas chromatography/mass spectrometry: U.S. Geological Survey Open-File Report 95–181, 60 p.

Zaugg, S.D., Smith, S.G., and Schroeder, M.P., 2006, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of wastewater compounds in whole water by continuous liquid-liquid extraction and capillary-column gas chromatography/mass spectrometry: U.S. Geological Survey Techniques and Methods, book 5, chap. B4, 30 p.

Tables

Table 1. Identification, sampling, and construction information for wells sampled for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[**GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Sampling schedules** are described in *table 2*. Land surface datum (LSD) is a datum plane that is approximately at land surface at each well. The elevation of the LSD is described in feet above the North American Vertical Datum 1988. **Abbreviations:** na, not available]

GAMA well identification No.	Sampling information		Type of well	Construction information (feet below land surface datum)			Elevation of land surface datum (feet above NAVD88)
	Date	Sampling schedule		Well depth	Perforation		
					Top	Bottom	
Grid wells							
OV-01	09-11-06	Intermediate	Production	215	na	na	4,193
OV-02	09-11-06	Slow	Production	126	60	120	4,006
OV-03	09-11-06	Fast	Production	250	50	250	4,269
OV-04	09-11-06	Intermediate	Production	340	na	na	6,270
OV-05	09-12-06	Intermediate	Production	na	na	na	3,760
OV-06	09-12-06	Slow	Production	196	155	196	3,846
OV-07	09-12-06	Intermediate	Production	650	290	650	4,302
OV-08	09-13-06	Intermediate	Production	800	240	800	5,004
OV-09	09-13-06	Intermediate	Production	na	na	na	4,440
OV-10	09-13-06	Slow	Production	na	na	na	4,664
OV-11	09-14-06	Slow	Production	161	121	161	5,844
OV-12	09-14-06	Intermediate	Production	126	96	116	5,974
OV-13	09-18-06	Intermediate	Production	114	69	109	6,139
OV-14	09-19-06	Slow	Production	237	40	220	3,866
OV-15	09-20-06	Intermediate	Monitoring	202	150	180	3,747
OV-16	09-20-06	Intermediate	Production	185	20	130	3,884
OV-17	09-21-06	Intermediate	Monitoring	616	47	322	4,042
OV-18	10-02-06	Intermediate	Production	642	210	640	4,554
OV-19	10-02-06	Intermediate	Production	na	na	na	4,532
OV-20	10-02-06	Fast	Production	na	na	na	4,594
OV-21	10-03-06	Fast	Production	255	140	240	3,857
OV-22	10-03-06	Intermediate	Production	650	300	640	3,910
OV-23	10-03-06	Fast	Production	188	na	na	3,839
OV-24	[1]10-04-06	Intermediate	Production	305	120	300	3,955
OV-25	10-04-06	Slow	Production	390	70	390	3,788
OV-26	10-04-06	Intermediate	Production	128	70	120	na
OV-27	10-05-06	Intermediate	Production	200	100	200	4,122
OV-28	10-05-06	Fast	Production	150	130	150	4,256
OV-29	10-05-06	Fast	Production	200	180	200	5,380
OV-30	10-05-06	Intermediate	Production	388	144	360	na
OV-31	10-16-06	Slow	Production	240	150	180	3,626
OV-32	10-23-06	Intermediate	Production	125	51	108	3,647
OV-33	10-23-06	Intermediate	Monitoring	319	258	298	3,704
OV-34	10-24-06	Intermediate	Monitoring	na	660	700	5,054
OV-35	10-24-06	Intermediate	Monitoring	290	250	290	3,974
OV-36	10-25-06	Intermediate	Production	na	na	na	3,710
OV-37	10-25-06	Intermediate	Production	400	100	390	4,377
OV-38	10-30-06	Fast	Production	232	80	232	4,684
OV-39	11-02-06	Fast	Production	272	55	272	3,740
OV-40	12-11-06	Intermediate	Monitoring	775	644	774	3,563
OIW-01	10-16-06	Intermediate	Production	850	320	830	2,351
OIW-02	10-17-06	Intermediate	Production	480	310	470	2,449

Table 1. Identification, sampling, and construction information for wells sampled for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[**GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Sampling schedules** are described in *table 2*. Land surface datum (LSD) is a datum plane that is approximately at land surface at each well. The elevation of the LSD is described in feet above the North American Vertical Datum 1988. **Abbreviations:** na, not available]

GAMA well identification No.	Sampling information		Type of well	Construction information (feet below land surface datum)			Elevation of land surface datum (feet above NAVD88)
	Date	Sampling schedule		Well depth	Perforation		
					Top	Bottom	
OIW-03	10-17-06	Fast	Production	na	na	na	3,078
OIW-04	10-18-06	Fast	Production	400	320	400	2,466
OIW-05	10-18-06	Intermediate	Production	1,020	560	1,000	2,561
OIW-06	10-18-06	Fast	Production	232	135	181	2,293
OIW-07	10-19-06	Intermediate	Production	620	260	600	2,666
OIW-08	10-30-06	Intermediate	Production	190	na	na	2,306
OIW-09	10-31-06	Intermediate	Spring	na	na	na	2,758
OIW-10	10-31-06	Fast	Production	260	200	260	2,328
OIW-11	12-06-06	Intermediate	Monitoring	77	75	77	2,237
OIW-12	12-07-06	Intermediate	Production	200	100	na	2,256
OIW-13	12-14-06	Fast	Monitoring	70	60	70	2,239
Understanding wells							
OVU-01	09-21-06	Intermediate	Production	590	180	570	3,885
OVU-02	10-04-06	Intermediate	Production	280	na	na	4,001
OVU-03	10-23-06	Intermediate	Monitoring	78	58	78	3,704
OVU-04	10-24-06	Intermediate	Monitoring	138	118	138	3,841
OVU-05	10-24-06	Intermediate	Monitoring	47	27	47	3,841
OVU-06	10-25-06	Intermediate	Monitoring	48	28	48	3,909
OVU-07	10-25-06	Intermediate	Monitoring	390	330	370	3,909
OVU-08	10-26-06	Slow	Production	600	150	600	2,630
OVU-09	10-26-06	Intermediate	Monitoring	41	21	41	3,907
OVU-10	10-26-06	Intermediate	Monitoring	315	275	315	3,909
OVU-11	11-02-06	Fast	Production	91	66	86	4,118
OVU-12	12-11-06	Intermediate	Monitoring	700	na	na	3,563
OVU-13	12-12-06	Intermediate	Monitoring	130	110	130	3,618
OIWU-01	10-17-06	Slow	Production	1,220	600	1,200	2,414
OIWU-02	10-18-06	Intermediate	Production	730	430	730	2,346
OIWU-03	10-19-06	Intermediate	Production	920	600	900	2,423
OIWU-04	11-01-06	Intermediate	Monitoring	690	232	690	2,650
OIWU-05	11-01-06	Intermediate	Monitoring	na	na	na	2,650
OIWU-06	12-13-06	Intermediate	Monitoring	na	na	na	2,212
OIWU-07	12-13-06	Intermediate	Monitoring	215	na	215	2,262
OIWU-08	12-14-06	Fast	Monitoring	150	55	130	2,246

[1] Also sampled 12-14-06.

Table 2. Classes of water-quality indicators, and chemical and microbial constituents collected for the slow, intermediate, and fast well sampling schedules in the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

Analyte classes	Analyte list table	Schedule		
		Slow	Intermediate	Fast
Water-quality indicators				
Dissolved oxygen, temperature, specific conductance		X	X	X
pH, alkalinity		X	X	
Turbidity		X		
Organic constituents				
Volatile organic compounds	*3A*	X	X	X
Gasoline oxygenates and degradates	*3B*	X		
Pesticides and pesticide degradates	*3C*	X	X	X
Wastewater-indicator compounds[1]	*3D*	X	X	
Pharmaceutical compounds[1]	*3E*	X		
Constituents of special interest				
Perchlorate	*3F*	X	X	X
N-Nitrosodimethylamine (NDMA)	*3F*	X	X	
1,2,3-Trichloropropane	*3F*	X	X	
Inorganic constituents				
Nutrients and dissolved organic carbon	*3G*	X	X	X
Major and minor ions and trace elements	*3H*	X	X	X
Species of chromium	*3I*	X	X	X
Species of arsenic and iron	*3I*	X	X	X
Stable isotopes				
Stable isotopes of hydrogen and oxygen in water	*3J*	X	X	X
Stable isotopes of carbon and carbon-14 abundance	*3J*	X	X	
Strontium and boron isotopes[1]	*3J*	X	X	
Radioactivity and gases				
Tritium	*3J*	X	X	X
Tritium and noble gases[1]	*3K*	X	X	X
Uranium isotopes	*3J*	X	X	
Radium isotopes	*3J*	X		
Radon-222	*3J*	X		
Gross alpha and beta radiation	*3J*	X		
Microbial constituents				
Microbial constituents	*3L*	X		

[1] Data not presented in this report.

Table 3A. Volatile organic compounds and gasoline additives, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 2020.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Threshold and threshold values as of April 9, 2008. HAL-US, U.S. Environmental Protection Agency lifetime health advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}. **Abbreviations:** CAS, Chemical Abstract Service; D, detected (*table 5*); LRL, laboratory reporting level; two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed; na, not available; µg/L, microgram per liter; —, not detected]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold		Detection
					Type	Value (µg/L)	
1,1,1,2-Tetrachloroethane	Solvent	77562	630-20-6	0.04	na	na	—
1,1,1-Trichloroethane	Solvent	34506	71-55-6	0.04	MCL-CA	200	—
1,1,2,2-Tetrachloroethane	Solvent	34516	79-34-5	0.10	MCL-CA	1	—
1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113)	Refrigerant	77652	76-13-1	0.04	MCL-CA	1,200	—
1,1,2-Trichloroethane	Solvent	34511	79-00-5	0.04	MCL-CA	5	—
1,1-Dichloroethane	Solvent	34496	75-34-3	0.06	MCL-CA	5	—
1,1-Dichloroethene	Organic synthesis	34501	75-35-4	0.02	MCL-CA	6	—
1,1-Dichloropropene	Organic synthesis	77168	563-58-6	0.04	na	na	—
1,2,3,4-Tetramethylbenzene	Gasoline hydrocarbon	49999	488-23-3	0.14	na	na	—
1,2,3,5-Tetramethylbenzene	Gasoline hydrocarbon	50000	527-53-7	0.12	na	na	—
1,2,3-Trichlorobenzene	Organic synthesis	77613	87-61-6	0.12	na	na	—
1,2,3-Trichloropropane	Solvent/Organic synthesis	77443	96-18-4	0.12	NL-CA	0.005	—
1,2,3-Trimethylbenzene	Gasoline hydrocarbon	77221	526-73-8	0.08	na	na	—
1,2,4-Trichlorobenzene	Solvent	34551	120-82-1	0.12	MCL-CA	5	—
1,2,4-Trimethylbenzene	Gasoline hydrocarbon	77222	95-63-6	0.056, 0.04	NL-CA	330	D
1,2-Dibromo-3-chloropropane (DBCP)	Fumigant	82625	96-12-8	0.50	MCL-US	0.2	—
1,2-Dibromoethane (EDB)	Fumigant	77651	106-93-4	0.04	MCL-US	0.05	—
1,2-Dichlorobenzene	Solvent	34536	95-50-1	0.04	MCL-CA	600	—
1,2-Dichloroethane	Solvent	32103	107-06-2	0.10	MCL-CA	0.5	—
1,2-Dichloropropane	Fumigant	34541	78-87-5	0.02	MCL-US	5	—
1,3,5-Trimethylbenzene	Organic synthesis	77226	108-67-8	0.04	NL-CA	330	—
1,3-Dichlorobenzene	Solvent	34566	541-73-1	0.03, 0.04	HAL-US	600	D
1,3-Dichloropropane	Fumigant	77173	142-28-9	0.06	na	na	—
1,4-Dichlorobenzene	Fumigant	34571	106-46-7	0.04	MCL-CA	5	—
1-Ethyl-2-methylbenzene (*o*-Ethyl toluene)	Gasoline hydrocarbon	77220	611-14-3	0.04	na	na	—
2,2-Dichloropropane	Fumigant	77170	594-20-7	0.06	na	na	—
2-Chlorotoluene	Solvent	77275	95-49-8	0.04	NL-CA	140	—
2-Hexanone	Solvent	77103	591-78-6	0.4	na	na	—
3-Chloro-1-propene	Organic synthesis	78109	107-05-1	0.08	na	na	—
4-Chlorotoluene	Solvent	77277	106-43-4	0.04	NL-CA	140	—
4-Isopropyl-1-methylbenzene	Gasoline hydrocarbon	77356	99-87-6	0.08	na	na	—
Acetone	Solvent	81552	67-64-1	6	na	na	—
Acrylonitrile	Organic synthesis	34215	107-13-1	0.4	RSD5-US	0.6	—
Benzene	Gasoline hydrocarbon	34030	71-43-2	0.021, 0.016	MCL-CA	1	D
Bromobenzene	Solvent	81555	108-86-1	0.02	na	na	—
Bromochloromethane	Fire retardant	77297	74-97-5	0.06	HAL-US	90	—
Bromodichloromethane	Disinfection by-product (THM)	32101	75-27-4	0.028, 0.04	MCL-US[1]	80	D
Bromoform (Tribromomethane)	Disinfection by-product (THM)	32104	75-25-2	0.08	MCL-US[1]	80	—
Carbon disulfide	Organic synthesis	77041	75-15-0	0.038, 0.06	NL-CA	160	D
Carbon tetrachloride (Tetrachloromethane)	Solvent	32102	56-23-5	0.08	MCL-CA	0.5	—
Chlorobenzene	Solvent	34301	108-90-7	0.02	MCL-CA	70	—
Chloroethane	Solvent	34311	75-00-3	0.10	na	na	—
Chloroform (Trichloromethane)	Disinfection by-product (THM)	32106	67-66-3	0.024, 0.04	MCL-US[1]	80	D

Table 3A. Volatile organic compounds and gasoline additives, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 2020.—Continued

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Threshold and threshold values as of April 9, 2008. HAL-US, U.S. Environmental Protection Agency lifetime health advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}. **Abbreviations:** CAS, Chemical Abstract Service; D, detected (*table 5*); LRL, laboratory reporting level; two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed; na, not available; µg/L, microgram per liter; —, not detected]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold		Detection
					Type	Value (µg/L)	
Chloromethane	Refrigerant/organic synthesis	34418	74-87-3	0.10	HAL-US	30	—
cis-1,2-Dichloroethene	Solvent	77093	156-59-2	0.02	MCL-CA	6	—
cis-1,3-Dichloropropene	Fumigant	34704	10061-01-5	0.06	RSD5-US[2]	4	—
Dibromochloromethane	Disinfection by-product (THM)	32105	124-48-1	0.12	MCL-US[1]	80	—
Dibromomethane	Solvent	30217	74-95-3	0.040	na	na	—
Dichlorodifluoromethane (CFC-12)	Refrigerant	34668	75-71-8	0.14	NL-CA	1,000	—
Dichloromethane (Methylene chloride)	Solvent	34423	75-09-2	0.06, 0.04	MCL-US	5	D
Diethyl ether	Solvent	81576	60-29-7	0.08	na	na	—
Diisopropyl ether (DIPE)	Gasoline oxygenate	81577	108-20-3	0.06	na	na	—
Ethyl methacrylate	Organic synthesis	73570	97-63-2	0.14	na	na	—
Ethyl *tert*-butyl ether (ETBE)	Gasoline oxygenate	50004	637-92-3	0.04	na	na	—
Ethylbenzene	Gasoline hydrocarbon	34371	100-41-4	0.02	MCL-CA	300	—
Hexachlorobutadiene	Organic synthesis	39702	87-68-3	0.10	RSD5-US	9	—
Hexachloroethane	Solvent	34396	67-72-1	0.14	HAL-US	1	—
Isopropylbenzene (Cumene)	Gasoline hydrocarbon	77223	98-82-8	0.04	NL-CA	770	—
m- and *p*-Xylene	Gasoline hydrocarbon	85795	108-38-3 / 106-42-3	0.08	MCL-CA[3]	1,750	—
Methyl acrylate	Organic synthesis	49991	96-33-3	0.4	na	na	—
Methyl acrylonitrile	Organic synthesis	81593	126-98-7	0.4	na	na	—
Methyl bromide (Bromomethane)	Fumigant	34413	74-83-9	0.4	HAL-US	10	—
Methyl ethyl ketone (MEK, 2-butanone)	Solvent	81595	78-93-3	1.6	HAL-US	4,000	—
Methyl iodide (Iodomethane)	Organic synthesis	77424	74-88-4	0.40	na	na	—
Methyl isobutyl ketone (MIBK)	Solvent	78133	108-10-1	0.20	NL-CA	120	—
Methyl methacrylate	Organic synthesis	81597	80-62-6	0.20	na	na	—
Methyl *tert*-butyl ether (MTBE)	Gasoline oxygenate	78032	1634-04-4	0.10	MCL-CA	13	D
Methyl *tert*-pentyl ether (*tert*-Amyl methyl ether, TAME)	Gasoline oxygenate	50005	994-05-8	0.04	na	na	—
Naphthalene	Gasoline hydrocarbon	34696	91-20-3	0.4	NL-CA	17	—
n-Butylbenzene	Gasoline hydrocarbon	77342	104-51-8	0.14	NL-CA	260	—
n-Propylbenzene	Solvent	77224	103-65-1	0.04	NL-CA	260	—
o-Xylene	Gasoline hydrocarbon	77135	95-47-6	0.04	MCL-CA[3]	1,750	—
sec-Butylbenzene	Gasoline hydrocarbon	77350	135-98-8	0.04	NL-CA	260	—
Styrene	Gasoline hydrocarbon	77128	100-42-5	0.04	MCL-US	100	—
tert-Butylbenzene	Gasoline hydrocarbon	77353	98-06-6	0.08	NL-CA	260	—
Tetrachloroethene (PCE)	Solvent	34475	127-18-4	0.03, 0.04	MCL-US	5	D
Tetrahydrofuran	Solvent	81607	109-99-9	1.2, 1.0	na	na	D
Toluene	Gasoline hydrocarbon	34010	108-88-3	0.02, 0.18	MCL-CA	150	D
trans-1,2-Dichloroethene	Solvent	34546	156-60-5	0.018	MCL-CA	10	—
trans-1,3-Dichloropropene	Fumigant	34699	10061-02-6	0.10	RSD5-US[2]	4	—
trans-1,4-Dichloro-2-butene	Organic synthesis	73547	110-57-6	0.60	na	na	—
Trichloroethene (TCE)	Solvent	39180	79-01-6	0.02	MCL-US	5	—
Trichlorofluoromethane (CFC-11)	Refrigerant	34488	75-69-4	0.08	MCL-CA	150	—
Vinyl bromide (Bromoethene)	Fire retardant	50002	593-60-2	0.12	na	na	—
Vinyl chloride (Chloroethene)	Organic synthesis	39175	75-01-4	0.08	MCL-CA	0.5	—

[1] The MCL-US, and MCL-CA thresholds for trihalomethanes are the sum of chloroform, bromoform, bromodichloromethane, and dibromochloromethane.

[2] The RSD5 threshold for 1,3-dichloropropene is the sum of its isomers (*cis* and *trans*).

[3] The MCL-CA thresholds for xylenes is the sum of *m*- and *p*-xylene, and *o*-xylene.

Table 3B. Gasoline oxygenates and degradates, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 4024.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level. **Abbreviations:** CAS, Chemical Abstract Service; LRL, laboratory reporting level; na, not available; µg/L, micrograms per liter; —, not detected]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold		Detection
					Type	Value (µg/L)	
Acetone	Solvent/degradate	81552	67-64-1	1.2	na	na	—
Diisopropyl ether	Gasoline oxygenate	81577	108-20-3	0.06	na	na	—
Ethyl *tert*-butyl ether (ETBE)	Gasoline oxygenate	50004	637-92-3	0.04	na	na	—
Methyl acetate	Solvent	77032	79-20-9	0.4	na	na	—
Methyl *tert*-butyl ether (MTBE)	Gasoline oxygenate	78032	1634-04-4	0.04	MCL-US	13	—
Methyl *tert*-pentyl ether	Gasoline oxygenate	50005	994-05-8	0.05	na	na	—
tert-Amyl alcohol	Gasoline oxygenate	77073	75-85-4	0.6	na	na	—
tert-Butyl alcohol (TBA)	Oxygenate/degradate	77035	75-65-0	1	NL-CA	12	—

Table 3C. Pesticides and pesticide degradates, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 2003.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}. **Abbreviations:** D, detected (*table 6*); CAS, Chemical Abstract Service; LRL, laboratory reporting level; two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed; na, not available; µg/L, microgram per liter; —, not detected]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold		Detection
					Type	Value (µg/L)	
1-Naphthol	Insecticide degradate	49295	90-15-3	0.0882	na	na	—[1]
2,6-Diethylaniline	Herbicide degradate	82660	579-66-8	0.006	na	na	—
2-Chloro-2,6-diethylacetanilide	Herbicide degradate	61618	6967-29-9	0.0065	na	na	—
2-Ethyl-6-methylaniline	Herbicide degradate	61620	24549-06-2	0.010	na	na	—
3,4-Dichloroaniline	Herbicide degradate	61625	95-76-1	0.0045	na	na	—
4-Chloro-2-methylphenol	Herbicide degradate	61633	1570-64-5	0.0050	na	na	—[1]
Acetochlor	Herbicide	49260	34256-82-1	0.006	na	na	—
Alachlor	Herbicide	46342	15972-60-8	0.005	MCL-US	2	—
Atrazine	Herbicide	39632	1912-24-9	0.007	MCL-CA	1	D
Azinphos-methyl	Insecticide	82686	86-50-0	0.08	na	na	—
Azinphos-methyl-oxon	Insecticide degradate	61635	961-22-8	0.042	na	na	—[1]
Benfluralin	Herbicide	82673	1861-40-1	0.01	na	na	—
Carbaryl	Insecticide	82680	63-25-2	0.06	RSD5-US	400	—
Chlorpyrifos	Insecticide	38933	2921-88-2	0.005	HAL-US	2	—
Chlorpyrofos, oxygen analog	Insecticide degradate	61636	5598-15-2	0.0562	na	na	—[1]
cis-Permethrin	Insecticide	82687	54774-45-7	0.010	na	na	—
Cyfluthrin	Insecticide	61585	68359-37-5	0.053	na	na	—
Cypermethrin	Insecticide	61586	52315-07-8	0.046	na	na	—[1]
Dacthal (DCPA)	Herbicide	82682	1861-32-1	0.003	HAL-US	70	—
Deethylatrazine (2-Chloro-4-isopropylamino-6-amino-*s*-triazine)	Herbicide degradate	04040	6190-65-4	0.014	na	na	D
Desulfinylfipronil	Insecticide degradate	62170	na	0.012	na	na	—
Desulfinylfipronil amide	Insecticide degradate	62169	na	0.029	na	na	—
Diazinon	Insecticide	39572	333-41-5	0.005	HAL-US	1	—
Diazinon, oxon	Insecticide degradate	61638	962-58-3	0.006	na	na	—
Dichlorvos	Insecticide	38775	62-73-7	0.013	na	na	—[1]
Dicrotophos	Insecticide	38454	141-66-2	0.0843	na	na	—[1]
Dieldrin	Insecticide	39381	60-57-1	0.009	RSD5-US	0.02	—
Dimethoate	Insecticide	82662	60-51-5	0.0061	na	na	—[1]
Ethion	Insecticide	82346	563-12-2	0.016	na	na	—
Ethion monoxon	Insecticide degradate	61644	17356-42-2	0.021	na	na	—
Fenamiphos	Insecticide	61591	22224-92-6	0.029	HAL-US	0.7	—
Fenamiphos sulfone	Insecticide degradate	61645	31972-44-8	0.053	na	na	—
Fenamiphos sulfoxide	Insecticide degradate	61646	31972-43-7	0.040	na	na	—[1]
Fipronil	Insecticide	62166	120068-37-3	0.016	na	na	—
Fipronil sulfide	Insecticide degradate	62167	120067-83-6	0.013	na	na	—
Fipronil sulfone	Insecticide degradate	62168	120068-36-2	0.024	na	na	—
Fonofos	Insecticide	04095	944-22-9	0.006	HAL-US	10	—
Hexazinone	Herbicide	04025	51235-04-2	0.026	HAL-US	400	D
Iprodione	Fungicide	61593	36734-19-7	0.026	na	na	—[1]
Isofenphos	Insecticide	61594	25311-71-1	0.011	na	na	—
Malaoxon	Insecticide degradate	61652	1634-78-2	0.039	na	na	—
Malathion	Insecticide	39532	121-75-5	0.016	HAL-US	100	—

Table 3C. Pesticides and pesticide degradates, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 2003.—Continued

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}. **Abbreviations:** D, detected (*table 6*); CAS, Chemical Abstract Service; LRL, laboratory reporting level; two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed; na, not available; µg/L, microgram per liter; —, not detected]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold		Detection
					Type	Value (µg/L)	
Metalaxyl	Fungicide	61596	57837-19-1	0.0069	na	na	—
Methidathion	Insecticide	61598	950-37-8	0.0087	na	na	—
Metolachlor	Herbicide	39415	51218-45-2	0.01	HAL-US	700	—
Metribuzin	Herbicide	82630	21087-64-9	0.012	HAL-US	70	—
Myclobutanil	Fungicide	61599	88671-89-0	0.033	na	na	—
Paraoxon-methyl	Insecticide degradate	61664	950-35-6	0.019	na	na	—[1]
Parathion-methyl	Insecticide	82667	298-00-0	0.008	HAL-US	1	—
Pendimethalin	Herbicide	82683	40487-42-1	0.02	na	na	—
Phorate	Insecticide	82664	298-02-2	0.02	na	na	—[1]
Phorate oxon	Insecticide degradate	61666	2600-69-3	0.027	na	na	—
Phosmet	Insecticide	61601	732-11-6	0.0079	na	na	—[1]
Phosmet oxon	Insecticide degradate	61668	3735-33-9	0.0511	na	na	—[1]
Prometon	Herbicide	04037	1610-18-0	0.01	HAL-US	100	—
Prometryn	Herbicide	04036	7287-19-6	0.0059	na	na	—
Pronamide (Propyzamide)	Herbicide	82676	23950-58-5	0.004	RSD5-US	20	—
Simazine	Herbicide	04035	122-34-9	0.005, 0.006	MCL-US	4	D
Tebuthiuron	Herbicide	82670	34014-18-1	0.016	HAL-US	500	D
Terbufos	Insecticide	82675	13071-79-9	0.012	HAL-US	0.4	—
Terbufos oxon sulfone	Insecticide degradate	61674	56070-15-6	0.045	na	na	—
Terbuthylazine	Herbicide	04022	5915-41-3	0.0083	na	na	—
Trifluralin	Herbicide	82661	1582-09-8	0.009	HAL-US	10	—

[1]The median matrix-spike recovery was less than 70 percent. Low recoveries may indicate that the compound might not have been detected in some samples if it was present at very low concentrations.

Table 3D. Wastewater-indicator compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 4433.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008. Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}. **Abbreviations:** CAS, Chemical Abstract Service; LRL, laboratory reporting level; na, not available; µg/L, microgram per liter]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold	
					Type	Value (µg/L)
1,4-Dichlorobenzene	Moth repellant, fumigant, deodorant	34571	106-46-7	0.2	MCL-CA	5
1-Methylnaphthalene	Gasoline, diesel fuel, or crude oil	81696	90-12-0	0.2	na	na
2,2',4,4'-Tetrabromodiphenyl ether	Flame retardant	63147	5436-43-1	0.2	na	na
2,6-Dimethylnaphthalene	Diesel/kerosene (trace in gasoline)	62805	581-42-0	0.2	na	na
2-Methylnaphthalene	Gasoline, diesel fuel, or crude oil	30194	91-57-6	0.2	na	na
3,4-Dichlorophenyl isocyanate	Organic synthesis	63145	102-36-3	2	na	na
3-*beta*-Coprostanol	stench in feces	62806	360-68-9	0.8	na	na
3-*beta*-Coprostanol	Carnivore fecal indicator	62806	360-68-9	0.8	na	na
3-Methyl-1(H)-indole (Skatole)	Fragrance, stench in feces and coal tar	62807	83-34-1	0.2	na	na
3-*tert*-Butyl-4-hydroxy anisole (BHA)	Antioxidant, general preservative	61702	25013-16-5	0.2	na	na
4-Cumylphenol	Nonionic detergent metabolite	62808	599-64-4	0.2	na	na
4-*n*-Octylphenol	Nonionic detergent metabolite	62809	1806-26-4	0.2	na	na
4-Nonylphenol diethoxylates	Nonionic detergent metabolite	61703	n/a	3.2	na	na
4-Octylphenol diethoxylates	Nonionic detergent metabolite	61705	n/a	0.32	na	na
4-Octylphenol monoethoxylates	Nonionic detergent metabolite	61706	n/a	1	na	na
4-Octylphenol monoethoxylates	Nonionic detergent metabolite	61706	n/a	1	na	na
4-*tert*-Octylphenol	Nonionic detergent metabolite	62810	140-66-9	0.2	na	na
5-Methyl-1H-benzotriazole	Antioxidant in antifreeze and deicers	61944	136-85-6	1.6	na	na
Acetophenone	Fragrance, flavor in beverages	62811	98-86-2	0.2	na	na
Acetyl hexamethyl tetrahydronaphthalene (AHTN)	Musk fragrance	62812	21145-77-7	0.2	na	na
Anthracene	Wood preservative, combustion product	34220	120-12-7	0.2	na	na
Anthraquinone	Dye/textiles, seed treatment	62813	84-65-1	0.2	na	na
Atrazine	Herbicide	39630	1912-24-9	0.2	MCL-CA	1
Benzo[a]pyrene	Cancer research, combustion product	34247	50-32-8	0.2	MCL-US	0.2
Benzophenone	Fixative for perfumes and soaps	62814	119-61-9	0.2	na	na
beta-Sitosterol	Plant sterol	62815	83-46-5	0.8	na	na
beta-Stigmastanol	Plant sterol	61948	19466-47-8	0.8	na	na
bis(2-Ethylhexyl) phthalate	Plasticiser	39100	117-81-7	2	na	na

Table 3D. Wastewater-indicator compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 4433.—Continued

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008. Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}. **Abbreviations:** CAS, Chemical Abstract Service; LRL, laboratory reporting level; na, not available; µg/L, microgram per liter]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold	
					Type	Value (µg/L)
Bisphenol A	Polycarbonate resins, flame retardant	62816	80-05-7	0.4	na	na
Bromacil	Herbicide	30234	314-40-9	0.2	HAL-US	70
Bromoform (tribromomethane)	Disinfection by-product	32104	75-25-2	0.2	MCL-US	80
Caffeine	Beverages	81436	58-08-2	0.2	na	na
Camphor	Flavor, odorant, ointments	62817	76-22-2	0.2	na	na
Carbaryl	Insecticide, crop and garden uses	39750	63-25-2	0.2	RSD5-US	400
Carbazole	Insecticide, manuf. dyes, explosives, and lubricants	77571	86-74-8	0.2	na	na
Chlorpyrifos	Insecticide, domestic pest and termite control	38932	2921-88-2	0.2	HAL-US	2
Cholesterol	Fecal indicator, plant sterol	62818	57-88-5	0.8	na	na
Cotinine	Primary nicotine metabolite	61945	486-56-6	0.8	na	na
Diazinon	Insecticide	39570	333-41-5	0.2	HAL-US	1
Dichlorvos	Insecticide	30218	62-73-7	0.2	na	na
Diethyl phthalate	Plasticiser, insecticide	34336	84-66-2	0.2	na	na
d-Limonene	Fungicide, antimicrobial, antiviral	62819	5989-27-5	0.2	na	na
Fluoranthene	Component of coal, tar, and asphalt	34376	206-44-0	0.2	na	na
Hexahydrohexamethylcyclopentabenzopyran (HHCB)	Musk fragrance	62823	1222-05-5	0.2	na	na
Indole	Pesticide ingredient, fragrance in coffee	62824	120-72-9	0.2	na	na
Isoborneol	Fragrance in perfumery, in disinfectants	62825	124-76-5	0.2	na	na
Isophorone	Solvent for lacquer, plastic, oil, silicon, resin	34408	78-59-1	0.2	HAL-US	100
Isopropylbenzene	Phenol/acetone, fuels and paint thinner	77223	98-82-8	0.2	NL-CA	770
Isoquinoline	Flavors and fragrances	62826	119-65-3	0.2	na	na
Menthol	Cigarettes, cough drops	62827	89-78-1	0.2	na	na
Metalaxyl	Herbicide, fungicide	4254	57837-19-1	0.2	na	na
Methyl salicylate	Liniment, food, beverage, UV-absorbing lotion	62828	119-36-8	0.2	na	na
Metolachlor	Herbicide	82612	51218-45-2	0.2	HAL-US	700
N,N-diethyl-*meta*-toluamide (DEET)	Insecticide	61947	134-62-3	0.2	na	na
Naphthalene	Fumigant, major component of gasoline	34696	91-20-3	0.2	NL-CA	17
Nonylphenol, monoethoxy- (total)	Nonionic detergent metabolite	61704	n/a	2	na	na
p-Cresol	Wood preservative	77146	106-44-5	0.2	na	na
Pentachlorophenol	Herbicide, fumigant	39032	87-86-5	0.8	MCL-US	1

Table 3D. Wastewater-indicator compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 4433.—Continued

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008. Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; RSD5-US, U.S. Environmental Protection Agency risk specific dose at a risk factor of 10^{-5}. **Abbreviations:** CAS, Chemical Abstract Service; LRL, laboratory reporting level; na, not available; µg/L, microgram per liter]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold	
					Type	Value (µg/L)
Phenanthrene	Explosives, crude oil, combustion product	34461	85-01-8	0.2	na	na
Phenol	Disinfectant, leachate	34694	108-95-2	0.2	HAL-US	2000
p-Nonylphenol (total)	Nonionic detergent metabolite	62829	84852-15-3	1.6	na	na
Prometon	Herbicide	39056	1610-18-0	0.2	HAL-US	100
Pyrene	Component of coal tar and asphalt	34469	129-00-0	0.2	na	na
Tetrachloroethylene (PCE)	Solvent, veterinary anthelmintic	34475	127-18-4	0.4	MCL-US	5
Tributyl phosphate	Antifoaming agent, flame retardant	62832	126-73-8	0.2	na	na
Triclosan	Disinfectant, antimicrobial	61708	3380-34-5	0.2	na	na
Triethyl citrate (ethyl citrate)	Cosmetics, pharmaceuticals	62833	77-93-0	0.2	na	na
Triphenyl phosphate	Plasticizer, flame retardant	62834	115-86-6	0.2	na	na
Tris(2-butoxyethyl)phosphate	Flame retardant	62830	78-51-3	0.2	na	na
Tris(2-chloroethyl)phosphate	Plasticizer, flame retardant	62831	115-96-8	0.2	na	na
Tris(dichlorisopropyl)phosphate	Flame retardant	61707	13674-87-8	0.2	na	na

Table 3E. Pharmaceutical compounds, primary uses or sources, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 2080.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Abbreviations:** CAS, Chemical Abstract Service; LRL, laboratory reporting level; na, not available; µg/L, microgram per liter]

Constituent	Primary use or source	USGS parameter code	CAS number	LRL (µg/L)	Threshold	
					Type	Value (µg/L)
1,7-Dimethylxanthine	Caffeine metabolite	62030	611-59-6	0.1	na	na
Acetaminophen	Analgesic	62000	103-90-2	0.08	na	na
Albuterol	Anti-inflammatory; bronchodilator	62020	18559-94-9	0.04	na	na
Caffeine	Stimulant	50305	58-08-2	0.06	na	na
Carbamazapine	Anticonvulsant; analgesic; mood stabilizer	62793	298-46-4	0.04	na	na
Codeine	Opiod narcotic	62003	76-57-3	0.04	na	na
Cotinine	Nicotine metabolite	62005	486-56-6	0.02	na	na
Dehydronifedipine	Antianginal metabolite	62004	67035-22-7	0.06	na	na
Diltiazem	Antianginal; antihypertensive	62008	42399-41-7	0.04	na	na
Diphenhydramine	Antihistamine	62796	58-73-1	0.02	na	na
Sulfamethoxazole	Antibacterial; antiprotozoal	62021	723-46-6	0.1	na	na
Thiabendazole	Anthelmintic	62801	148-79-8	0.04	na	na
Trimethoprim	Antibacterial	62023	738-70-5	0.01	na	na
Warfarin	Anticoagulant	62024	81-81-2	0.06	na	na

Table 3F. Constituents of special interest, primary uses or sources, comparative thresholds, and reporting information for the Montgomery Watson Harza Laboratory.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; NL-CA, California Department of Public Health notification level. **Abbreviations:** CAS, Chemical Abstract Service; D, detected (*table 7*); na, not available; MRL, minimum reporting level; µg/L, microgram per liter; —, not detected]

Constituent	Primary use or source	CAS number	MRL (µg/L)	Threshold		Detection
				Type	Value (µg/L)	
Perchlorate	Rocket fuel, fireworks, flares	14797-73-0	0.5	NL-CA	6	D
1,2,3-Trichloropropane (TCP)	Industrial solvent, organic synthesis	96-18-4	0.005	HAL-US	40	—
N-Nitrosodimethylamine (NDMA)	Rocket fuel, plasticizer	62-75-9	0.002	NL-CA	0.010	—

Table 3G. Nutrients and dissolved organic carbon, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory schedule 2755 and laboratory code 2613.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008; HAL-US, U.S. Environmental Protection Agency lifetime health advisory level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Abbreviations:** CAS, Chemical Abstract Service; D, detected (*table 8*); LRL**,** laboratory reporting level; two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed. mg/L, milligrams per liter; na, not available]

Constituent	USGS parameter code	CAS number	LRL (mg/L)	Threshold		Detection
				Type	Value (mg/L)	
Ammonia (as nitrogen)	00608	7664-41-7	0.010	HAL-US	30	D
Nitrite (as nitrogen)	00613	14797-65-0	0.002	MCL-US	1	D
Nitrate plus nitrite (as nitrogen)	00631	na	0.060	MCL-US	10	D
Total nitrogen (ammonia, nitrite, nitrate, organic nitrogen)	62854	17778-88-0	0.06	na	na	D
Orthophosphate (as phosphorus)	00671	14265-44-2	0.006	na	na	D
Dissolved organic carbon (DOC)	00681	na	0.33, 0.40	na	na	D

Table 3H. Major and minor ions and trace elements, comparative thresholds, and reporting information for the U.S. Geological Survey National Water Quality Laboratory Schedule 1948.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008; AL-US, U.S. Environmental Protection Agency action level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; NL-CA, California Department of Public Health notification level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. **Abbreviations:** CAS, Chemical Abstract Service; D, detected (*tables 9* and *10*); LRL, laboratory reporting level; two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed. mg/L, milligrams per liter; na, not available; µg/L, micrograms per liter]

Constituent	USGS parameter code	CAS number	LRL	Threshold		Detection
				Type	Value (µg/L)	
Major and minor ions (mg/L)						
Bromide	71870	24959-67-9	0.02	na	na	D
Calcium	00915	7440-70-2	0.02	na	na	D
Chloride	00940	16887-00-6	0.2, 0.12	SMCL-CA	250 (500)[1]	D
Fluoride	00950	16984-48-8	0.10	MCL-CA	2	D
Iodide	78165	7553-56-2	0.002	na	na	D
Magnesium	00925	7439-95-4	0.008, 0.014	na	na	D
Potassium	00935	7440-09-7	0.16, 0.04	na	na	D
Silica	00955	7631-86-9	0.04, 0.18	na	na	D
Sodium	00930	7440-23-5	0.20	na	na	D
Sulfate	00945	14808-79-8	0.18	SMCL-CA	250 (500)[1]	D
Residue on evaporation (total dissolved solids, TDS)	70300	na	10	SMCL-US	500 (1,000)[1]	D
Trace elements (µg/L)						
Aluminum	01106	7429-90-5	1.6	MCL-CA	1,000	D
Antimony	01095	7440-36-0	0.2, 0.06	MCL-US	6	D
Arsenic	01000	7440-38-2	0.12	MCL-US	10	D
Barium	01005	7440-39-3	0.2, 0.08	MCL-CA	1,000	D
Beryllium	01010	7440-41-7	0.06	MCL-US	4	D
Boron	01020	7440-42-8	8	NL-CA	1,000	D
Cadmium	01025	7440-43-9	0.04	MCL-US	5	D
Chromium	01030	7440-47-3	0.04, 0.12	MCL-CA	50	D
Cobalt	01035	7440-48-4	0.04	na	na	D
Copper	01040	7440-50-8	0.4	AL-US	1,300	D
Iron	01046	7439-89-6	6	SMCL-CA	300	D
Lead	01049	7439-92-1	0.08, 0.12	AL-US	15	D
Lithium	01130	7439-93-2	0.6	na	na	D
Manganese	01056	7439-96-5	0.2	SMCL-CA	50	D
Mercury	71890	7439-97-6	0.010	MCL-US	2	D
Molybdenum	01060	7439-98-7	0.4, 0.12	HAL-US	40	D
Nickel	01065	7440-02-0	0.06	MCL-CA	100	D
Selenium	01145	7782-49-2	0.08	MCL-US	50	D
Silver	01075	7440-22-4	0.20,0 .1	SMCL-CA	100	D
Strontium	01080	7440-24-6	0.4	HAL-US	4,000	D
Thallium	01057	7440-28-0	0.04	MCL-US	2	D
Tungsten	01155	7440-33-7	0.06	na	na	D
Uranium	22703	7440-61-1	0.04	MCL-US	30	D
Vanadium	01085	7440-62-2	0.10, 0.04	NL-CA	50	D
Zinc	01090	7440-66-6	0.6	HAL-US	2,000	D

[1]The recommended SMCL-CA thresholds for chloride, sulfate, and TDS are listed with the upper SMCL-CA thresholds in parentheses.

Table 3I. Arsenic, chromium, and iron species, comparative thresholds, and reporting information for the U.S. Geological Survey Trace Metal Laboratory, Boulder, Colorado.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. **Threshold:** Thresholds and threshold values as of April 9, 2008. Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency lifetime health advisory level; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Abbreviations:** CAS, Chemical Abstract Service; D, detected (*table 11*); MDL, method detection level; na, not available; µg/L, micrograms per liter]

Constituent	USGS parameter code	CAS number	MDL (µg/L)	Threshold		Detection
				Type	Level (µg/L)	
Arsenic(III)	99034	22569-72-8	1	na	na	D
Arsenic(total)	99033	7440-38-2	0.5	MCL-US	10	D
Chromium(VI), hexavalent	01032	18540-29-9	1	na	na	D
Chromium(total)	01030	7440-47-3	1	MCL-CA	50	D
Iron(II)	01047	7439-89-6	2	na	na	D
Iron(total)	01046	7439-89-6	2	HAL-US	300	D

Table 3J. Isotopic and radioactive constituents, comparative thresholds, and reporting information for laboratories.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. Thresholds and threshold values as of June 1, 2008. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to more common lighter isotope of that element, relative to a standard reference material. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Other abbreviations:** CAS, Chemical Abstract Service; CSU, 1-sigma combined standard uncertainty; MRL, minimum reporting level; MU, method uncertainty; na, not available; pCi/L, picocuries per liter; ssL_C, sample-specific critical level; D, detected in ground-water samples (*tables 12* and *13*)]

Constituent	USGS parameter code	CAS number	Reporting level type	Reporting level or uncertainty	Threshold type	Threshold value	Detection
Stable isotope ratios (per mil)							
$\delta^{2}H$ of water[1]	82082	na	MU	2	na	na	D
$\delta^{18}O$ of water[1]	82085	na	MU	0.20	na	na	D
$\delta^{13}C$ of dissolved carbonates[2]	82081	na	1-sigma	0.05	na	na	D
Isotope ratios (atom ratio)							
Strontium isotope ratio[3]	75978	na	MU	0.00005	na	na	D
Boron isotope ratio[3]	62648	na	MU	0.00005	na	na	D
Radioactive constituents (percent modern)							
Carbon-14[4]	49933	14762-75-5	MU	0.0015	na	na	D
Radioactive constituents (pCi/L)							
Radon-222[5]	82303	14859-67-7	na	CSU	Prop. MCL-US	[6]300 (4,000)	D
Tritium[7]	07000	10028-17-8	MRL	1	MCL-CA	20,000	D
Tritium[8]	07000	10028-17-8	MRL	0.3	MCL-CA	20,000	D
Gross-alpha radioactivity, 72-hour and 30-day counts[9]	62636, 62639	12587-46-1	ssL_C	CSU	MCL-US	15	D
Gross-beta radioactivity, 72-hour and 30-day counts[9]	62642, 62645	12587-47-2	ssL_C	CSU	MCL-CA	50	D
Radium-226[9]	09511	13982-63-3	ssL_C	CSU	MCL-US	[10]5	D
Radium-228[9]	81366	15262-20-1	ssL_C	CSU	MCL-US	[10]5	D
Uranium-234[9]	22610	13966-29-5	ssL_C	CSU	MCL-CA	[11]20	D
Uranium-235[9]	22620	15117-96-1	ssL_C	CSU	MCL-CA	[11]20	D
Uranium-238[9]	22603	7440-61-1	ssL_C	CSU	MCL-CA	[11]20	D

[1] USGS Stable Isotope Laboratory, Reston, Virginia.

[2] University of Waterloo (contract laboratory).

[3] USGS Metals Isotope Research Laboratory, Menlo Park, California. Results not presented in this report.

[4] University of Arizona, Accelerator Mass Spectrometry Laboratory (contract laboratory).

[5] USGS National Water Quality Laboratory.

[6] Two MCLs have been proposed for Radon-222. The proposed Alternative MCL is in parentheses.

[7] USGS Tritium Laboratory, Menlo Park, California.

[8] Lawrence Livermore National Laboratory.

[9] Eberline Analytical Services (contract laboratory).

[10] The MCL-US threshold for radium is the sum of radium-226 and radium-228.

[11] The MCL-CA threshold for uranium is the sum of uranium-234, uranium-235, and uranium-238.

Table 3K. Noble gases and tritium, comparison thresholds and reporting information for the Lawrence Livermore National Laboratory.

[The five-digit U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. Thresholds and threshold values as of June 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-CA, California Department of Public Health maximum contaminant level. **Other abbreviations:** CAS, Chemical Abstract Service; MU, method uncertainty; na, not available; cm^3 STP/g, cubic centimeters of gas at standard temperature and pressure per gram of water; pCi/L, picocuries per liter]

Constituent	USGS parameter code	CAS number	MU (percent)	Reporting units	Threshold type	Threshold value (pCi/L)
Helium-3/Helium-4	61040	na/7440-59-7	0.75	atom ratio	na	na
Argon	85563	7440-37-1	2	cm^3 STP/g	na	na
Helium-4	85561	7440-59-7	2	cm^3 STP/g	na	na
Krypton	85565	7439-90-9	2	cm^3 STP/g	na	na
Neon	61046	7440-01-09	2	cm^3 STP/g	na	na
Xenon	85567	7440-63-3	2	cm^3 STP/g	na	na
Tritium	07000	10028-17-8	1	pCi/L	MCL-CA	20,000

Table 3L. Microbial constituents, comparison thresholds, and reporting information for the USGS Ohio Microbiology Laboratory parameter codes 90901, 90900, 99335 and 99332.

[The five-digit USGS parameter code is used to uniquely identify a specific constituent or property. Thresholds and threshold values as of March 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists.MCL-US, U.S. Environmental Protection Agency maximum contaminant level; TT-US, U.S. Environmental Protection Agency treatment technique—a required process intended to reduce the level of contamination in drinking water. **Other abbreviations:** MDL, method detection limit; na, not available; mL, milliliters; —, not detected]

Constituent	USGS parameter code	Primary source	MDL	Threshold type	Threshold value	Detection
Escherichia coli[1]	90901	Sewage and animal waste indicator	1 colony/100 mL	TT-US	Zero	—
Total coliform—including fecal coliform and *E. coli*)[1]	90900	Sewage and animal waste indicator	1 colony/100 mL	MCL-US	5 percent of samples positive per month	—
F-specific coliphage	99335	Sewage and animal waste indicator	na	TT-US	99.99 percent killed / inactivated	—
Somatic coliphage	99332	Sewage and animal waste indicator	na	TT-US	99.99 percent killed / inactivated	—

[1]Analyzed in the field.

Table 4. Water-quality indicators in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **GAMA identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** SMCL-CA, California Department of Public Health secondary maximum contaminant level. The upper value is shown in parentheses. SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations:** °C, degrees Celsius; mg/L, milligrams per liter; nc, sample not collected; na, not available; NTU, nephelometric turbidity unit; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; RL, reporting limit; *, value exceeds threshold; **, value exceeds upper threshold]

GAMA identification No.	Turbidity (NTU) (63676)	Dissolved oxygen (mg/L) (00300)	Water temperature (°C) (00010)	pH (standard units) Lab (00403)	pH (standard units) Field (00400)	Specific conductance (µS/cm at 25°C) Lab (90095)	Specific conductance (µS/cm at 25°C) Field (00095)	Alkalinity Lab (mg/L as $CaCO_3$) (29801)	Alkalinity Field (mg/L as $CaCO_3$) (29802)
Threshold type	**na**	**na**	**na**	**SMCL-US**	**SMCL-US**	**SMCL-CA**	**SMCL-CA**	**na**	**na**
Threshold level	**na**	**na**	**na**	**6.5 – 8.5**	**6.5 – 8.5**	**900 (1,600)**	**900 (1,600)**	**na**	**na**
[RL]	**[0.1]**	**[0.2]**	**[0.0 – 38.5]**	**[0-14]**	**[0-14]**	**[5]**	**[5]**	**[1]**	**[1]**
Grid wells									
OV-01	nc	5.4	13.4	7.8	7.7	152	151	70	nc
OV-02	0.2	5.5	16.0	7.0	6.5	127	124	54	47.3
OV-03	nc	nc	na	7.8	na	468	na	128	nc
OV-04	nc	11.1	14.0	7.1	6.8	161	162	74	nc
OV-05	nc	15.6	16.6	6.9	6.6	226	226	100	nc
OV-06	nc	<.2	16.0	8.1	8.0	232	229	97	94.2
OV-07	nc	9.3	12.8	7.0	6.8	160	163	60	nc
OV-08	nc	8.2	17.8	7.3	6.8	209	206	65	nc
OV-09	nc	6.6	15.3	7.1	6.9	261	253	114	nc
OV-10	0.2	6.8	15.0	6.8	6.8	106	100	47	44.2
OV-11	0.2	3.4	17.5	8.2	8.0	235	230	72	68.1
OV-12	nc	12.0	11.4	7.3	6.6	80	80	38	nc
OV-13	nc	6.2	11.1	7.2	7.0	216	212	69	nc
OV-14	nc	6.0	15.5	7.5	7.3	189	186	72	68.8
OV-15	nc	3.9	18.9	*8.6	*8.6	136	135	54	nc
OV-16	nc	5.7	15.9	7.8	7.5	278	275	112	nc
OV-17	0.2	2.4	24.3	7.8	7.7	351	354	115	nc
OV-18	nc	8.4	15.0	8.1	7.9	292	275	117	nc
OV-19	nc	1.8	15.0	7.4	6.8	162	160	76	nc
OV-20	nc	nc	17.0	7.9	7.8	418	404	144	nc
OV-21	nc	7.3	19.0	7.6	7.5	106	105	51	nc
OV-22	nc	8.3	16.0	8.0	7.7	204	201	68	nc
OV-23	nc	7.2	14.5	7.8	7.3	228	225	78	nc
OV-24	nc	2.3	13.5	7.7	7.3	223	214	104	nc
OV-25	0.1	6.2	15.5	7.1	6.6	186	182	74	nc
OV-26	nc	8.3	16.5	7.5	*6.4	138	136	57	nc
OV-27	nc	5.5	17.0	7.7	7.5	807	816	228	nc
OV-28	nc	7.0	17.5	8.0	7.7	366	364	99	nc
OV-29	nc	5.2	15.0	7.8	7.4	376	372	171	nc
OV-30	nc	6.2	20.5	7.5	7.6	524	530	161	nc
OV-31	1.4	3.6	20.5	7.8	7.4	195	195	80	77.2
OV-32	nc	0.2	21.7	7.5	7.4	*1,390	*1,390	494	nc
OV-33	nc	0.5	19.7	7.8	7.3	454	467	218	nc
OV-34	nc	3.8	19.4	7.5	6.7	205	209	97	nc
OV-35	nc	1.6	18.9	6.7	*6.4	*1,090	*1,120	282	nc

Table 4. Water-quality indicators in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **GAMA identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** SMCL-CA, California Department of Public Health secondary maximum contaminant level. The upper value is shown in parentheses. SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations:** °C, degrees Celsius; mg/L, milligrams per liter; nc, sample not collected; na, not available; NTU, nephelometric turbidity unit; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; RL, reporting limit; *, value exceeds threshold; **, value exceeds upper threshold]

GAMA identification No.	Turbidity (NTU) (63676)	Dissolved oxygen (mg/L) (00300)	Water temperature (°C) (00010)	pH (standard units)		Specific conductance (µS/cm at 25°C)		Alkalinity	
				Lab (00403)	Field (00400)	Lab (90095)	Field (00095)	Lab (mg/L as $CaCO_3$) (29801)	Field (mg/L as $CaCO_3$) (29802)
Threshold type	**na**	**na**	**na**	**SMCL-US**	**SMCL-US**	**SMCL-CA**	**SMCL-CA**	**na**	**na**
Threshold level	**na**	**na**	**na**	**6.5 – 8.5**	**6.5 – 8.5**	**900 (1,600)**	**900 (1,600)**	**na**	**na**
[RL]	**[0.1]**	**[0.2]**	**[0.0 – 38.5]**	**[0-14]**	**[0-14]**	**[5]**	**[5]**	**[1]**	**[1]**
OV-36	nc	11.2	18.1	7.5	7.2	486	493	221	nc
OV-37	nc	4.5	12.3	7.7	6.9	111	104	50	nc
OV-38	nc	6.9	15.9	7.3	6.9	578	557	234	nc
OV-39	nc	0.3	18.8	7.6	7.1	675	655	335	nc
OV-40	nc	0.7	28.8	7.2	7.2	**3,090	**3,080	1,610	nc
OIW-01	nc	12.3	31.0	*9.4	*9.4	402	447	144	nc
OIW-02	nc	11.3	na	8.0	7.9	447	475	98	nc
OIW-03	nc	5.5	24.5	*9.8	*9.8	330	343	135	nc
OIW-04	nc	nc	22.5	7.1	nc	*1,440	*1,470	565	nc
OIW-05	nc	15.8	26.5	7.7	7.4	427	459	117	nc
OIW-06	nc	2.1	25.5	7.9	7.8	*1,180	*1,200	83	nc
OIW-07	nc	0.3	28.5	*8.7	*8.7	489	491	96	nc
OIW-08	nc	1.7	23.8	7.4	7.2	*980	*964	244	nc
OIW-09	nc	2.7	22.3	7.0	6.9	*944	*936	216	nc
OIW-10	nc	<0.2	24.2	8.0	7.8	729	735	164	nc
OIW-11	0.1	0.3	24.0	7.7	7.7	**2,100	**1,980	192	nc
OIW-12	nc	11.0	24.0	7.5	7.5	*1,260	*1,220	357	nc
OIW-13	nc	4.3	23.0	7.5	7.5	**4,400	**4,390	97	nc
Understanding wells									
OVU-01	nc	7.5	18.8	7.9	7.8	107	105	48	nc
OVU-02	nc	3.9	20.0	7.7	7.5	*1,060	*1,070	237	nc
OVU-03	nc	0.7	21.3	7.8	7.7	784	800	233	nc
OVU-04	9.2	8.1	18.4	7.8	7.7	91	90	41	nc
OVU-05	nc	0.8	18.4	7.5	7.0	158	158	62	nc
OVU-06	0.3	<.2	16.7	7.8	7.7	458	459	132	nc
OVU-07	0.8	0.5	19.0	7.8	7.7	450	454	194	nc
OVU-08	2	6.0	17.0	*8.9	*9.1	299	296	110	108.0
OVU-09	nc	0.6	15.7	7.4	6.9	425	425	157	nc
OVU-10	nc	0.3	17.3	7.8	7.8	430	429	168	nc
OVU-11	nc	0.7	15.5	7.6	7.5	225	217	106	nc
OVU-12	nc	0.3	31.0	8.3	8.4	**8,900	**8,910	na	nc
OVU-13	nc	0.5	25.5	8.5	*8.7	**3,540	**3,550	1,480	nc

Table 4. Water-quality indicators in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five digit number below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. **GAMA identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** SMCL-CA, California Department of Public Health secondary maximum contaminant level. The upper value is shown in parentheses. SMCL-US, U.S. Environmental Protection Agency secondary maximum contaminant level. **Abbreviations:** °C, degrees Celsius; mg/L, milligrams per liter; nc, sample not collected; na, not available; NTU, nephelometric turbidity unit; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; RL, reporting limit; *, value exceeds threshold; **, value exceeds upper threshold]

GAMA identification No.	Turbidity (NTU) (63676)	Dissolved oxygen (mg/L) (00300)	Water temperature (°C) (00010)	pH (standard units)		Specific conductance (µS/cm at 25°C)		Alkalinity	
				Lab (00403)	Field (00400)	Lab (90095)	Field (00095)	Lab (mg/L as $CaCO_3$) (29801)	Field (mg/L as $CaCO_3$) (29802)
Threshold type	**na**	**na**	**na**	**SMCL-US**	**SMCL-US**	**SMCL-CA**	**SMCL-CA**	**na**	**na**
Threshold level	**na**	**na**	**na**	**6.5 – 8.5**	**6.5 – 8.5**	**900 (1,600)**	**900 (1,600)**	**na**	**na**
[RL]	**[0.1]**	**[0.2]**	**[0.0 – 38.5]**	**[0-14]**	**[0-14]**	**[5]**	**[5]**	**[1]**	**[1]**
OIWU-01	0.2	3.5	30.0	8.2	8.1	331	352	82	80.1
OIWU-02	nc	0.4	30.0	*9.1	*9.0	343	342	106	nc
OIWU-03	nc	1.6	29.7	7.3	8.2	348	361	65	nc
OIWU-04	nc	7.0	27.0	7.7	7.7	477	476	129	nc
OIWU-05	nc	6.5	27.8	7.8	7.7	476	479	128	nc
OIWU-06	nc	0.5	27.0	8.1	8.0	**2,070	**2,100	125	nc
OIWU-07	nc	2.2	25.5	7.8	7.7	773	776	150	nc
OIWU-08	nc	3	21.5	7.5	7.4	*1,280	*1,260	174	nc

Table 5. Volatile organic compounds (VOCs) and gasoline additives detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 74 wells were analyzed, but only samples with detections are listed. Analytes are grouped by primary use or source and listed in descending order of detection frequency in the grid wells within each group. **GAMA identification number:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. LRL: laboratory reporting level, two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed. Threshold and threshold values as of June 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-US, U.S. Environmental Protection Agency maximum contaminant level; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level. **Other abbreviations:** E, estimated value; V, analyte detected in sample and an associated blank, thus data are not included in ground-water quality assessment; µg/L, microgram per liter; —, not detected]

GAMA identification no.	Disinfection by-product		Solvent				Gasoline oxygenate
	Chloroform (µg/L) (32106)	Bromodichloromethane (µg/L) (32101)	Tetrachloroethene (PCE) (µg/L) (34475)	1,3-Dichlorobenzene (µg/L) (34566)	Tetrahydrofuran (µg/L) (81607)	Dichloromethane (µg/L) (34423)	Methyl *tert*-butyl ether (MTBE) (µg/L) (78032)
Threshold type	**MCL-US**	**MCL-US**	**MCL-US**	**HAL-US**		**MCL-US**	**MCL-CA**
Threshold level	**[1]80**	**[1]80**	**5**	**600**		**5**	**13**
[LRL]	**[0.024, 0.04]**	**[0.028, 0.04]**	**[0.03, 0.04]**	**[0.03, 0.04]**	**[1.2, 1]**	**[0.06, 0.04]**	**[0.05, 0.04]**
Grid wells							
OV-01	—	—	—	E0.02	—	—	—
OV-08	0.11	—	—	—	—	—	—
OV-10	E0.03	—	—	—	—	—	—
OV-11	—	—	E0.03	—	—	—	—
OV-16	—	—	0.16	—	—	—	—
OV-18	—	—	—	—	—	—	—
OV-22	0.26	—	—	—	—	—	—
OV-24	—	—	—	—	—	—	0.1
OV-25	E0.02	—	—	—	—	—	—
OV-31	—	—	—	—	—	—	—
OV-32	—	—	—	—	—	—	—
OV-33	—	—	—	—	2	—	—
OV-34	—	—	—	—	—	—	—
OV-35	—	—	—	—	—	—	—
OIW-01	—	—	—	—	—	—	—
OIW-04	—	—	—	—	—	—	—
OIW-09	E0.03	—	—	—	—	—	—
OIW-13	—	—	—	—	—	—	—
Number of detections	5	0	2	1	1	0	1
Detection frequency (percent)	9	0	4	2	2	0	2
Understanding wells							
OVU-08	0.42	—	E0.06	—	—	—	—
OVU-10	—	—	—	—	2	—	—
OVU-12	—	—	—	—	—	—	—
OIWU-02	E0.02	—	—	—	—	—	—
OIWU-07	6.75	—	—	—	—	0.1	—
OIWU-08	E0.06	E0.02	—	—	—	—	—

Table 5. Volatile organic compounds (VOCs) and gasoline additives detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 74 wells were analyzed, but only samples with detections are listed. Analytes are grouped by primary use or source and listed in descending order of detection frequency in the grid wells within each group. **GAMA Identification number:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. LRL: laboratory reporting level, two numbers are shown for constituents if the LRL changed during the time that the data were being analyzed. Threshold and threshold values as of June 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-US, U.S. Environmental Protection Agency maximum contaminant level; HAL-US, U.S. Environmental Protection Agency health advisory level; MCL-CA; California Department of Public Health maximum contaminant level; NL-CA, California Department of Public Health notification level. **Other abbreviations:** E, estimated value; V, analyte detected in sample and an associated blank thus data are not included in ground-water quality assessment; µg/L, microgram per liter; —, not detected]

GAMA identification no.	Sulfide	Gasoline hydrocarbon			Detections per well
	Carbon disulfide (µg/L) (77041)	Benzene (µg/L) (34030)	Toluene (µg/L) (34010)	1,2,4-Trimethyl-benzene (µg/L) (77222)	
Threshold type	**NL-CA**	**MCL-CA**	**MCL-CA**	**NL-CA**	
Threshold level	**160**	**1**	**150**	**330**	
[LRL]	**[0.038, 0.06]**	**[0.021, 0.016]**	**[0.02, 0.018]**	**[0.056, 0.04]**	
Grid wells					
OV-01	—	—	—	—	1
OV-08	—	—	—	—	1
OV-10	—	—	—	—	1
OV-11	—	—	—	—	1
OV-16	—	—	—	—	1
OV-18	—	—	V0.01	—	0
OV-22	—	—	—	—	1
OV-24	—	—	—	—	1
OV-25	—	—	—	V0.02	1
OV-31	—	—	—	V0.06	0
OV-32	—	—	—	V0.11	0
OV-33	—	—	—	—	1
OV-34	0.09	—	—	—	1
OV-35	(E0.04)[2]	—	—	—	0
OIW-01	(E0.03)[2]	—	—	—	0
OIW-04	—	—	—	V0.07	0
OIW-09	—	—	—	—	1
OIW-13	—	—	V0.01	—	0
Number of detections	1	0	0	0	
Detection frequency (percent)	2	0	0	0	[3]21
Understanding wells					
OVU-08	—	—	0.57	V0.02	3
OVU-10	—	—	V0.01	—	1
OVU-12	—	E0.01	—	—	1
OIWU-02	—	—	—	—	1
OIWU-07	0.08	—	V0.01	—	3
OIWU-08	—	E0.04	V0.05	—	3

[1] The MCL-US threshold for trihalomethanes is the sum of chloroform, bromoform, bromodichloromethane, and dibromochloromethane.

[2] Carbon disulfide was not detected in the replicate sample for OIW-01, therefore detections reported at concentrations below the LRL are not included in ground-water quality assessment.

[3] Frequency of detection of at least one VOC in the grid wells. Detections with V remark codes are not included.

Table 6. Pesticides and (or) pesticide degradates detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells except OV-03, OV-20, OV-21, OV-23, OV-28, OV-29 were analyzed, but only samples with detections are listed. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory Level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; MCL-CA; California Department of Public Health maximum contaminant level. **Abbreviations:** E, estimated value; LRL, laboratory reporting level; two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. µg/L, microgram per liter; —, not detected]

GAMA well identification No.	Herbicide				Herbicide degradate	Detections per well
	Simazine (µg/L) (04035)	Atrazine (µg/L) (39632)	Hexazinone (µg/L) (04025)	Tebuthiuron (µg/L) (82670)	Deethylatrazine (µg/L) (04040)	
LRL	**[0.005, 0.006]**	**[0.007]**	**[0.026]**	**[0.016]**	**[0.014]**	
Threshold type	**MCL-US**	**MCL-CA**	**HAL-US**	**HAL-US**	**na**	
Threshold level	**4**	**1**	**400**	**500**	**na**	
Grid wells						
OV-07	E 0.006	—	—	—	—	1
OV-08	—	E 0.006	—	—	—	1
OV-24	E 0 .004	—	—	E 0.01	—	2
OV-30	—	—	E 0.008	—	—	1
Number of detections	3	1	1	1	0	
Detection frequency (percent)	6	2	2	2	0	[1]8
Understanding wells						
OIWU-07	—	E 0.004	—	—	E 0.006	2
Number of detections	0	1	0	0	1	2

[1]Frequency of detection of at least one pesticide in the grid wells.

Table 7. Constituents of special interest: perchlorate, *N*-nitrosodimethylamine (NDMA), and trichloropropane (1,2,3-TCP) detected in the ground-water samples collected in the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all 74 wells were analyzed for perchlorate, samples from the 59 intermediate and slow wells were sampled for NDMA and 1,2,3-TCP were analyzed; only wells with at least one detection are listed. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory. Some previous reports in this series used the NL-CA of 0.005 µg/L as the comparison threshold. NL-CA, California Department of Public Health notification level. **Abbreviations:** MRL, method reporting limit; —, analyzed but not detected]

GAMA well identification No.	Percholorate (µg/L) (61209)	*N*-Nitroso-dimethylamine (NDMA) (µg/L) (64176)	1,2,3-Trichloro-propane (µg/L) (77443)
Threshold type	**NL-CA**	**NL-CA**	**HAL-US**
Threshold level	**6**	**0.01**	**40**
MRL	**[0.5]**	**[0.002]**	**[0.005]**
Grid wells			
OV-05	0.51	na	na
OIW-08	0.87	na	na
OIW-10	0.64	na	na
Number of detections	3	0	0
Detection frequency based on 53 grid wells (percentage)	6	—	—
Understanding wells			
OIWU-04	0.64	—	—

Table 8. Nutrients and dissolved organic carbon detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were anlayzed. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. LRL, laboratory reporting level, two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. **Abbreviations:** E, estimated value; mg/L, milligram per liter; na, not available; —, not detected]

GAMA well identification No.	Ammonia, as nitrogen (mg/L) (00608)	Nitrite plus nitrate, as nitrogen (mg/L) (00631)	Nitrite, as nitrogen (mg/L) (00613)	Total nitrogen (nitrate + nitrite + ammonia + organic-nitrogen) as nitrogen (mg/L) (62854)	Orthophosphate, as phosphorous (mg/L) (00671)	Dissolved organic carbon (DOC) (mg/L) (00681)
LRL	**0.01**	**0.06**	**0.002**	**0.06**	**0.006**	**0.33, 0.4**
Threshold type	**HAL-US**	**MCL-US**	**MCL-US**	**na**	**na**	**na**
Threshold level	**30**	**10**	**1**	**na**	**na**	**na**
			Grid wells			
OV-01	≤0.008	0.38	—	0.38	0.021	E0.2
OV-02[1]	—	0.51	—	0.49	0.024	—
OV-03	≤0.006	0.12	—	0.15	0.014	—
OV-04	≤0.007	0.38	—	0.38	0.037	E0.3
OV-05	≤0.005	1.00	—	1.01	0.025	E0.2
OV-06	0.029	—	—	—	0.082	—
OV-07	—	0.16	—	0.19	0.019	0.3
OV-08	—	1.38	—	1.45	0.027	—
OV-09	—	0.93	—	0.97	0.059	0.4
OV-10	—	0.14	—	0.14	0.015	—
OV-11[1]	—	2.33	—	2.23	0.013	E0.2
OV-12	≤0.011	0.13	—	0.17	0.031	E0.2
OV-13	≤0.005	0.25	—	0.26	0.008	E0.2
OV-14	—	0.49	—	0.49	0.029	E0.2
OV-15[1]	—	0.27	—	0.25	0.030	E0.2
OV-16	—	0.88	—	0.93	0.075	0.3
OV-17[1]	—	0.17	—	0.15	0.028	—
OV-18	—	0.73	—	0.74	0.016	E0.2
OV-19	—	0.09	—	≤0.10	0.026	0.5
OV-20[1]	—	1.83	—	1.74	0.011	—
OV-21[1]	—	0.10	—	0.09	0.050	—
OV-22[1]	≤0.010	0.21	—	0.20	0.020	—
OV-23	—	0.39	—	0.41	0.051	—
OV-24	—	0.48	—	0.49	0.020	E0.2
OV-25	—	0.25	—	0.25	0.022	0.4
OV-26	≤0.010	1.53	—	1.57	0.012	E0.2
OV-27	—	1.18	—	1.22	0.015	E0.3
OV-28	—	0.31	—	0.31	0.020	—
OV-29	—	0.45	—	0.45	0.017	—
OV-30	—	0.95	—	0.97	0.019	E0.2
OV-31[1]	—	0.15	—	0.14	0.023	—
OV-32	1.04	≤0.04	0.002	1.13	0.102	E0.2

Table 8. Nutrients and dissolved organic carbon detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were anlayzed. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. LRL, laboratory reporting level, two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. **Abbreviations:** E, estimated value; mg/L, milligram per liter; na, not available; —, not detected]

GAMA well identification No.	Ammonia, as nitrogen (mg/L) (00608)	Nitrite plus nitrate, as nitrogen (mg/L) (00631)	Nitrite, as nitrogen (mg/L) (00613)	Total nitrogen (nitrate + nitrite + ammonia + organic-nitrogen) as nitrogen (mg/L) (62854)	Orthophosphate, as phosphorous (mg/L) (00671)	Dissolved organic carbon (DOC) (mg/L) (00681)
LRL	**0.01**	**0.06**	**0.002**	**0.06**	**0.006**	**0.33, 0.4**
Threshold type	**HAL-US**	**MCL-US**	**MCL-US**	**na**	**na**	**na**
Threshold level	**30**	**10**	**1**	**na**	**na**	**na**
OV-33	0.121	—	E0.002	0.19	0.169	1.2
OV-34	—	0.26	—	0.30	0.023	E0.2
OV-35[1]	E0.014	0.18	E0.002	0.17	—	E0.2
OV-36	—	0.10	—	0.10	0.054	E0.3
OV-37	—	0.29	—	0.32	0.012	—
OV-38	—	0.14	—	0.16	0.036	—
OV-39	E0.017	—	—	≤ 0.07	0.046	—
OV-40	2.24	—	—	2.56	0.211	2.9
OIW-01	0.207	0.79	0.023	1.00	0.034	—
OIW-02	—	1.78	—	1.79	0.014	—
OIW-03	—	1.11	—	1.37	0.017	—
OIW-04	—	1.21	—	1.22	0.046	—
OIW-05[1]	—	1.80	—	1.74	0.025	—
OIW-06[1]	—	1.25	—	1.24	0.013	—
OIW-07	E0.018	1.45	0.006	1.50	0.018	E0.2
OIW-08	—	1.25	—	1.26	0.062	—
OIW-09	—	0.17	—	0.21	0.013	E0.4
OIW-10	—	—	—	≤ 0.06	0.016	—
OIW-11	0.294	—	—	0.34	0.038	1.1
OIW-12	—	0.29	0.005	0.32	0.029	—
OIW-13	—	0.40	—	0.40	0.042	—
			Understanding wells			
OVU-01[1]	—	0.16	—	0.15	0.041	E0.2
OVU-02	1.11	E0.05	E0.002	1.42	0.033	1.2
OVU-03	1.37	—	—	1.56	0.198	0.9
OVU-04[1]	—	0.07	—	≤0.05	0.068	E0.2
OVU-05[1]	—	E0.05	—	≤0.04	0.032	E0.2
OVU-06	0.680	—	—	0.73	0.187	0.7
OVU-07	0.349	—	—	0.40	0.072	0.4
OVU-08	—	1.47	—	1.57	0.133	E0.2
OVU-09	—	—	—	≤0.04	0.037	1.1
OVU-10	1.24	—	E0.001	1.29	0.101	0.4

Table 8. Nutrients and dissolved organic carbon detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were anlayzed. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. LRL, laboratory reporting level, two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. **Abbreviations:** E, estimated value; mg/L, milligram per liter; na, not available; —, not detected]

GAMA well identification No.	Ammonia, as nitrogen (mg/L) (00608)	Nitrite plus nitrate, as nitrogen (mg/L) (00631)	Nitrite, as nitrogen (mg/L) (00613)	Total nitrogen (nitrate + nitrite + ammonia + organic-nitrogen) as nitrogen (mg/L) (62854)	Orthophosphate, as phosphorous (mg/L) (00671)	Dissolved organic carbon (DOC) (mg/L) (00681)
LRL	**0.01**	**0.06**	**0.002**	**0.06**	**0.006**	**0.33, 0.4**
Threshold type	**HAL-US**	**MCL-US**	**MCL-US**	**na**	**na**	**na**
Threshold level	**30**	**10**	**1**	**na**	**na**	**na**
OVU-11	—	0.30	—	0.31	0.030	—
OVU-12	14.5	—	E0.005	17.1	2.830	14.6
OVU-13	1.05	—	—	1.25	0.261	1.8
OIWU-01	—	2.75	—	2.78	0.011	—
OIWU-02	0.022	0.96	E0.002	0.99	0.018	E0.2
OIWU-03	—	1.32	0.004	1.35	0.013	—
OIWU-04	—	2.02	—	2.05	0.031	E0.2
OIWU-05	—	2.16	—	2.20	0.015	—
OIWU-06	0.318	—	—	0.33	0.023	—
OIWU-07	≤0.0012	1.07	E0.001	1.31	0.019	5.8
OIWU-08	—	1.07	—	1.14	0.031	—

[1]Total nitrogen in these samples is less than the sum of the filtered nitrogen analytes, but falls within the USGS National Water Quality Laboratory acceptance criterion of a 10 percent relative percent difference.

Table 9. Major and minor ions and dissolved solids detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** MCL-CA, California Department of Public Health maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. The SMCL-CA for chloride, sulfate, and total dissolved solids have recommended and upper threshold values. The upper value is shown in parentheses. **Abbreviations:** E, estimated value; LRL, laboratory reporting level; mg/L, milligrams per liter; —, not detected; na, not available; *, value exceeds recommended threshold; **, value exceeds upper threshold]

GAMA well identification No.	Calcium (mg/L) (00915)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)
LRL	**0.02**	**0.008, 0.014**	**0.16, 0.04**	**0.2**	**0.02**	**0.2, 0.12**
Threshold type	**na**	**na**	**na**	**na**	**na**	**SMCL-CA**
Threshold level	**na**	**na**	**na**	**na**	**na**	**250 (500)**
Grid wells						
OV-01	19.2	2.34	2.19	6.32	—	0.82
OV-02	13.6	2.03	1.43	8.51	E0.01	4.34
OV-03	44.2	6.14	4.09	42.3	0.03	8.23
OV-04	12.9	1.22	4.62	16.9	0.02	1.27
OV-05	23.2	3.53	2.18	17.0	E0.02	3.31
OV-06	24.0	4.92	2.69	15.2	E0.01	3.25
OV-07	17.6	3.39	2.13	8.16	E0.01	0.88
OV-08	22.4	2.48	1.72	17.3	E0.01	3.33
OV-09	28.5	5.36	2.51	15.5	0.02	2.62
OV-10	11.5	1.84	1.31	5.45		0.52
OV-11	19.9	3.31	1.99	18.9	0.04	13.0
OV-12	8.2	1.36	1.35	5.13	—	0.96
OV-13	16.6	2.40	1.85	22.1	E0.01	9.55
OV-14	18.1	4.34	1.33	12.6	E0.01	3.74
OV-15	6.94	.30	0.83	20.5	E0.01	3.86
OV-16	22.6	7.37	3.44	21.2	0.03	9.06
OV-17	24.4	1.63	4.24	43.9	0.03	11.7
OV-18	43.2	4.23	4.43	8.49	0.03	4.40
OV-19	16.3	2.52	1.76	13.3	E0.01	1.47
OV-20	55.8	5.61	5.08	19.6	0.07	13.4
OV-21	9.62	2.26	1.14	8.18	—	1.03
OV-22	17.5	2.85	1.42	19.6	E0.01	9.22
OV-23	23.1	4.82	4.68	13.2	E0.01	7.38
OV-24	26.3	6.53	2.92	9.03	—	2.95
OV-25	19.6	2.78	2.19	13.8	E0.01	6.97
OV-26	16.9	2.97	2.68	4.71	E0.01	0.96
OV-27	85.4	14.8	8.34	64.6	0.08	24.4
OV-28	51.6	5.59	5.03	10.6	E0.02	2.80
OV-29	44.5	6.70	5.75	24.1	E0.01	4.82
OV-30	51.8	16.4	5.24	34.3	0.05	7.82
OV-31	16.6	1.33	2.07	20.9	E0.01	1.91
OV-32	36.0	66.2	28.2	151	0.18	109
OV-33	36.7	14.4	4.94	38.0	0.03	19.4
OV-34	18.1	4.40	1.85	17.5	E0.02	3.15
OV-35	47.2	9.03	8.46	154	0.09	127
OV-36	42.8	16.2	2.26	34.1	0.06	17.6
OV-37	13.4	2.28	1.93	5.63	—	1.70
OV-38	67.9	14.8	2.73	30.2	0.05	9.90
OV-39	22.3	7.49	3.34	122	0.02	14.8
OV-40	23.4	55.0	19.5	650	0.23	139

Table 9. Major and minor ions and dissolved solids detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** MCL-CA, California Department of Public Health maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. The SMCL-CA for chloride, sulfate, and total dissolved solids have recommended and upper threshold values. The upper value is shown in parentheses. **Abbreviations:** E, estimated value; LRL, laboratory reporting level; mg/L, milligrams per liter; —, not detected; na, not available; *, value exceeds recommended threshold; **, value exceeds upper threshold]

GAMA well identification No.	Calcium (mg/L) (00915)	Magnesium (mg/L) (00925)	Potassium (mg/L) (00935)	Sodium (mg/L) (00930)	Bromide (mg/L) (71870)	Chloride (mg/L) (00940)
LRL	**0.02**	**0.008, 0.014**	**0.16, 0.04**	**0.2**	**0.02**	**0.2, 0.12**
Threshold type	**na**	**na**	**na**	**na**	**na**	**SMCL-CA**
Threshold level	**na**	**na**	**na**	**na**	**na**	**250 (500)**
OIW-01	3.35	0.60	1.52	81.5	0.09	25.5
OIW-02	26.7	4.06	2.25	56.4	0.14	34.8
OIW-03	1.01	0.05	0.22	68.6	0.10	8.16
OIW-04	151.0	62.2	10.4	83.5	0.24	75.6
OIW-05	32.3	5.33	2.08	45.3	0.13	27.0
OIW-06	51.0	15.3	5.98	140	0.46	*255
OIW-07	12.5	2.44	1.77	83.4	0.17	72.9
OIW-08	43.1	11.0	3.07	147	0.16	58.7
OIW-09	101	21.20	2.97	70.3	0.13	43.6
OIW-10	16.8	3.91	2.53	126	0.18	80.4
OIW-11	105	32.6	16.5	262	0.62	219
OIW-12	48.7	38.0	15.3	154	0.29	104
OIW-13	218	115	28.7	432	2.17	**1,320
			Understanding wells			
OVU-01	11.4	1.87	0.90	8.0	—	0.95
OVU-02	111	26.80	7.91	76	0.57	104
OVU-03	55.2	23.20	5.56	72.6	0.14	80.1
OVU-04	8.86	2.20	0.98	5.7	—	0.74
OVU-05	16.6	2.83	1.92	9.89	—	0.90
OVU-06	25.1	4.47	6.87	66.8	0.03	13.4
OVU-07	29.9	6.98	5.31	52.5	0.03	18.4
OVU-08	12.1	0.46	5.04	49.5	0.03	5.79
OVU-09	28.8	7.05	2.96	49.0	0.06	22.8
OVU-10	28.4	6.21	3.35	47.5	E0.02	16.0
OVU-11	28.9	4.96	3.06	8.21	—	1.79
OVU-12	3.71	6.07	40.5	2,140	2.75	**1,280
OVU-13	1.90	2.40	34.8	839	0.54	*259
OIWU-01	23.9	0.55	2.14	43.1	0.10	23.3
OIWU-02	10.0	2.68	1.80	57.3	0.10	26.5
OIWU-03	24.2	1.10	2.06	39.8	0.11	36.4
OIWU-04	39.0	5.55	1.93	53.7	0.14	26.1
OIWU-05	39.4	5.28	2.01	54.0	0.14	27.4
OIWU-06	33.1	7.64	12.2	348	0.80	**506
OIWU-07	49.8	15.50	10.9	83.3	0.15	43.1
OIWU-08	94.1	22.50	8.44	127	0.56	172

Table 9. Major and minor ions and dissolved solids detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** MCL-CA, California Department of Public Health maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. The SMCL-CA for chloride, sulfate, and total dissolved solids have recommended and upper threshold values. The upper value is shown in parentheses. **Abbreviations:** E, estimated value; LRL, laboratory reporting level; mg/L, milligrams per liter; —, not detected; na, not available; *, value exceeds recommended threshold; **, value exceeds upper threshold]

GAMA well identification No.	Fluoride (mg/L) (00950)	Iodide (mg/L) (71865)	Silica (mg/L) (00955)	Sulfate (mg/L) (00945)	Total dissolved solids (TDS) (mg/L) (70300)
LRL	**0.10**	**0.002**	**0.04, 0.018**	**0.18**	**10**
Threshold type	**MCL-CA**	**na**	**na**	**SMCL-CA**	**SMCL-CA**
Threshold level	**2.00**	**na**	**na**	**250 (500)**	**500 (1,000)**
		Grid wells			
OV-01	E0.09	—	30.8	5.36	112
OV-02	0.15	—	28.3	3.66	100
OV-03	0.48	—	22.0	92.0	294
OV-04	0.10	—	65.1	5.92	150
OV-05	0.26	—	23.3	8.78	149
OV-06	0.62	0.006	29.6	16.7	162
OV-07	0.15	—	21.8	16.3	113
OV-08	0.77	—	22.3	32.7	154
OV-09	0.65	—	36.7	11.9	175
OV-10	0.10	—	23.9	5.3	76
OV-11	1.63	E0.001	21.0	10.5	152
OV-12	0.11	—	22.2	2.2	52
OV-13	0.22	—	13.0	22.6	119
OV-14	0.16	—	24.8	14.9	142
OV-15	0.28	—	28.1	8.77	100
OV-16	0.25	E0.001	33.0	14.6	182
OV-17	0.95	—	74.0	40.9	270
OV-18	0.19	—	38.2	23.3	201
OV-19	0.30	0.002	35.6	4.81	123
OV-20	0.62	—	44.8	40.4	283
OV-21	0.14	—	33.6	3.12	87
OV-22	E0.06	—	22.0	17.9	134
OV-23	0.52	—	24.7	21.4	139
OV-24	0.11	E0.001	23.6	7.1	146
OV-25	E0.10	—	24.8	9.72	122
OV-26	E0.09	—	25.6	6.02	100
OV-27	0.19	E0.001	55.8	160	*579
OV-28	0.64	—	46.7	77.4	277
OV-29	1.33	—	45.2	17.7	254
OV-30	0.24	—	57.8	99.9	383
OV-31	0.74	—	34.0	15.4	150
OV-32	1.17	0.076	54.2	108	*839
OV-33	0.86	0.020	69.6	E0.14	298
OV-34	0.25	E0.002	42.3	5.39	144
OV-35	0.50	0.088	42.2	72.6	*672
OV-36	0.42	0.022	36.2	18.1	297
OV-37	0.22	—	24.9	5.82	84
OV-38	0.45	—	31.1	58.2	363
OV-39	*2.90	0.014	36.3	11	435
OV-40	1.52	0.115	94.2	42.5	**2,030

Table 9. Major and minor ions and dissolved solids detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code is used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** MCL-CA, California Department of Public Health maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. The SMCL-CA for chloride, sulfate, and total dissolved solids have recommended and upper threshold values. The upper value is shown in parentheses. **Abbreviations:** E, estimated value; LRL, laboratory reporting level; mg/L, milligrams per liter; —, not detected; na, not available; *, value exceeds recommended threshold; **, value exceeds upper threshold]

GAMA well identification No.	Fluoride (mg/L) (00950)	Iodide (mg/L) (71865)	Silica (mg/L) (00955)	Sulfate (mg/L) (00945)	Total dissolved solids (TDS) (mg/L) (70300)
LRL	**0.1**	**0.002**	**0.04, 0.018**	**0.18**	**10**
Threshold type	**MCL-CA**	**na**	**na**	**SMCL-CA**	**SMCL-CA**
Threshold level	**2.0**	**na**	**na**	**250 (500)**	**500 (1,000)**
OIW-01	1.10	0.036	25.7	17.5	253
OIW-02	0.77	E0.001	31.8	58.6	296
OIW-03	0.92	0.004	23.2	10.7	208
OIW-04	0.84	—	37.1	152	*938
OIW-05	0.93	—	38.5	46	288
OIW-06	0.54	0.013	36.1	63.6	*701
OIW-07	0.81	0.046	35.1	28.8	298
OIW-08	1.23	0.008	42.2	160	*643
OIW-09	1.19	0.009	39.0	212	*633
OIW-10	1.27	0.065	29.9	68.7	441
OIW-11	0.63	0.074	62.8	*492	**1,400
OIW-12	0.81	0.062	46.2	140	*769
OIW-13	0.29	E0.006	74.3	52	**2,550
			Understanding wells		
OVU-01	0.14	—	29.7	5.61	84
OVU-02	0.62	0.050	52.1	167	*709
OVU-03	0.84	0.056	65.7	59.2	*507
OVU-04	0.16	—	30.4	3.96	78
OVU-05	0.43	—	23.1	14.8	101
OVU-06	0.45	0.012	51.8	71.3	315
OVU-07	1.10	0.027	55.9	14.7	296
OVU-08	*2.75	E0.001	36.0	20.4	210
OVU-09	0.77	0.022	32.5	24.8	272
OVU-10	0.86	0.019	44.6	28.2	282
OVU-11	E0.09	—	32.5	7.31	147
OVU-12	*2.60	0.545	89.5	2.37	**5,940
OVU-13	*2.69	0.160	27.9	139	**2,310
OIWU-01	0.43	E0.002	33.1	32.7	228
OIWU-02	0.82	0.020	33.9	21.5	224
OIWU-03	0.80	0.015	28.1	36.8	217
OIWU-04	0.94	—	31.4	58.6	303
OIWU-05	0.93	—	31.9	58.7	311
OIWU-06	*2.10	0.236	71.1	68.8	**1,190
OIWU-07	0.95	0.016	61.5	169	*541
OIWU-08	0.49	0.008	54.6	211	*845

Table 10. Trace elements detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists; AL-US; U.S. Environmental Protection Agency action level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; NL-CA, California Department of Public Health notification level; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. LRL, laboratory reporting level, two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. **Abbreviations:** E, estimated value; µg/L, micrograms per liter; —, not detected; na, not available; *, value exceeds threshold]

GAMA well identification No.	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Cobalt (µg/L) (01035)
LRL	**1.6**	**0.2, 0.06**	**0.12**	**0.2, 0.08**	**0.06**	**8**	**0.04**	**0.04, 0.12**	**0.04**
Threshold type	**MCL-CA**	**MCL-US**	**MCL-US**	**MCL-CA**	**MCL-US**	**NL-CA**	**MCL-US**	**MCL-CA**	**na**
Threshold level	**1,000**	**6**	**10**	**1,000**	**4**	**1,000**	**5**	**50**	**na**
Grid wells									
OV-01	E1.4	—	2.5	8	—	14	—	0.26	—
OV-02	—	—	0.17	20	—	23	—	0.12	—
OV-03	E1.5	—	2.3	18	—	143	—	0.29	—
OV-04	—	—	0.45	4	E0.04	17	—	≤0.08	—
OV-05	—	—	0.20	21	—	166	E0.02	0.11	E0.02
OV-06	E1.1	—	3.5	11	—	59	0.05	≤0.05	E0.03
OV-07	—	—	0.46	11	—	29	—	0.28	E0.02
OV-08	E1.3	—	1.6	13	—	23	0.04	0.84	—
OV-09	—	—	0.27	102	—	21	E0.02	0.19	—
OV-10	—	—	0.18	10	—	E 4	—	0.15	—
OV-11	≤0.9	—	1.9	28	—	29	E0.03	0.30	—
OV-12	—	—	1.6	5	—	14	E0.02	≤0.06	—
OV-13	—	—	0.51	7	—	260	—	0.22	—
OV-14	≤1.0	—	1.7	13	—	100	—	0.34	E0.02
OV-15	16.7	E0.12	4.5	3	—	38	—	3.1	—
OV-16	4.7	—	1.5	8	—	141	—	0.43	—
OV-17	1.7	0.28	*10.3	21	—	273	E0.02	0.73	E0.03
OV-18	2.2	0.14	1.8	135	—	35	E0.02	1.1	—
OV-19	E1.1	—	3.7	14	—	44	—	≤0.08	0.14
OV-20	1.8	0.20	4.7	86	—	103	E0.02	1.6	—
OV-21	E1.6	—	0.34	10	—	16	—	0.28	—
OV-22	2.0	0.12	0.54	14	—	237	—	0.71	0.04
OV-23	3.2	E0.05	1.9	5	—	234	E0.09	0.79	—
OV-24	≤1.0	—	0.47	17	—	33	—	0.61	E0.02
OV-25	E1.1	0.10	0.57	9	—	141	—	0.13	—
OV-26	E1.1	—	0.42	12	—	14	—	0.26	—
OV-27	1.9	0.09	1.9	45	—	494	—	1.1	E0.02
OV-28	2.4	0.19	5.1	37	—	27	E0.02	0.71	—
OV-29	1.8	0.32	3.5	90	—	97	—	2.5	—
OV-30	1.7	0.09	3.0	64	—	107	—	0.87	—
OV-31	E1.5	0.07	3.7	18	—	84	—	0.44	—
OV-32	≤0.8	0.3	*62.5	57	—	*2,750	E0.02	0.17	E0.02
OV-33	E1.2	—	1.0	55	—	271	E0.02	0.49	0.04
OV-34	E1.4	—	0.3	14	—	99	—	≤0.07	0.64
OV-35	—	E0.04	*13.9	59	—	*2,910	E0.02	0.17	2.00
OV-36	—	—	0.76	73	—	426	E0.02	0.56	E0.02
OV-37	—	E0.03	1.2	4	—	15	—	0.25	—
OV-38	—	E0.03	0.26	93	—	120	—	0.21	—
OV-39	1.6	E0.05	4.4	3	—	*1,600	0.11	≤0.07	E0.02

Table 10. Trace elements detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists; AL-US; U.S. Environmental Protection Agency action level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; NL-CA, California Department of Public Health notification level; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. LRL, laboratory reporting level, two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. **Abbreviations:** E, estimated value; µg/L, micrograms per liter; —, not detected; na, not available; *, value exceeds threshold]

GAMA well identification No.	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	Mercury (µg/L) (71890)	Molybdenum (µg/L) (01060)	Nickel (µg/L) (01065)
LRL	**0.4**	**6**	**0.08, 0.12**	**0.6**	**0.2**	**0.01**	**0.4, 0.12**	**0.06**
Threshold type	**AL-US**	**SMCL-CA**	**AL-US**	**na**	**SMCL-CA**	**MCL-US**	**HAL-US**	**MCL-CA**
Threshold level	**1,300**	**300**	**15**	**na**	**50**	**2**	**40**	**100**
Grid wells—Continued								
OV-01	≤0.28	—	≤0.33	8.0	—	—	3.0	0.13
OV-02	1.0	E5	1.47	6.7	—	—	1.6	0.06
OV-03	≤0.63	—	1.56	18.0	E0.1	—	5.4	0.81
OV-04	1.3	—	≤0.54	5.8	—	—	1.7	—
OV-05	6.7	15	7.31	9.9	1.2	—	4.9	0.21
OV-06	—	32	≤0.20	2.2	*142	—	*43.7	E0.05
OV-07	2.7	—	1.88	.7	0.2	—	3.5	0.07
OV-08	0.77	E 4	1.59	1.9	E0.1	—	25.7	—
OV-09	1.3	11	≤0.66	4.3	E0.1	—	5.8	0.11
OV-10	2.8	—	≤0.43	1.3	—	—	6.8	E0.04
OV-11	—	—	≤0.20	13.1	—	—	14.5	—
OV-12	1.2	14	≤0.26	4.1	1	—	2.5	0.08
OV-13	≤0.30	35	≤0.09	12.5	0.4	—	4.9	—
OV-14	1.3	—	≤0.43	3.0	—	—	3.5	—
OV-15	—	—	—	2.4	—	—	5.0	—
OV-16	≤0.49	—	≤0.06	5.7	2.9	—	4.0	0.08
OV-17	—	—	—	69.2	—	—	10.5	0.06
OV-18	—	—	≤0.11	4.2	—	—	6.9	≤0.03
OV-19	≤0.45	130	≤0.11	10.8	*93.7	≤0.009	3.7	0.13
OV-20	1.1	—	≤0.08	21.2	0.9	—	9.5	0.06
OV-21	1.6	—	≤0.75	1.1	—	—	3.7	E0.04
OV-22	2.7	—	≤0.72	.8	—	—	1.3	E0.04
OV-23	2.9	—	≤0.53	2.2	—	—	33.2	0.07
OV-24	2.9	9	≤0.68	1.9	5.8	≤0.010	1.8	0.08
OV-25	3.6	8	6.46	12.7	E0.4	—	2.5	E0.05
OV-26	1.5	—	≤0.55	2.2	0.2	≤0.014	2.6	≤0.03
OV-27	≤0.64	E 3	1.18	20.0	0.4	—	2.7	E0.04
OV-28	≤0.31	—	≤0.14	8.5	0.3	—	11.2	E0.05
OV-29	3.1	—	2.91	45.8	0.2	≤0.007	5.3	E0.04
OV-30	1.4	—	1.04	13.9	0.3	—	2.6	0.04
OV-31	≤0.20	7	≤0.56	59.8	0.7	—	1.2	0.08
OV-32	1.3	15	≤0.27	707	46.0	—	6.1	1.1
OV-33	≤0.22	154	≤0.09	94.8	*174	—	14.7	≤0.41
OV-34	—	195	—	40.0	*151	—	1.0	0.79
OV-35	—	*12,300	≤0.13	459	*474	—	17.2	2.3
OV-36	1.2	—	≤0.48	24.7	0.3	≤0.011	11.7	0.08
OV-37	≤0.56	E 3	≤0.61	6.9	—	—	6.8	—
OV-38	≤0.62	E 3	≤0.49	1.2	—	—	7.1	0.17
OV-39	0.76	268	≤0.08	188	18.4	—	*65.0	0.07

Table 10. Trace elements detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists; AL-US; U.S. Environmental Protection Agency action level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; NL-CA, California Department of Public Health notification level; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. LRL, laboratory reporting level, two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. **Abbreviations:** E, estimated value; µg/L, micrograms per liter; —, not detected; na, not available; *, value exceeds threshold]

GAMA well identification No.	Selenium (µg/L) (01145)	Silver (µg/L) (01075)	Strontium (µg/L) (01080)	Thallium (µg/L) (01057)	Tungsten (µg/L) (01155)	Uranium (µg/L) (22703)	Vanadium (µg/L) (01085)	Zinc (µg/L) (01090)
LRL	**0.08**	**0.2, 0.1**	**0.4**	**0.04**	**0.06**	**0.04**	**0.1, 0.04**	**0.6**
Threshold type	**MCL-US**	**SMCL-CA**	**HAL-US**	**MCL-US**	**na**	**MCL-US**	**NL-CA**	**SMCL-CA**
Threshold level	**50**	**100**	**4,000**	**2**	**na**	**30**	**50**	**5,000**
Grid wells—Continued								
OV-01	0.17	—	79.7	—	1.3	6.82	4.3	2.9
OV-02	—	—	112	—	0.27	0.47	1.8	29.8
OV-03	0.2	—	338	—	6.5	3.58	1.1	3.6
OV-04	0.18	—	75.9	—	0.41	2.48	1.3	11.3
OV-05	0.32	—	241	—	≤0.06	9.91	1.3	20.8
OV-06	—	—	131	—	14.4	0.68	5.9	≤0.39
OV-07	0.12	—	116	—	0.14	1.25	1.5	14.1
OV-08	0.71	—	119	—	9.0	*41.1	8.8	2.4
OV-09	E0.04	—	234	—	1.2	5.79	3.0	4.4
OV-10	0.13	—	60.6	—	0.29	0.31	2.0	3.4
OV-11	0.42	—	125	—	6.0	10.8	3.2	2.5
OV-12	—	—	106	—	≤0.06	1.15	1.1	13.6
OV-13	0.09	—	107	—	≤0.05	8.46	0.98	4.1
OV-14	0.13	—	148	—	0.26	2.14	3.4	1.6
OV-15	0.13	—	64.8	—	2.2	2.33	19.0	—
OV-16	0.21	—	158	—	1.6	5.51	9.9	1.8
OV-17	0.77	—	233	—	10.5	4.39	5.7	—
OV-18	1.6	—	118	—	0.74	24.5	1.9	—
OV-19	—	—	172	—	0.15	11.1	3.0	24.3
OV-20	1.7	—	246	—	1.2	*37.4	4.7	2.4
OV-21	E0.06	—	91.6	—	0.32	1.28	4.8	15.3
OV-22	0.1	—	157	—	0.12	2.41	4.8	1.4
OV-23	0.27	—	127	—	2.4	6.91	17.4	3.1
OV-24	0.17	—	123	—	0.12	8.72	2.9	6.2
OV-25	0.22	—	162	—	≤0.10	1.55	1.1	21.9
OV-26	0.33	—	67.3	—	0.16	1.00	4.1	9.2
OV-27	1.1	—	783	—	0.76	11.9	1.5	1.4
OV-28	0.51	—	165	—	5.5	10.5	5.2	20.3
OV-29	0.31	—	384	—	≤0.08	*30.6	8.2	5.1
OV-30	0.5	—	737	—	0.54	3.33	2.9	1.9
OV-31	0.15	—	271	—	0.27	1.61	0.96	7.9
OV-32	0.61	—	1,330	0.10	5.1	.94	2.4	25.0
OV-33	—	—	224	—	27.9	E0.03	0.16	3.6
OV-34	0.13	—	185	—	0.63	6.47	4.2	≤0.60
OV-35	0.36	—	536	—	—	11.0	1.3	≤0.90
OV-36	E0.07	—	370	—	0.12	9.26	9.7	1.6
OV-37	0.26	—	63	—	1.0	2.66	2.2	2.6
OV-38	0.11	—	445	—	0.60	15.3	5.0	4.2
OV-39	—	—	350	—	2.9	12.5	1.8	28.8

Table 10. Trace elements detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

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GAMA well identification No.	Aluminum (µg/L) (01106)	Antimony (µg/L) (01095)	Arsenic (µg/L) (01000)	Barium (µg/L) (01005)	Beryllium (µg/L) (01010)	Boron (µg/L) (01020)	Cadmium (µg/L) (01025)	Chromium (µg/L) (01030)	Cobalt (µg/L) (01035)
LRL	**1.6**	**0.2, 0.06**	**0.12**	**0.2, 0.08**	**0.06**	**8**	**0.04**	**0.04, 0.12**	**0.04**
Threshold type	**MCL-CA**	**MCL-US**	**MCL-US**	**MCL-CA**	**MCL-US**	**NL-CA**	**MCL-US**	**MCL-CA**	**na**
Threshold level	**1,000**	**6**	**10**	**1,000**	**4**	**1,000**	**5**	**50**	**na**
					Grid wells—Continued				
OV-40	—	—	0.28	179	—	*8,490	—	—	E0.06
OIW-01	11.5	0.31	8.8	3	—	472	E0.12	0.24	—
OIW-02	1.6	0.09	2.1	31	—	194	—	1.1	—
OIW-03	22.2	0.19	*16.3	0.25	—	193	—	26.5	—
OIW-04	≤0.9	0.21	7.1	82	—	211	E0.06	0.61	0.06
OIW-05	≤0.8	E0.09	2.6	54	—	262	—	0.67	—
OIW-06	12.4	1.21	4.0	54	—	*1,040	—	0.25	—
OIW-07	2.0	0.54	9.7	11	—	502	—	0.13	—
OIW-08	2.0	E0.03	3.3	64	—	819	0.04	1.1	—
OIW-09	—	—	1.3	32	—	222	0.07	0.71	E0.02
OIW-10	2.3	E0.03	1.4	24	—	*1,790	—	0.12	—
OIW-11	E1.5	E0.05	3.0	8	—	*1,780	E0.02	0.09	—
OIW-12	1.6	0.41	9.2	43	—	*2,940	—	0.09	0.10
OIW-13	4.8	0.16	*62.3	144	—	*14,600	—	6.3	—
					Understanding wells				
OVU-01	≤0.9	—	0.43	10	—	9	—	0.17	—
OVU-02	E1.5	E0.04	*18.6	100	—	377	—	≤0.07	0.32
OVU-03	E1.1	—	4.4	131	—	567	E0.02	1.1	0.04
OVU-04	E1.4	—	0.35	7	—	36	—	0.51	—
OVU-05	≤1.0	E0.04	E0.11	9	—	37	E0.02	0.79	—
OVU-06	2.4	0.11	2.0	52	—	388	E0.02	0.67	0.12
OVU-07	E1.5	0.11	4.7	29	—	377	—	1.2	0.05
OVU-08	8.1	0.16	*10.5	13	—	118	E0.02	1.2	—
OVU-09	E1.1	0.56	2.2	29	—	882	0.04	0.82	0.04
OVU-10	E1.3	0.07	4.4	63	—	389	E0.02	0.4	0.09
OVU-11	5.2	E0.03	2.5	19	—	17	—	0.7	—
OVU-12	17.3	—	1.8	366	—	*37,100	—	—	0.32
OVU-13	7.9	0.18	*513	76	0.09	*10,400	0.07	E0.11	0.08
OIWU-01	2.0	0.08	2.2	27	—	182	—	4.4	—
OIWU-02	4.2	0.32	*12.6	13	—	348	—	0.23	—
OIWU-03	2.9	0.07	3.7	19	—	156	E0.02	0.45	—
OIWU-04	2.7	E0.04	1.9	47	—	251	E .02	1.2	0.08
OIWU-05	E1.5	E0.04	1.6	55	—	257	—	1.1	E0.02
OIWU-06	—	—	8.0	E 4	—	*4,300	—	—	—
OIWU-07	15.6	0.84	*29.9	2	—	317	0.23	—	—
OIWU-08	—	0.25	*14.2	58	—	*1,200	E 0 .02	1.3	E0.03

Table 10. Trace elements detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

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GAMA well identification No.	Copper (µg/L) (01040)	Iron (µg/L) (01046)	Lead (µg/L) (01049)	Lithium (µg/L) (01130)	Manganese (µg/L) (01056)	Mercury (µg/L) (71890)	Molybdenum (µg/L) (01060)	Nickel (µg/L) (01065)
LRL	**0.4**	**6**	**0.08, 0.12**	**0.6**	**0.2**	**0.01**	**0.4, 0.12**	**0.06**
Threshold type	**TT-US**	**SMCL-CA**	**TT-US**	**na**	**SMCL-CA**	**MCL-US**	**HAL-US**	**MCL-CA**
Threshold level	**1,300**	**300**	**15**	**na**	**50**	**2**	**40**	**100**
Grid wells—Continued								
OV-40	≤0.40	297	≤0.32	1,560	*74.5	—	3.8	2.5
OIW-01	—	—	≤0.49	77.4	0.7	—	5.0	E0.05
OIW-02	0.70	E4	≤0.63	20.6	0.4	≤0.006	15.6	E0.04
OIW-03	≤0.54	38	≤0.48	12.8	0.9	—	3.9	≤0.03
OIW-04	6.9	—	1.80	142	E0.2	—	21.5	0.46
OIW-05	≤0.36	—	1.05	18.3	—	0.018	15.5	—
OIW-06	≤0.46	15	0.94	151	0.6	≤0.015	9.6	E0.04
OIW-07	—	8	≤0.18	67.7	1.2	0.021	4.5	—
OIW-08	—	15	≤0.59	64.8	0.5	—	36.4	0.35
OIW-09	—	E 3	—	56.8	4.8	≤0.011	*42.9	0.29
OIW-10	—	25	≤0.68	52.9	23.2	≤0.007	8.6	—
OIW-11	—	25	—	174	3.5	—	12.2	0.23
OIW-12	E0.23	42	≤0.06	263	*64.3	—	17.5	0.30
OIW-13	E0.48	—	—	1,070	—	—	3.0	2.8
Understanding wells—Continued								
OVU-01	1.3	E5	1.70	1.4	—	—	1.1	0.09
OVU-02	—	*937	≤0.11	34.8	*313	—	2.8	0.49
OVU-03	—	235	≤0.12	184	*191	—	13.2	0.26
OVU-04	≤0.44	—	—	1.1	0.6	≤0.015	2.0.	0.19
OVU-05	1.1	—	—	2.2	E0.2	—	17.2	0.25
OVU-06	0.94	66	≤0.08	37.0	*119	—	9.3	0.15
OVU-07	—	16	—	42.6	*199	≤0.013	5.5	0.15
OVU-08	≤0.26	10	≤0.41	12.8	0.7	—	18.5	0.08
OVU-09	1.6	—	≤0.06	5.2	4.7	≤0.011	21.0	0.44
OVU-10	≤0.41	94	—	21.4	*141	—	6.8	0.46
OVU-11	≤0.26	E 5	≤0.62	3.0	—	—	3.4	≤0.03
OVU-12	—	33	≤0.36	441	5.7	—	1.3	0.40
OVU-13	≤0.24	22	≤0.35	2,080	15.3	—	37.9	0.36
OIWU-01	—	—	≤0.16	22.7	0.2	—	3.4	≤0.03
OIWU-02	≤0.51	—	≤0.15	70.2	—	≤0.016	5.2	—
OIWU-03	≤0.45	—	≤0.81	16.6	0.3	≤0.016	13.1	0.06
OIWU-04	≤0.39	—	—	15.8	0.5	≤0.007	8.4	0.33
OIWU-05	—	—	—	15.9	—	—	7.9	0.25
OIWU-06	—	13	—	741	—	—	—	—
OIWU-07	—	*355	—	145	*204	—	*118	0.52
OIWU-08	≤0.27	25	—	80.0	0.6	—	3.7	0.36

Table 10. Trace elements detected in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were analyzed. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists; AL-US; U.S. Environmental Protection Agency action level; HAL-US, U.S. Environmental Protection Agency Lifetime Health Advisory; NL-CA, California Department of Public Health notification level; MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. LRL, laboratory reporting level, two numbers are shown for constituents if the LRL changed during time that the data were being analyzed. **Abbreviations:** E, estimated value; µg/L, micrograms per liter; —, not detected; na, not available; *, value exceeds threshold]

GAMA well identification No.	Selenium (µg/L) (01145)	Silver (µg/L) (01075)	Strontium (µg/L) (01080)	Thallium (µg/L) (01057)	Tungsten (µg/L) (01155)	Uranium (µg/L) (22703)	Vanadium (µg/L) (01085)	Zinc (µg/L) (01090)
LRL	**0.08**	**0.2, 0.1**	**0.4**	**0.04**	**0.06**	**0.04**	**0.1, 0.04**	**0.6**
Threshold type	**MCL-US**	**SMCL-CA**	**HAL-US**	**MCL-US**	**na**	**MCL-US**	**NL-CA**	**SMCL-CA**
Threshold level	**50**	**100**	**4,000**	**2**	**na**	**30**	**50**	**5,000**
Grid wells—Continued								
OV-40	—	—	730	—	73.5	0.22	0.26	9.4
OIW-01	0.18	—	91.8	—	3.4	2.39	10.9	≤1.0
OIW-02	0.62	—	242	—	0.32	2.26	20.3	4.9
OIW-03	3.0	—	7.7	—	10.7	3.37	*134	7.7
OIW-04	0.79	—	1,120	—	1.1	*64.4	22.8	14.9
OIW-05	0.59	—	316	—	0.23	5.05	13.8	≤1.1
OIW-06	1.1	E0.1	2,360	—	0.35	6.56	8.8	≤0.64
OIW-07	0.37	—	329	—	2.0	3.54	10.8	—
OIW-08	1.3	—	480	—	4.7	11.9	33.5	8.7
OIW-09	0.72	—	986	—	1.2	16.3	11.2	≤0.52
OIW-10	—	—	372	—	1.6	1.28	4.8	2.5
OIW-11	E0.05	—	2,790	—	2.0	1.37	0.1	≤0.39
OIW-12	0.17	—	823	0.04	6.3	23.5	11.9	19.6
OIW-13	E1.3	—	*4,830	—	0.30	1.6	12.4	12.3
Understanding wells—Continued								
OVU-01	E0.06	—	77.1	—	≤0.10	3.02	3.5	1.5
OVU-02	—	—	1,020	—	23.7	1.22	1.1	≤0.30
OVU-03	—	—	468	—	34.5	0.33	0.24	≤0.53
OVU-04	E0.05	—	87.5	—	0.26	0.72	4.4	≤0.46
OVU-05	0.12	—	112	—	0.22	2.34	2.80	≤0.76
OVU-06	—	—	126	—	19.1	0.11	0.46	≤0.37
OVU-07	—	—	374	—	31.6	0.64	1.2	≤0.44
OVU-08	0.53	—	87.8	—	46.3	13.0	13.2	≤0.52
OVU-09	0.08	—	165	—	0.81	20.9	9.0	2.0
OVU-10	—	—	272	—	16.8	0.06	0.14	≤0.44
OVU-11	0.32	—	112	—	1.7	9.99	6.6	6.3
OVU-12	E0.2	—	334	—	579	E0.08	1.5	4.6
OVU-13	—	—	350	—	125	4.15	0.23	9.4
OIWU-01	0.64	—	430	—	≤0.11	3.11	14.9	—
OIWU-02	0.23	—	266	—	2.4	2.80	18.1	—
OIWU-03	0.41	—	373	—	0.25	1.44	21.3	≤0.89
OIWU-04	0.8	—	410	—	1.5	8.12	13.5	≤0.04
OIWU-05	0.76	—	429	—	0.46	8.75	13.4	—
OIWU-06	—	—	2,450	—	27.5	—	—	—
OIWU-07	1.4	E0.3	802	—	0.48	20.3	9.3	6.4
OIWU-08	8.5	—	1,780	—	0.83	13.7	14.1	15.3

Table 11. Species of inorganic arsenic, iron, and chromium in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. Data shown here were analyzed at the USGS Trace Metal Laboratory in Boulder, Colorado, and are not stored in the USGS NWIS database. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Thresholds and threshold values as of April 9, 2008. Information about analytes given in *table 3I*. Samples from all wells were analyzed; only wells with at least one detection are listed. Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. **Abbreviations:** MDL, method detection level; µg/L, micrograms per liter; na, not available; —, not detected*, value exceeds threshold]

GAMA well identification No.	Iron (µg/L) (01046)	Iron (II) (µg/L) (01047)	Arsenic (µg/L) (99033)	Arsenic (III) (µg/L) (99034)	Chromium (µg/L) (01030)	Chromium (VI) (µg/L) (01032)
Threshold type	**SMCL-CA**	**na**	**MCL-US**	**na**	**MCL-CA**	**na**
Threshold level	**300**	**na**	**10**	**na**	**50**	**na**
[MDL]	**[2]**	**[2]**	**[0.5]**	**[1]**	**[1]**	**[1]**
Grid wells						
OV-01	≤3	—	1.7	—	—	—
OV-02	8	5	—	—	—	—
OV-03	≤4	≤2	1.8	—	—	—
OV-04	≤2	—	—	—	—	—
OV-05	16	11	—	—	—	—
OV-06	32	27	2.4	1.8	—	—
OV-07	≤4	≤2	0.92	—	—	—
OV-08	6	≤3	0.73	—	—	—
OV-09	5	—	—	—	—	—
OV-11	≤2	—	1.6	—	—	—
OV-12	17	8	0.79	—	—	—
OV-13	38	33	0.73	—	—	—
OV-14	≤2	≤2	1.4	—	—	—
OV-15	≤3	≤2	3.7	—	2	2
OV-16	—	—	1.4	—	—	—
OV-17	≤3	≤2	8.4	—	—	—
OV-18	≤3	—	1.4	—	—	2
OV-19	126	84	3.1	—	—	—
OV-20	≤3	—	3.7	—	1	1
OV-23	6	≤3	1.7	—	—	—
OV-24	13	9	—	—	—	—
OV-25	8	4	1.5	—	—	—
OV-26	—	—	0.55	—	—	—
OV-27	≤4	≤2	1.6	—	—	—
OV-28	—	—	3	—	—	—
OV-29	—	—	2.8	—	2	2
OV-30	≤4	≤3	2.3	—	—	—
OV-31	≤4	—	1.8	—	—	—
OV-32	18	7	*47	1.8	—	—
OV-33	156	96	—	—	1	—
OV-34	208	193	—	—	—	—
OV-35	*12,800	12,400	*12	4.5	—	—
OV-36	7	4	—	—	—	—
OV-37	≤4	≤3	—	—	—	—
OV-38	≤4	≤3	—	—	—	—
OV-39	256	106	3.6	—	—	—
OV-40	*323	323	—	—	—	—

Table 11. Species of inorganic arsenic, iron, and chromium in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey (USGS) parameter code is used to uniquely identify a specific constituent or property. Data shown here were analyzed at the USGS Trace Metal Laboratory in Boulder, Colorado, and are not stored in the USGS NWIS database. Values less than or equal to concentrations measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Thresholds and threshold values as of April 9, 2008. Information about analytes given in *table 3I*. Samples from all wells were analyzed; only wells with at least one detection are listed. Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level; SMCL-CA, California Department of Public Health secondary maximum contaminant level. **Abbreviations:** MDL, method detection level; µg/L, micrograms per liter; na, not available; —, not detected*, value exceeds threshold]

GAMA well identification No.	Iron (µg/L) (01046)	Iron (II) (µg/L) (01047)	Arsenic (µg/L) (99033)	Arsenic (III) (µg/L) (99034)	Chromium (µg/L) (01030)	Chromium (VI) (µg/L) (01032)
Threshold type	**SMCL-CA**	**na**	**MCL-US**	**na**	**MCL-CA**	**na**
Threshold level	**300**	**na**	**10**	**na**	**50**	**na**
[MDL]	**[2]**	**[2]**	**[0.5]**	**[1]**	**[1]**	**[1]**
OIW-01	≤2	≤2	7.6	—	—	—
OIW-02	≤4	—	2.7	—	1	1
OIW-03	9	—	8.8	—	28	28
OIW-04	—	—	5.9	—	—	—
OIW-05	5	—	2	—	—	—
OIW-06	19	5	4.5	—	—	—
OIW-07	8	—	8.3	—	—	—
OIW-08	19	11	2.7	—	—	—
OIW-09	7	7	0.58	—	—	—
OIW-10	27	6	—	—	—	—
OIW-11	29	28	2.8	1.7	—	—
OIW-12	43	13	7.2	—	—	—
OIW-13	≤4	≤3	*43	—	7	6
Number of detections					7	7
Detection frequency based on 53 grid wells (percentage)					13	13
			Understanding wells			
OVU-02	*923	734	*16	13	—	—
OVU-03	238	231	3.5	3	—	—
OVU-04	≤3	≤3	—	—	—	—
OVU-05	5	4	—	—	—	—
OVU-06	64	58	1.1	—	—	—
OVU-07	21	17	3.7	—	1	—
OVU-08	11	4	7.9	—	1	—
OVU-09	≤4	4	1.6	—	—	—
OVU-10	99	94	4.5	4.5	—	—
OVU-11	5	4	1.6	—	—	—
OVU-12	39	39	1	1.7	—	—
OVU-13	27	26	*420	370	—	—
OIWU-01	—	—	1.5	—	7	6
OIWU-02	≤4	≤3	*10	—	—	—
OIWU-03	—	—	3	—	—	—
OIWU-04	5	≤3	1.8	—	—	—
OIWU-05	≤3	≤3	0.69	—	—	—
OIWU-06	15	14	5.9	5.1	1	—
OIWU-07	*340	182	*19	—	—	—
OIWU-08	5	≤3	10	—	1	1

Table 12. Results for analyses of stable isotope ratios, and tritium and carbon-14 activities in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were analyzed for stable isotopes of hydrogen and oxygen of water and tritium; samples from the 9 slow wells and the 50 intermediate wells were analyzed for carbon. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to more common lighter isotope of that element, relative to a standard reference material. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Abbreviations:** na, not available; nc, not collected; pCi/L, picocuries per liter]

GAMA well identification No.	$\delta^{2}H$ (per mil) (82082)	$\delta^{18}O$ (per mil) (82085)	Tritium (pCi/L) (07000)	$\delta^{13}C$ (per mil) (82081)	Carbon-14 (percent modern) (49933)
Threshold type	**na**	**na**	**MCL-CA**	**na**	**na**
Threshold level	**na**	**na**	**20,000**	**na**	**na**
Grid wells					
OV-01	–125	–16.66	19.8	–17.00	112.8
OV-02	–122	–16.32	14.7	–15.86	107.8
OV-03	–126	–16.86	1.6	nc	nc
OV-04	–130	–17.42	1.9	–15.12	97.20
OV-05	–115	–15.45	17.6	–12.45	108.1
OV-06	–123	–16.87	<1	–9.39	26.56
OV-07	–119	–16.23	17.9	–15.88	112.4
OV-08	–128	–17.24	2.9	–14.97	88.64
OV-09	–133	–17.64	3.2	–14.95	110.2
OV-10	–122	–16.44	18.6	–15.57	111.5
OV-11	–133	–17.60	1.6	–13.42	77.90
OV-12	–117	–15.65	16.6	–14.34	110.6
OV-13	–120	–15.96	13.8	–12.78	71.94
OV-14	–119	–15.98	19.8	–14.43	110.0
OV-15	–124	–16.70	<1	–15.24	60.66
OV-16	–122	–16.27	15.4	–13.03	85.15
OV-17	–128	–16.85	1.6	–8.32	33.55
OV-18	–122	–16.39	1.9	–9.42	67.85
OV-19	–118	–15.86	21.4	–17.22	112.8
OV-20	–122	–16.03	1.6	nc	nc
OV-21	–125	–16.59	2.9	nc	nc
OV-22	–121	–16.35	7.7	–11.83	88.59
OV-23	–122	–16.36	10.2	nc	nc
OV-24	–125	–16.53	23.6	–14.59	104.4
OV-25	–118	–15.72	20.2	–13.64	96.21
OV-26	–124	–16.54	14.4	–15.98	109.3
OV-27	–120	–15.82	1.9	–9.34	76.28
OV-28	–121	–16.07	<1	nc	nc
OV-29	–121	–16.10	<1	nc	nc
OV-30	–124	–16.46	3.5	–6.62	38.25
OV-31	–108	–14.72	<1	–11.47	63.33
OV-32	–120	–15.83	<1	–4.58	4.310
OV-33	–122	–16.38	<1	nc	nc
OV-34	–122	–16.24	<1	–10.95	57.96
OV-35	–117	–15.84	1.9	–5.55	15.94
OV-36	–115	–15.04	16.6	–7.42	78.42
OV-37	–127	–16.81	14.4	–14.98	104.3
OV-38	–104	–13.93	5.8	nc	nc

Table 12. Results for analyses of stable isotope ratios, and tritium and carbon-14 activities in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from all wells were analyzed for stable isotopes of hydrogen and oxygen of water and tritium; samples from the 9 slow wells and the 50 intermediate wells were analyzed for carbon. Stable isotope ratios are reported in the standard delta notation (δ), the ratio of a heavier isotope to more common lighter isotope of that element, relative to a standard reference material. **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. **Threshold:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-CA, California Department of Public Health maximum contaminant level; MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Abbreviations:** na, not available; nc, not collected; pCi/L, picocuries per liter]

GAMA well identification No.	δ^2H (per mil) (82082)	$\delta^{18}O$ (per mil) (82085)	Tritium (pCi/L) (07000)	$\delta^{13}C$ (per mil) (82081)	Carbon-14 (percent modern) (49933)
Threshold type	**na**	**na**	**MCL-CA**	**na**	**na**
Threshold level	**na**	**na**	**20,000**	**na**	**na**
OV-39	–122	–16.38	<1	nc	nc
OV-40	–127	–16.56	<1	–3.23	1.440
OIW-01	nc	nc	<1	–7.79	5.110
OIW-02	–94.0	–12.46	<1	–6.10	38.87
OIW-03	–107	–13.73	<1	nc	nc
OIW-04	–91.3	–11.66	nc	nc	nc
OIW-05	–91.5	–12.30	<1	–6.83	65.50
OIW-06	–97.1	–12.63	<1	nc	nc
OIW-07	–97.8	–13.00	<1	–5.91	3.400
OIW-08	–93.5	–11.97	nc	0.74	14.12
OIW-09	–90.6	–11.74	1.9	–7.56	92.85
OIW-10	–97.9	–12.63	nc	nc	nc
OIW-11	–93.6	–12.02	1.9	–9.80	63.75
OIW-12	–92.8	–11.81	<1	–2.00	20.73
OIW-13	–101	–11.21	<1	nc	nc
Understanding wells					
OVU-01	–125	–16.70	<1	–15.02	91.56
OVU-02	nc	nc	12.8	–10.37	25.43
OVU-03	–120	–15.82	<1	–8.65	18.18
OVU-04	–123	–16.54	16.3	–14.89	95.39
OVU-05	–122	–16.22	38.1	–13.74	104.2
OVU-06	–126	–16.69	<1	–12.81	71.31
OVU-07	–128	–16.75	<1	–10.42	13.31
OVU-08	–129	–16.95	7.0	–13.60	78.58
OVU-09	–117	–14.93	9.9	–10.13	87.43
OVU-10	–127	–16.85	nc	–8.87	17.53
OVU-11	–126	–16.59	27.5	nc	nc
OVU-12	–125	–16.06	<1	–3.06	1.440
OVU-13	–121	–15.65	<1	–4.22	1.480
OIWU-01	–96.1	–12.92	<1	–10.36	23.64
OIWU-02	nc	nc	nc	–8.14	6.310
OIWU-03	–95.2	–12.82	<1	–9.09	20.14
OIWU-04	–92.4	–12.31	na	–4.69	55.95
OIWU-05	–92.9	–12.30	<1	–5.16	57.94
OIWU-06	–102	–13.19	nc	–3.30	2.810
OIWU-07	–97.3	–12.81	<1	–10.18	40.70
OIWU-08	–94.8	–12.25	1.3	nc	nc

Table 13A. Uranium isotopes detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from the 9 slow and 50 intermediate wells were analyzed (*table 2*). *Table 3J* contains additional information about the analytes. Measured values less than the sample-specific critical level (ssL_C) are reported as nondetections (—). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. Thresholds and threshold values as of June 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Other abbreviations:** CSU, 1-sigma combined standard uncertainty; pCi/L, picocurie per liter; nc, sample not collected; —, not detected; *, the sum of the three isotopes is above threshold value]

GAMA well identification number	Uranium-234 (pCi/L) (22610)		Uranium-235 (pCi/L) (22620)		Uranium-238 (pCi/L) (22603)	
Threshold type	MCL-CA		MCL-CA		MCL-CA	
Threshold value	[1]20		[1]20		[1]20	
	result ± CSU	ssL_C	result ± CSU	ssL_C	result ± CSU	ssL_C
			Grid wells			
OV-01	2.78 ± 0.12	0.017	0.148 ± 0.024	0.0078	1.959 ± 0.094	0.014
OV-02	0.197 ± 0.027	0.0078	—	0.0094	0.160 ± 0.024	0.0078
OV-04	0.840 ± 0.059	0.01	0.023 ± 0.015	0.015	0.639 ± 0.051	0.013
OV-05	3.91 ± 0.16	0.02	0.226 ± 0.031	0.015	3.11 ± 0.13	0.018
OV-06	0.219 ± 0.028	0.01	0.0110 ± 0.0075	0.0086	0.204 ± 0.025	0.0071
OV-07	0.437 ± 0.039	0.014	0.026 ± 0.011	0.0086	0.440 ± 0.039	0.0071
OV-08	*14.07 ± 0.45	0.038	*0.944 ± 0.064	0.0082	*12.70 ± 0.41	0.036
OV-09	2.21 ± 0.11	0.015	0.096 ± 0.022	0.01	1.727 ± 0.095	0.015
OV-10	0.123 ± 0.020	0.0081	0.0119 ± 0.0060	0.007	0.136 ± 0.020	0.0057
OV-11	4.39 ± 0.16	0.018	0.196 ± 0.024	0.0066	3.17 ± 0.12	0.014
OV-12	0.427 ± 0.040	0.013	0.023 ± 0.012	0.009	0.370 ± 0.037	0.01
OV-13	3.43 ± 0.14	0.018	0.213 ± 0.029	0.0084	2.70 ± 0.12	0.017
OV-14	0.988 ± 0.084	0.014	—	0.016	0.649 ± 0.067	0.014
OV-15	0.774 ± 0.052	0.011	0.037 ± 0.014	0.0079	0.508 ± 0.041	0.011
OV-16	2.045 ± 0.095	0.013	0.095 ± 0.017	0.0076	1.746 ± 0.087	0.011
OV-17	1.873 ± 0.097	0.014	0.068 ± 0.017	0.0099	1.219 ± 0.076	0.014
OV-18	9.82 ± 0.30	0.019	0.376 ± 0.031	0.009	7.66 ± 0.24	0.018
OV-19	4.17 ± 0.16	0.018	0.170 ± 0.025	0.0082	3.11 ± 0.13	0.015
OV-22	1.086 ± 0.066	0.01	0.023 ± 0.012	0.0089	0.665 ± 0.051	0.0074
OV-24	3.14 ± 0.12	0.019	0.249 ± 0.027	0.0067	2.75 ± 0.11	0.017
OV-25	0.526 ± 0.030	0.0068	0.0204 ± 0.0080	0.0063	0.497 ± 0.029	0.0052
OV-26	0.256 ± 0.026	0.0057	—	0.0098	0.291 ± 0.028	0.0057
OV-27	6.06 ± 0.19	0.015	0.177 ± 0.020	0.0077	3.64 ± 0.12	0.013
OV-30	1.983 ± 0.078	0.0087	0.047 ± 0.010	0.0047	0.999 ± 0.050	0.0068
OV-31	0.628 ± 0.033	0.0068	0.0268 ± 0.0080	0.0052	0.515 ± 0.029	0.0074
OV-32	0.542 ± 0.043	0.0066	0.014 ± 0.011	0.008	0.308 ± 0.030	0.0066
OV-33	0.0145 ± 0.0085	0.0068	—	0.0082	0.0204 ± 0.0085	0.0068
OV-34	1.974 ± 0.094	0.013	0.081 ± 0.017	0.0079	1.876 ± 0.088	0.0092
OV-35	4.07 ± 0.16	0.023	0.315 ± 0.034	0.0086	3.19 ± 0.14	0.021
OV-36	3.64 ± 0.14	0.018	0.142 ± 0.024	0.0079	2.65 ± 0.12	0.015
OV-37	0.905 ± 0.059	0.011	0.031 ± 0.012	0.009	0.726 ± 0.052	0.011
OV-40	0.212 ± 0.028	0.011	0.029 ± 0.013	0.0096	0.106 ± 0.021	0.008
OIW-01	0.754 ± 0.052	0.013	0.061 ± 0.017	0.0079	0.616 ± 0.046	0.0093
OIW-02	0.889 ± 0.055	0.013	0.058 ± 0.014	0.0079	0.760 ± 0.052	0.011
OIW-05	2.23 ± 0.10	0.012	0.069 ± 0.018	0.008	1.621 ± 0.081	0.012
OIW-07	1.212 ± 0.067	0.013	0.060 ± 0.017	0.0078	1.074 ± 0.061	0.011
OIW-08	4.91 ± 0.18	0.014	0.144 ± 0.024	0.0078	3.42 ± 0.14	0.013
OIW-09	6.32 ± 0.22	0.021	0.286 ± 0.031	0.011	5.20 ± 0.19	0.02
OIW-11	0.558 ± 0.040	0.0094	0.017 ± 0.012	0.011	0.500 ± 0.038	0.0077
OIW-12	10.20 ± 0.33	0.024	0.417 ± 0.038	0.01	8.10 ± 0.27	0.022

Table 13A. Uranium isotopes detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December, 2006.—Continued

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from the 9 slow and 50 intermediate wells were analyzed (*table 2*). *Table 3J* contains additional information about the analytes. Measured values less than the sample-specific critical level (ssL_C) are reported as non-detections (—). **GAMA well identification No.:** OV, Owens Valley study area grid well; OIW, Indian Wells Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. Thresholds and threshold values as of June 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Other abbreviations:** CSU, 1-sigma combined standard uncertainty; pCi/L, picocurie per liter; nc, sample not collected; —, not detected; *, the sum of the three isotopes is above threshold value]

GAMA well identification number	Uranium-234 (pCi/L) (22610)		Uranium-235 (pCi/L) (22620)		Uranium-238 (pCi/L) (22603)	
Threshold type	MCL-CA		MCL-CA		MCL-CA	
Threshold value	[1]20		[1]20		[1]20	
	result ± CSU	ssL_C	result ± CSU	ssL_C	result ± CSU	ssL_C
			Understanding wells			
OVU-01	1.135 ± 0.071	0.0083	0.047 ± 0.017	0.01	0.886 ± 0.064	0.0083
OVU-02	0.691 ± 0.046	0.01	0.030 ± 0.012	0.007	0.362 ± 0.031	0.0058
OVU-03	0.115 ± 0.020	0.011	0.0198 ± 0.0080	0.0092	0.098 ± 0.020	0.013
OVU-04	0.275 ± 0.027	0.0096	0.0201 ± 0.0085	0.0067	0.208 ± 0.025	0.0055
OVU-05	0.720 ± 0.049	0.0092	0.024 ± 0.010	0.0079	0.681 ± 0.049	0.0065
OVU-06	0.052 ± 0.014	0.0081	—	0.014	0.062 ± 0.014	0.0081
OVU-07	0.342 ± 0.035	0.0077	—	0.0094	0.189 ± 0.027	0.0077
OVU-08	5.20 ± 0.18	0.016	0.176 ± 0.021	0.006	3.49 ± 0.13	0.017
OVU-09	6.81 ± 0.25	0.023	0.297 ± 0.037	0.0092	5.93 ± 0.22	0.023
OVU-10	0.014 ± 0.014	0.014	—	0.0097	—	0.008
OVU-12	0.162 ± 0.025	0.0081	—	0.0098	0.073 ± 0.018	0.0081
OVU-13	2.08 ± 0.10	0.015	0.088 ± 0.019	0.0089	1.355 ± 0.078	0.015
OIWU-01	1.136 ± 0.066	0.011	0.040 ± 0.013	0.0077	0.884 ± 0.055	0.009
OIWU-02	0.989 ± 0.065	0.01	0.035 ± 0.012	0.009	0.897 ± 0.059	0.0074
OIWU-03	0.549 ± 0.038	0.0071	0.0236 ± 0.0080	0.0061	0.384 ± 0.032	0.0071
OIWU-04	3.50 ± 0.14	0.016	0.105 ± 0.022	0.0085	2.43 ± 0.11	0.012
OIWU-05	3.77 ± 0.15	0.015	0.116 ± 0.021	0.0079	2.77 ± 0.12	0.015
OIWU-06	0.084 ± 0.021	0.011	—	0.0095	0.044 ± 0.014	0.0079
OIWU-07	7.57 ± 0.31	0.034	0.342 ± 0.047	0.015	6.22 ± 0.27	0.028

[1] The MCL-CA threshold for uranium is the sum of uranium-234, uranium-235, and uranium-238.

Table 13B. Gross alpha and beta radioactivity detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from the nine slow wells were analyzed (*table 2*). *Table 3J* contains additional information about the analytes. The reference nuclide for measurement of gross alpha is thorium-230 and the reference nuclide for measurement of gross beta is cesium-137. Measured values less than the sample-specific critical level (ssL_C) are reported as nondetections (—). **GAMA well identification No.:** OV, Owens Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. Thresholds and threshold values as of June 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Other abbreviations:** CSU, combined standard uncertainty; pCi/L, picocurie per liter; —, not detected]

GAMA well identification number	Gross alpha radioactivity, 72-hour count (pCi/L) (62636)		Gross alpha radioactivity, 30-day count (pCi/L) (62639)		Gross beta radioactivity, 72-hour count (pCi/L) (62642)		Gross beta radioactivity, 30-day count (pCi/L) (62645)	
Threshold type	MCL-US		MCL-US		MCL-CA		MCL-CA	
Threshold value	15		15		50		50	
	result ± CSU	ssL_c	result ± CSU	ssL_c	result ± CSU	ssL_c	result ± CSU	ssL_c
Grid wells								
OV-02	—	0.97	—	1.3	1.48 ± 0.57	0.88	1.60 ± 0.57	0.87
OV-06	—	1.2	—	1.1	2.40 ± 0.65	0.91	1.9 ± 1.0	1.6
OV-10	0.67 ± 0.39	0.41	—	0.77	—	1.5	—	1.5
OV-11	9.9 ± 1.7	0.6	8.0 ± 1.7	1.1	2.32 ± 0.74	0.95	6.5 ± 1.0	0.94
OV-14	1.50 ± 0.62	0.53	—	1.2	—	1.6	2.24 ± 0.64	0.86
OV-25	3.9 ± 1.0	0.84	—	1.3	1.86 ± 0.68	0.94	1.91 ± 0.87	1.4
OV-31	1.6 ± 1.0	1.2	—	1.2	1.74 ± 0.62	0.86	1.74 ± 0.67	0.93
Understanding wells								
OVU-08	9.6 ± 2.0	1.4	9.6 ± 1.3	0.56	5.13 ± 0.87	0.89	8.41 ± 0.93	0.45
OIWU-01	6.9 ± 1.1	0.73	3.7 ± 1.4	1.3	2.43 ± 0.44	0.53	4.47 ± 0.87	0.99

Table 13C. Radium isotopes and radon detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December, 2006.

[The five-digit number in parentheses below the constituent name is the U.S. Geological Survey parameter code used to uniquely identify a specific constituent or property. Samples from the nine slow wells were analyzed (*table 2*). *Table 3J* contains additional information about the analytes. Values less than the sample-specific critical level (ssLC) are reported as non-detections (—). Values less than the activities measured in field blanks (*table A3*) are reported with a less than or equal to sign (≤). **GAMA well identification No.:** OV, Owens Valley study area grid well; OVU, Owens Valley study area understanding well; OIWU, Indian Wells Valley study area understanding well. Thresholds and threshold values as of June 1, 2008. **Threshold type:** Maximum contaminant level thresholds are listed as MCL-US when the MCL-US and MCL-CA are identical, and as MCL-CA when the MCL-CA is lower than the MCL-US or no MCL-US exists. MCL-US, U.S. Environmental Protection Agency maximum contaminant level. **Other abbreviations:** CSU, combined standard uncertainty; pCi/L, picocurie per liter; —, not detected]

GAMA well identification number	Radium-226 (pCi/L) (09511)		Radium-228 (pCi/L) (81366)		Radon-222 (pCi/L) (82303)
Threshold type	**MCL-US**		**MCL-US**		**proposed MCL-US**
Threshold value	**[1]5**		**[1]5**		**[2]300 (4,000)**
	result ± CSU	**ssL_c**	**result ± CSU**	**ssL_c**	**result ± CSU[3]**
			Grid wells		
OV-02	0.117 ± 0.015	0.014	0.41 ± 0.24	0.22	3510 ± 25
OV-06	0.042 ± 0.011	0.015	—	0.19	1850 ± 19
OV-10	≤0.023 ± 0.011	0.014	0.61 ± 0.43	0.27	2980 ± 23
OV-11	0.130 ± 0.014	0.013	0.39 ± 0.10	0.23	1350 ± 17
OV-14	0.047 ± 0.012	0.014	0.86 ± 0.12	0.25	1860 ± 19
OV-25	0.144 ± 0.017	0.015	—	0.32	2950 ± 24
OV-31	0.069 ± 0.013	0.014	—	0.27	830 ± 13
			Understanding wells		
OVU-08	<0.039 ± 0.012	0.015	—	0.24	560 ± 12
OIWU-01	0.088 ± 0.014	0.012	—	0.27	560 ± 12

[1] The MCL-US threshold for radium is the sum of radium-226 and radium-228.

[2] Two MCLs have been proposed for Radon-222. The proposed Alternative MCL is in parentheses.

[3] The 2-sigma combined standard uncertainties reported for radon-222 in the USGS NWIS have been divided by two and reported here as 1-sigma combined standard uncertainties for consistency with reporting of the other radiochemical constituents.

Appendix

This appendix includes discussions of the methods used to collect and analyze ground-water samples and report the data for the OWENS study unit. These methods were selected to obtain representative samples of the ground water from each well and to minimize the potential for contamination of the samples or bias in the data. Procedures used to collect and assess quality-control data, and the results of the quality-control assessments also are discussed.

Sample Collection and Analysis

Ground-water samples were collected by using standard and modified USGS protocols from the USGS National Water Quality Assessment (NAWQA) program (Koterba and others, 1995; U.S. Geological Survey National Field Manual, variously dated) and protocols described by Weiss (1968), Shelton and others (2001), Ball and McClesky (2003a,b), and Wright and others (2005). Prior to sampling, each well was pumped continuously in order to purge at least three casing-volumes of water from the well (Wilde and others, 1999). Wells were sampled using Teflon tubing with brass and stainless-steel fittings attached to a sampling point on the well discharge pipe as close to the well as possible. The sampling point always was located upstream of any well-head treatment system or water storage tank. If a chlorinating system was attached to the well, the chlorinator was shut off at least 24 hours prior to purging and sampling the well in order to purge the system of chlorine. For the fast and intermediate schedule, samples were collected at the well head using a foot-long length of Teflon tubing. For the slow schedule, the samples were collected inside an enclosed chamber located inside a mobile laboratory and connected to the well head by a 10- to 50-ft length of the Teflon tubing (Lane and others, 2003). All fittings and lengths of tubing were cleaned between samples (Wilde, 2004).

For the field measurements, ground water was pumped through a flow-through chamber fitted with a multi-probe meter that simultaneously measures the water-quality indicators—dissolved oxygen (DO), temperature, pH, and specific conductance (SC). Field measurements were made in accordance with protocols in the USGS National Field Manual (Radtke and others, 2005; Wilde and Radtke, 2005; Lewis, 2006; Wilde, 2006; and Wilde and others, 2006). All sensors on the multi-probe meter were calibrated daily. Measured DO, temperature, pH, and SC values were recorded at 5-minute intervals for at least 30 minutes, and when these values remained stable for 20 minutes, samples for laboratory analyses were then collected. Field measurements and instrument calibrations were recorded by hand on field record sheets and electronically in PCFF-GAMA, a software package designed by the USGS with support from the GAMA program. Analytical service requests also were managed by PCFF-GAMA. Information from PCFF-GAMA was uploaded directly into NWIS at the end of every week of sample collection.

For analyses requiring filtered water, ground water was diverted through a 0.45-μm vented capsule filter, a disk filter, or a baked glass-fiber filter, depending on the protocol for the analysis (Wilde and others, 1999; 2004). Prior to sample collection, polyethylene sample bottles were pre-rinsed twice using deionized water and then once with sample water before sample collection. Samples requiring acidification were acidified to a pH of 2 or less with the appropriate acids using vials of certified, traceable concentrated acids obtained from the USGS National Water Quality Laboratory (NWQL).

Temperature-sensitive samples were stored on ice prior to, and during, daily shipping to the various laboratories. The non-temperature sensitive samples for tritium, noble gases, chromium speciation and stable isotopes were shipped monthly, while samples for volatile organic compounds, pesticides, compounds of special interest, dissolved organic carbon, radium isotopes, gross alpha and beta radioactivity, and radon-222 were shipped daily.

Detailed sampling protocols for individual analyses and groups of analytes are described in Koterba and others (1995) and the USGS National Field Manual (Wilde and others, 1999; 2004) and in the references for analytical methods listed in *table A1*; only brief descriptions are given here. Volatile organic compounds (VOCs) and gasoline oxygenates and degradates, and 1,2,3-trichloropropane (1,2,3-TCP) samples were collected in 40-mL baked amber glass sample vials that were purged with three vial volumes of sample water before bottom filling to eliminate atmospheric contamination. Six normal (6 N) hydrochloric acid (HCl) was added as a preservative to the VOC samples, but not to the gasoline oxygenates and degradate samples or the 1,2,3-TCP samples. Perchlorate samples were collected in 125-mL polyethylene bottle. Tritium samples were collected by bottom filling two 1-L polyethylene bottles with unfiltered ground water, after first overfilling the bottle with three volumes of water. Samples for analysis of stable isotopes of water were collected in 60-mL clear glass bottles filled with unfiltered water, each sealed with a conical cap, and secured with electrical tape to prevent leakage and evaporation.

Pesticides and pesticide degradation products, wastewater indicators, pharmaceutical compounds, and *N*-nitrosodimethylamine (NDMA) samples were collected in 1-L baked amber glass bottles. Pesticides and pharmaceutical samples were filtered through a glass fiber filter during the collection, while the NDMA samples were filtered at the Montgomery Watson Harza Laboratory prior to analysis. Wastewater indicator samples were not filtered.

Ground-water samples for major and minor ions, trace element, alkalinity, and total-dissolved-solids analyses required filling one 250-mL polyethylene bottle with raw ground water, and one 500-mL and one 250-mL polyethylene bottle with filtered ground water (Wilde and others, 2004). Samples were filtered using a 0.45-µm Whatman capsule filter. Each 250-mL filtered sample then was preserved with 7.5 N nitric acid. Mercury samples were collected by filtering ground water into a 250-mL glass bottle and preserving with 6 N hydrochloric acid (HCl). Arsenic and iron speciation samples were filtered into 250-mL polyethylene bottle that were covered with opaque tape to prevent light exposure and preserved with 6N HCl. Each nutrient sample was filtered into a 125-mL brown polyethylene bottle. Radium isotopes and gross alpha and beta radiation samples were filtered into 1-L polyethylene bottles and acidified with nitric acid. Carbon isotope samples were filtered and bottom-filled into two 500-mL glass bottles that were first overfilled with three bottle volumes of ground water. These samples had no headspace, and were each sealed with a conical cap to avoid atmospheric contamination. Samples for field alkalinity titrations were collected by filtering ground water into a 500-mL polyethylene bottle.

DOC, chromium, radon-222, dissolved gases, and microbial constituents were collected from the hose bib at the well head, regardless of the sampling schedule (fast, intermediate, or slow). DOC was collected after rinsing the sampling equipment with universal blank water (Wilde and others, 2004). Using a 50-mL syringe and 0.45-µm disk filter, each ground-water sample then was filtered into a 125-mL baked glass bottle and preserved with 4.5-N sulfuric acid. Chromium speciation samples were collected using a 10-mL syringe with an attached 0.45-µm disk filter. After the syringe was rinsed thoroughly and filled with ground water, 4 mL was forced through the disk filter; the next 2 mL of the ground water was filtered slowly into a small centrifuge vial for analysis of total chromium. The sample for chromium (VI) was then collected by attaching a small cation-exchange column to the syringe filter, and after conditioning the column with 2 mL of sample water, 2 mL were collected in a second centrifuge vial. Both vials were preserved with 10 µL of 7.5-N nitric acid (Ball and McClesky, 2003a,b).

For the collection of radon-222, a stainless-steel and Teflon valve assembly was attached to the sampling port at the well head (Wilde and others, 2004). The valve was closed partially to create back pressure, and a 10-mL sample was taken through a Teflon septum on the value assembly using a glass syringe affixed with a stainless steel needle. The sample was then injected into a 25-mL vial partially filled with scintillation mixture (mineral oil) and shaken. The vial was then placed in a cardboard tube in order to shield it from light during shipping.

Noble gases were collected in 3/8-in. copper tubes using reinforced nylon tubing connected to the hose bib at the wellhead. Ground water was flushed through the tubing to dislodge bubbles before flow was restricted with a back pressure valve. Clamps on either side of the copper tube were then tightened, trapping a sample of ground water for analyses of noble gases (Weiss, 1968).

Samples for analysis of microbial constituents also were collected at the well head (Bushon, 2003; Myers, 2004). Prior to the collection of samples, the sampling port was sterilized using isopropyl alcohol, and ground water was run through the sampling port for at least 3 minutes to remove any traces of the sterilizing agent. Two sterilized 250-mL bottles then were filled with ground water for coliform analyses (total and *Escherichia* coliform determinations), and one sterilized 3-L carboy was filled for coliphage analyses (F specific and somatic coliphage determinations).

Turbidity, alkalinity, and total coliforms and *Escherichia* coliform (*E. coli*) were measured in the mobile laboratory at the well site. Turbidity was measured in the field with a calibrated turbidity meter. Total coliforms and *E. coli* plates were prepared using sterilized equipment and reagents (Myers, 2004). Plates were counted under an ultraviolet light, following a 22–24 hour incubation time. Alkalinity was measured on filtered samples by Gran's titration method (Rounds, 2006). Titration data were entered directly into PCFF-GAMA and the concentrations of bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) were calculated automatically from the titration data using the advanced speciation method.

Ten laboratories performed chemical and microbial analyses for this study (*table A1*), although most of the analyses were performed at the NWQL or by labs contracted by the NWQL. The NWQL maintains a rigorous quality-assurance program (Pirkey and Glodt, 1998; Maloney, 2005). Laboratory quality-control samples, including method blanks, continuing calibration verification standards, standard reference samples, reagent spikes, external certified reference materials, and external blind proficiency samples, are analyzed regularly. Method-detection limits are tested continuously and laboratory reporting levels updated accordingly. NWQL maintains National Environmental Laboratory Accreditation Program (NELAP) and other certifications (*http://nwql.usgs.gov/Public/lab_cert.shtml*). In addition, the Branch of Quality Systems within the USGS Office of Water Quality maintains independent oversight of quality assurance at the NWQL and labs contracted by the NWQL. The Branch of Quality Systems also runs a National Field Quality Assurance program that includes annual testing of all USGS field personnel for proficiency in making field water-quality measurements (*http://nfqa.cr.usgs.gov/*). Results for analyses made at the NWQL or by laboratories contracted by the NWQL are uploaded directly into NWIS by the NWQL.

Data Reporting

The following section details the laboratory reporting conventions and the constituents that are determined by multiple methods or by multiple laboratories.

Laboratory Reporting Conventions

The USGS NWQL uses the laboratory reporting level (LRL) as a threshold for reporting analytical results. The LRL is set to minimize the reporting of false negatives (not detecting a compound when it is actually present in a sample) to less than 1 percent (Childress and others, 1999). The LRL is set at two-times the long-term method detection level (LT-MDL), The LT-MDL is derived from the standard deviation of at least 24 MDL determinations made over an extended period of time. The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the concentration is greater than zero (at MDL there is less than 1 percent chance of a false positive) (U.S. Environmental Protection Agency, 2002a). The USGS NWQL monitors and updates LRL values regularly, and the values listed in this report were in effect during the period when analyses were made for ground-water samples from the OWENS study.

Detections between the LRL and the LT-MDL are reported as estimated concentrations (designated with an “E” before the value in the tables and text). For information-rich methods, detections below the LT have high certainty of detection, but the precise concentration is uncertain. Information-rich methods are those that utilize gas chromatography or high-performance liquid chromatography (HPLC) with mass spectrometry detection (VOCs, gasoline additives, pesticides, pharmaceuticals, wastewater-indicators). Compounds are identified by presence of characteristic fragmentation patterns in their mass spectra in addition to being quantified by measurement of peak areas at their chromatographic retention times. E-coded values also may result from detections outside the range of calibration standards, for detections that did not meet all laboratory quality-control criteria, and for samples that were diluted prior to analysis (Childress and others, 1999).

Some compound concentrations in this study are reported using minimum reporting levels (MRLs) or method uncertainties. The MRL is the smallest measurable concentration of a constituent that may be reported reliably using a given analytical method (Timme, 1995). The method uncertainty generally indicates the precision of a particular analytical measurement; it gives a range of values wherein the true value will be found.

The methods used for analysis of radiochemical constituents (gross-alpha radioactivity, gross-beta radioactivity, radium isotopes, and uranium isotopes) measure activities by using counting techniques (*table A1*). The reporting limits for radiochemical constituents are based on sample-specific critical levels (ssL_C) (McCurdy and others, 2008). The critical level is analogous to the LT-MDL used for reporting analytical results for organic and non-radioactive inorganic constituents. Here, the critical level is defined as the minimum measured activity that indicates a positive detection of the radionuclide in the sample with less than a 5 percent probability of a false positive detection. Sample-specific critical levels are used for radiochemical measurements because the critical level is sensitive to sample size and sample yield during analytical processing, as well as being dependent on instrument background, the counting times for the sample and background, and the characteristics of the instrument being used and the nuclide being measured. An ssL_C is calculated for each sample, and the measured activity in the sample is compared to the ssL_C associated with that sample. Measured activities less than the ssL_C are reported as non-detections.

The analytical uncertainties associated with measurement of activities are also sensitive to sample-specific parameters, including sample size, sample yield during analytical processing, and time elapsed between sample collection and various steps in the analytical procedure, as well as parameters associated with the instrumentation. Therefore, measured activities of radioactive constituents are reported with sample-specific uncertainties. Activities of uranium isotopes, radium isotopes, and gross alpha and beta radiation are reported with sample-specific 1-sigma combined standard uncertainties (CSU). Radon activities are reported with 2-sigma combined standard uncertainties in the USGS NWIS database, and reported in this report with 1-sigma combined standard uncertainties for consistency with reporting of the other radiochemical constituents.

Stable isotopic compositions of oxygen, hydrogen, and carbon are reported as relative isotope ratios in units of per mil, using the standard delta notation (Coplen and others, 2002):

$$\delta^i E = \left[\frac{R_{sample}}{R_{reference}} - 1 \right] \bullet 1,000 \text{ per mil}$$

where

- i is the atomic mass of the heavier isotope of element E (18 for oxygen, 13 for carbon, or 2 for hydrogen),
- E is the element (O for oxygen-18, C for carbon, or H for hydrogen),
- R_{sample} is the ratio of the abundance of the heavier isotope of the element (^{18}O, ^{13}C, or ^{2}H) to the lighter isotope of the element (^{16}O, ^{12}C, or ^{1}H) in the sample and,
- $R_{reference}$ is the ratio of the abundance of the heavier isotope of the element to the lighter isotope of the element in the reference material.

The reference material for oxygen and hydrogen is Vienna Standard Mean Ocean Water (VSMOW), which is assigned $\delta^{18}O$ and $\delta^{2}H$ values of 0 per mil (note than $\delta^{2}H$ also is written as δD because the common name of the heavier isotope of hydrogen, hydrogen-2, is deuterium). The reference material for carbon is Vienna Peedee Belemnite (VPDB), which is assigned a $\delta^{13}C$ value of 0 per mil.

Constituents on Multiple Analytical Schedules

Nine constituents targeted in the OWENS study were determined by more than one analytical schedule (*table A2*). The preferred method for constituents analyzed at USGS laboratories was selected based on the procedure recommended by the NWQL (*http://wwwnwql.cr.usgs.gov/USGS/Preferred_method_selection_procedure.html*). Methods with full approval are preferred over those with provisional approval and approved methods are favored over research methods. The method with greater accuracy and precision and lower LRLs for the overlapping constituents is preferred. A method may be selected as the preferred method to provide consistency with historical data analyzed by the same method.

Five of the constituents each appear on two of the following NWQL analytical schedules: VOCs (Schedule 2020; *table 3A*), and gasoline oxygenates and degradates (Schedule 4024; *table 3B*) (*table A2*). For constituents on Schedules 2020 and 4024, the preferred method was Schedule 2020 to provide consistency (all samples collected for the GAMA Priority Basin Project are analyzed using Schedule 2020). Only the results from schedule 2020 are reported.

The water-quality indicators—pH, specific conductance, and alkalinity—were measured in the field and at the NWQL. The field measurements are the preferred method for all three constituents; however, both are reported because laboratory pH and alkalinity measurements were made on a greater number of samples.

For arsenic, chromium, and iron concentrations, the approved method, Schedule 1948, used by the NWQL is preferred over the research methods used by the USGS Trace Metal Laboratory. The concentrations measured by the Trace Metal Laboratory are only to calculated ratios of redox species for each element, $\frac{As(V)}{As(III)}$ for arsenic, $\frac{Cr(VI)}{Cr(III)}$ for chromium, and $\frac{Fe(III)}{Fe(II)}$ for iron. For example:

$$\frac{Fe(III)}{Fe(II)} = \frac{Fe(T) - Fe(II)}{Fe(II)}$$

where

Fe(T) is the total iron concentration (measured)
Fe(II) is the concentration of ferrous iron (measured), and
Fe(III) is the concentration of ferric iron (calculated).

Quality Assurance

The quality-assurance methods used for this study followed the protocols used by the USGS NAWQA program (Koterba and others, 1995) and described in the USGS National Field Manual (U.S. Geological Survey, variously dated). The quality-assurance plan followed by the NWQL, the primary laboratory used to analyze samples for this study, is described in Maloney (2005) and Pirkey and Glodt (1998). Quality-control (QC) samples collected in the OWENS study include source-solution blanks, field blanks, replicates, and matrix and surrogate spikes. QC samples were collected to evaluate contamination, and bias and variability of the data that may have resulted from sample collection, processing, storage, transportation, and laboratory analysis.

Blanks

The primary purposes of collecting blanks are to evaluate the magnitude of potential contamination of samples with analytes of interest, and to identify and mitigate sources of contamination. Contamination in blanks may originate from several different types of sources, including: systematic contamination from field or laboratory equipment or processes, known sources of contaminants specific to a field site, contaminated source-solution water, carry-over from the previous sample, and random contamination from field or laboratory equipment or processes.

Two types of blanks were collected: source-solution and field blanks. Source-solution blanks were collected to verify that the blank water used for the field blanks was free of the analytes of interest. Field blanks were collected to assess potential contamination of samples during collection, processing, transport, and analysis. Blanks were collected using blank certified by the NWQL to contain less than the LRL or MRL of the analytes investigated in the study. Field blanks were collected at approximately 7 percent of the wells sampled. Field blanks were analyzed for VOCs, gasoline oxygenates and degradates, pesticides, perchlorate, NDMA, 1,2,3-TCP, nutrients, major and minor ions, trace elements, iron, arsenic, and chromium speciation, and radioactive constituents. Certified blank water was not available for tritium or noble gases, thus field blanks were not collected for these constituents.

Source-solution blanks were collected at the selected sampling site by pouring blank water directly into sample containers that were preserved, stored, shipped, and analyzed in the same manner as were the ground-water samples. For field blanks, blank water either was pumped or poured through the sampling equipment (fittings and tubing) used to collect ground water, then processed and transported using the same protocols used for the ground-water samples.

All detections of the constituents of interest in field blanks required investigation of the magnitude and potential source of the contamination. Depending on the source of the contamination, different strategies for flagging data for ground-water samples were applied.

The first potential source of contamination evaluated was systematic contamination of the blank water received from the NWQL. The certificates of analysis for the lots of blank water used to collect the field blanks were examined (*http://wwwnwql.cr.usgs.gov/USGS/OBW/obw.html*). The lots of blank water used during OWENS were certified by NWQL as free of the constituents being analyzed in the study.

The second potential source evaluated was contamination from sources of VOCs specific to a field site or condition. Contamination from specific sources may produce distinctive patterns of detections in field blanks and ground-water samples, particularly for the VOCs. Substances that may be encountered at the field site, such as lubricants (for example, WD-40), cements used on PVC pipe, exhaust fumes from pump engines, and the methanol used to clean sample lines, contain recognizable associations of VOC constituents. For example, cements used on PVC pipe primarily are composed of tetrahydrofuran with lesser amounts of acetone, methyl ethyl ketone (MEK), and cyclohexanone (not analyzed in this study). However, detection of these recognizable associations of VOC constituents in ground-water samples does not necessarily indicate contamination during sample collection because these VOC constituents also may occur together in ground water.

If a recognizable association of VOC constituents was detected in a field blank or in a ground-water sample, then the field notes and photographs from the site where the sample was collected were examined for evidence of the probable contaminant source. If the constituents were present in the field blank and ground-water sample from the same site at similar concentrations and the field notes or photographs indicated that the probable contaminant source was present, then the detections of that constituent in the ground-water sample were V-coded and all other ground-water samples collected at sites where the same condition may have occurred were considered for V-coding. For example, detections of the association ethylbenzene, benzene, toluene, and xylenes in a field blank and ground-water sample collected from a site with a suffocating atmosphere of diesel fumes would be V-coded. If no probable contaminant sources were identified in the field notes or photographs, the detections in the field blanks also were used to develop V-coding thresholds for data from all ground-water samples.

The data were considered for V-coding if the constituents were present in a ground-water sample and not in the associated field blank, or a ground-water sample from a site where no blanks were collected, and the field notes or photographs indicated that the probable contaminant source was present. For example, detections of tetrahydrofuran in ground-water samples from sites where the water passed through PVC-pipe between the wellhead and the sampling port were considered for V-coding.

The third potential source of contamination evaluated was carry-over from the previous sample collected with the same equipment. Carry-over between samples is very rare because the procedures used to clean the equipment between samples have been developed and tested extensively to assure that carry-over does not occur. If non-detections were reported in field blanks or ground-water samples collected after ground-water samples containing high concentrations of the constituent, then carry-over was ruled out as a source of contamination.

The fourth potential source of contamination evaluated was random contamination from field or laboratory equipment or processes. All detections in field blanks that could not be accounted for by source-solution contamination, specific known conditions at field sites, or carry-over were used in the evaluation. Random contamination in field and laboratory processes has an equal chance of affecting each ground-water sample. Thus, strategies for flagging detections of constituents subject to random contamination in field and laboratory processes must be applied to all ground-water samples.

Different notation was used for flagging detections of organic and inorganic constituents that may have been subject to contamination during sample collection, handling, or analysis. Inorganic constituents are naturally present in ground water, and the concerns about inorganic constituents generally are related to concentration, rather than detection (presence or absence). In contrast, concerns about organic constituents generally are related to both detection and concentration. Therefore, different schema are used for assessing and flagging data for organic and inorganic constituents.

For organic constituents, V-codes were applied. The purpose of V-coding was to flag detections that have a greater chance of being false-positive detections. A false-positive detection is a detection that is caused by contamination during sample collection, handling, or analysis of a ground-water sample that would otherwise have a non-detection for that constituent. Results with V-codes were not considered detections of the constituent for this study, and were not included in calculations of detection frequencies for organic constituents. The V-coding level was defined as the highest concentration of the constituent detected in a field blank plus the LT-MDL (equal to one-half the LRL) for that constituent.

For inorganic constituents, a ≤ symbol was applied to low-concentration detections of constituents that may have been affected by contamination during sample collection, handling, or analysis. The ≤ symbol means that the concentration of the constituents in the ground-water sample is less than or equal to the measured concentration (including the possibility that it may be less than the LT-MDL and therefore a non-detection). The ≤ symbol was applied to all detections of constituents in ground-water samples that had concentrations less than or equal to the highest concentration measured for that constituent in field blanks collected during OWENS (field blanks were collected at 7 percent of the wells sampled).

Replicates

Sequential replicate samples were collected to assess the precision of the water-quality data. The variability between concentrations in the replicate sample pairs was represented by the relative standard deviation (RSD) at high concentrations and by the standard deviation (SD) at low concentrations (Anderson, 1987; Mueller and Titus, 2005). The RSD is defined as the SD divided by the mean concentration for each replicate pair of samples, expressed as a percentage. For this study, acceptable precision was defined as an RSD of less than 10 percent for replicate pairs with concentrations greater than 5 times the LRL for the constituent, and as a SD of less than the LRL for replicate pairs with concentrations less than 5 times the LRL for the constituent. Acceptable precision for radiochemical constituents was defined as the presence of overlap between the results (value ± 1-sigma CSU) for the two analyses. Sequential replicate samples were collected at 4 percent of the wells sampled.

Matrix Spikes

Addition of known concentration of a constituent (‘spike’) to a replicate ground-water sample enables the analyzing laboratory to determine the effect of the matrix, in this case ground water, on the analytical technique used to measure the constituent. The known compounds added in matrix spikes are the same as those being analyzed in the method. This enables an analysis of matrix interferences on a compound-by-compound basis. Matrix spikes were added at the laboratory performing the analysis. Low matrix-spike recovery may indicate that the compound might not be detected in some samples if it were present at very low concentrations. Low and high matrix-spike recoveries may be a potential concern if the concentration of a compound in a ground-water sample is close to the MCL: a low recovery could falsely result in a measured concentration below the MCL; whereas, a high recovery could falsely result in a measured concentration above the MCL.

Acceptable ranges for matrix-spike recoveries are based on the acceptable ranges established for laboratory “set” spike recoveries. Laboratory set spikes are aliquots of laboratory blank water to which the same spike solution used for the matrix spikes has been added. One set spike is analyzed with each set of samples. Acceptable ranges for set spike recoveries are 70 to 130 percent for NWQL Schedules 2020, 4024, and 4433 (Connor and others, 1998; Rose and Sandstrom, 2003; Zaugg and others, 2006), 60 to 120 percent for NWQL Schedule 2003 (Sandstrom and others, 2001), and 60 to 130 percent for Schedule 2080 (Kolpin and others, 2002). Based on these ranges, 70 to 130 percent was defined as the acceptable range for matrix-spike recoveries for organic compounds in this study.

Matrix spike were performed for VOCs, gasoline additive compounds, pesticide compounds, NDMA, and 1,2,3-TCP because the analytical methods for these constituents are chromatographic methods which may be susceptible to matrix interferences (*tables A5A–C*).

Surrogates

Surrogate compounds are added to ground-water samples in the laboratory prior to analysis in order to evaluate the recovery of similar constituents. Surrogate compounds were added to all ground-water and quality-control samples that were analyzed for VOCs, gasoline additives, pesticides, NDMA, and 1,2,3-TCP (*table A6*). Most of the surrogate compounds are deuterated analogs of compounds being analyzed. For example, the surrogate toluene-*d*8 used for the VOC analytical method has the same chemical structure as toluene, except that the eight hydrogen-1 atoms on the molecule have been replaced by deuterium (hydrogen-2). Toluene-*d*8 and toluene behave very similarly in the analytical procedure, but the small mass difference between the two compounds results in slightly different chromatographic retention times, thus, the use of a toluene-*d*8 surrogate does not interfere with the analysis of toluene (Grob, 1995). Only 0.015 percent of hydrogen atoms are deuterium (Firestone and others, 1996), thus, deuterated compounds like toluene-*d*8 do not occur naturally and are not found in ground-water samples. Surrogates are used to identify general problems that may arise during sample analysis that could affect the analysis results for all compounds in that sample. Potential problems include matrix interferences (such as high levels of dissolved organic carbon) that produce a positive bias and (or) incomplete laboratory recovery (possibly due to improper maintenance and calibration of analytical equipment) that produces a negative bias. A 70- to 130-percent recovery of surrogates generally is considered acceptable; values outside this range indicate possible problems with the processing and analysis of samples (Connor and others, 1998; Sandstrom and others, 2001).

Quality-Control Samples Results

Detections in Field Blanks and Source-Solution Blanks

Five field blanks and two source-solution blanks were collected for analysis of VOCs, and two compounds were detected: toluene and chloroform. Toluene was detected in two field blanks at a concentration of E0.02 µg/L. Toluene was also frequently detected at low concentrations in field balnks from other GAMA study units. Five detections of toluene in ground-water samples with concentrations less than the LRL of 0.18 µg/L were therefore V-coded (*table 5*). V-coded data are not used in the assessment of ground-water quality.

1,2,4-Trimethylbenzene was not detected in field blanks collected at OWENS sites; however, it has been detected at low concentrations in field blanks from several other GAMA study units. Low concentrations of 1,2,4-trimethylbenzene were detected in five ground-water samples from OWENS, and in three of them, it was the only VOC detected. Based on the detection of the compound in field blanks from other study units, and the unusual detection pattern in OWENS, all five detections of 1,2,4-trimethylbenzene were V-coded, and therefore not used in the assessment of ground-water quality (*table 5*).

Chloroform was detected in one field blank at a concentration of E0.05 µg/L, which was greater than the concentrations measured in four of the nine ground-water samples with detections of chloroform. However, because chloroform was very rarely detected in field blanks from any other GAMA study unit, no data from OWENS were V-coded at this time.

Five field blanks were collected for analysis of nutrients, dissolved organic carbon, major and minor ions, trace elements, and trace element species. Of these 48 constituents, 22 were detected in at least one field blank. However, one of the five field blanks contained 17 constituents, while the other four field blanks each contained 8 or fewer constituents. No other GAMA study unit had field blanks containing more than 10 nutrient, major ion, and trace element constituents (except for field blanks affected by known contamination of the source-solution blank water prior to shipment from the NWQL). Therefore, this field blank was considered anomalous and not representative, and was not used in the assessment of the quality of the ground-water data.

The highest concentration of a constituent measured in the four remaining field blanks was considered representative of the potential amount of contamination that may occur during sample collection, handling, and analysis. All detections in ground-water samples with concentrations less than or equal to the highest concentration measured in the four field blanks were flagged with ≤ symbols. The ≤ flagging indicates that the true concentration of the constituent in the ground-water sample may be less than or equal to the measured concentration, including the possibility that the true concentration may have been a non-detection. Data with ≤ flagging were used in the assessment of ground-water quality. All of the ≤ flagged data have concentrations near the LRLs for the constituents, much lower than the concentrations of the regulatory and non-regulatory thresholds. Detections near the LRLs for ammonia, nitrate, total nitrogen, aluminum, chromium, copper, lead, mercury, nickel, tungsten, zinc, and species of iron received ≤ flagging (*tables A3*, *8, 10, 11*).

One field blank was collected for analysis of radium isotopes and gross alpha and beta radioactivities. Radium-226 was detected at an activity of 0.0326 ± 0.0090 pCi/L in the field blank (*table A3*). Two detections of radium-226 in ground-water samples with activities less than 0.0416 pCi/L (upper end of activity range in the blank) were flagged with a ≤ symbol (*table 13C*).

No compounds were detected in field blanks for the following analyte groups: pesticides and pesticide degradates (four field blanks) and constituents of special interest (nine field blanks).

Variability in Replicate Samples

Tables A4A–D summarize the results of replicate sample pairs for analytes detected in ground-water samples collected during the OWENS study. Measured concentrations are reported for all replicate sample pairs with relative variability greater than the acceptable limits of an RSD value of less than 10 percent or a SD of less than the LRL for the constituent. Three sequential replicate samples were collected, resulting in analysis of 495 replicate pairs, counted by constituent. Of the 175 replicate pairs for constituents detected in ground-water samples, 11 had variability greater than acceptable limits.

One organic constituent had an unacceptable replicate pair (*table A4A*). Carbon disulfide was detected at a concentration below the LRL in the ground-water sample, but not detected in the replicate sample. Because detection frequencies are reported for organic constituents, this discrepancy is noteworthy, even though the reported data (E0.03 µg/L and < 0.06 µg/L) are analytically indistinguishable. Carbon disulfide was detected at concentrations below the LRL in two ground-water samples; both detections were flagged as potentially unreliable, and were not included in the assessment of ground-water quality (*table 5*).

Fluoride, iodide, total nitrogen, boron, iron, molybdenum, and tungsten, measured on NWQL schedule 1948, and total iron and total arsenic measured by research methods at the USGS Trace Metals Laboratory each had one replicate pair with unacceptable variability (*table A4B,C*). However, all of the unacceptable pairs were from just one of the three sequential replicate samples analyzed. In addition, many of the pairs have vastly different values (for example, 0.92 µg/L and 2.82 µg/L for fluoride). This suggests that this sequential replicate may have been mislabeled and therefore not be representative of analytical precision. No data were flagged as a result of these results.

One replicate pair for radon-222 had unacceptable precision (*table A4D*). However, all radon-222 activities measured in this study were well below the alternative MCL-US of 4,000 pCi/L. Thus, the lower precision would not affect the number of samples reported as above or below the threshold value.

Matrix Spike Recoveries

Tables A5A–C present a summary of matrix-spike recoveries for the OWENS study. Three ground-water samples were spiked with VOCs (schedule 2020), and one was spiked with gasoline oxygenates and degradates (schedule 4024) to calculate matrix-spike recoveries (*table A5A*). Median matrix-spike recoveries were within the acceptable range of 70 and 130 percent for all compounds (*table A5A*).

Two ground-water samples were spiked with pesticide and pesticide degradate compounds in order to calculate matrix-spike recoveries. Forty-nine of the 63 compounds had median matrix-spike recoveries within the acceptable range of 70 and 130 percent (*table A5B*). Fourteen spike compounds had median matrix-spike recoveries below 70 percent. Of these, only 2-chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) was detected in ground-water samples. (Note that low recoveries may indicate that this compound was not detected in some samples if it was present at very low concentrations).

One ground-water sample was spiked with NDMA and 1,2,3-TCP. The spike recoveries were within the acceptable range of 70 to 130 percent (*table A5C*).

Surrogate Compound Recoveries

Surrogate compounds were added to ground-water samples in the laboratory and analyzed to evaluate the recovery of similar constituents. *Table A6* list in columns the surrogate, analytical schedule on which it was applied, the number of analyses for blank and ground-water samples, the number of surrogate recoveries below 70 percent, and the number of surrogate recoveries above 130 percent for the blank and ground-water samples. Blank and ground-water samples were considered separately to assess whether the matrices present in non-blank samples affect surrogate recoveries. No systematic differences between surrogate recoveries in blank and ground-water samples were observed. All surrogate recoveries in analyses of pesticides were in the acceptable range of 70 to 130 percent recovery, as were 91 percent of surrogate recoveries for NDMA, 1,2,3-TCP analyses, and 89 percent of the surrogate recoveries for VOCs and gasoline oxygenates.

Table A1. Analytical methods used for the determination of organic, inorganic, and microbial constituents by the U.S. Geological Survey National Water Quality Laboratory and additional contract laboratories.

[**Analytical method:** MI agar, supplemental nutrient agar in which coliforms (total and *Escherichia*) produce distinctly different fluorescence under ultraviolet lighting. **Abbreviations:** USGS, U.S. Geological Survey; NWQL, National Water Quality Laboratory; UV, ultraviolet; VOCs, volatile organic compounds]

Analyte classes	Analytical method	Laboratory and analytical schedule	Citation(s)
		Water-quality indicators	
Field parameters	Calibrated field meters and test kits	USGS field measurement	U.S. Geological Survey, variously dated
		Organic constituents	
VOCs	Purge and trap capillary gas chromatography/mass spectrometry	NWQL, Schedule 2020	Connor and others, 1998
Gasoline oxygenates	Heated purge and trap/gas chromatography/mass spectrometry	NWQL, Schedule 4024	Rose and Sandstrom, 2003
Pesticide and degradates	Solid-phase extraction and gas chromatography/mass spectrometry	NWQL, schedule 2003	Zaugg and others, 1995; Lindley and others, 1996; Sandstrom and others, 2001; Madsen and others, 2003
Pharmaceuticals	Solid-phase extraction and HPLC/mass spectrometry	NWQL, schedule 2080	Furlong and others, 2001
Wastewater-indicators	Solid-phase extraction and gas chromatography/mass spectrometry	NWQL, schedule 4433	Zaugg and others, 2006
		Constituents of special interest	
Perchlorate	Chromatography and mass spectrometry	Montgomery Watson Harza Laboratory	Hautman and others, 1999
N-nitrosodimethylamine (NDMA)	Chromatography and mass spectrometry	Montgomery Watson Harza Laboratory	U.S. Environmental Protection Agency, 1996; U.S. Environmental Protection Agency, 1999b
1,2,3-Trichloropropane	Gas chromatography/electron capture detector	Montgomery Watson Harza Laboratory	U.S. Environmental Protection Agency, 1995
		Inorganic constituents	
Nutrients	Alkaline persulfate digestion, Kjedahl digestion	NWQL, schedule 2755	Fishman, 1993; Patton and Kryskalla, 2003
Dissolved organic carbon	UV-promoted persulfate oxidation and infrared spectrometry	NWQL, schedule 2612	Brenton and Arnett, 1993
Major and minor ions, trace elements and nutrients	Atomic absorption spectrometry, colorimetry, ion-exchange chromatography, inductively-coupled plasma atomic emission spectrometry and mass spectrometry	NWQL, schedule 1948	Fishman and Friedman, 1989; Faires, 1993; Fishman, 1993; McLain, 1993; American Public Health Association, 1998; Garbarino, 1999; Garbarino and Damrau, 2001; Garbarino and others, 2006
Chromium, arsenic and iron species	Various techniques of ultraviolet visible (UV-VIS) spectrophotometry and atomic absorbance spectroscopy	USGS Trace Metal Laboratory, Boulder, Colorado	Stookey, 1970; To and others, 1998; Ball and McCleskey, 2003a and 2003b; McCleskey and others, 2003

Table A1. Analytical methods used for the determination of organic, inorganic, and microbial constituents by the U.S. Geological Survey National Water Quality Laboratory and additional contract laboratories.—Continued

[**Analytical method:** MI agar, supplemental nutrient agar in which coliforms (total and *Escherichia*) produce distinctly different fluorescence under ultraviolet lighting. **Abbreviations:** USGS, U.S. Geological Survey; NWQL, National Water Quality Laboratory; UV, ultraviolet; VOCs, volatile organic compounds]

Analyte classes	Analytical method	Laboratory and analytical schedule	Citation(s)
Stable isotopes			
Stable isotopes of hydrogen and oxygen of water	Gaseous hydrogen and carbon dioxide-water equilibration and stable-isotope mass spectrometry	USGS Stable Isotope Laboratory, Reston, Virginia	Epstein and Mayeda, 1953; Coplen and others, 1991; Coplen, 1994
Carbon isotopes	Accelerator mass spectrometry	University of Waterloo, Environmental Isotope Lab; University of Arizona Accelerator Mass Spectrometry Lab	Donahue and others, 1990; Jull and others, 2004
Radioactivity and gases			
Tritium	Electrolytic enrichment-liquid scintillation	USGS Stable Isotope and Tritium Laboratory, Menlo Park, California	Thatcher and others, 1977
Tritium and noble gases	Helium-3 in-growth and mass spectrometry	Lawrence Livermore National Laboratory	Moran and others, 2002; Eaton and others, 2004
Radon-222	Liquid scintillation counting	NWQL, schedule 1369	American Society for Testing and Materials, 1998
Radium 226/228	Alpha activity counting	Eberline Analytical Services, NWQL method 1262	U.S. Environmental Protection Agency, 1980 (USEPA method 903)
Gross alpha and beta radioactivity	Alpha and beta activity counting	Eberline Analytical Services, NWQL method 1792	U.S. Environmental Protection Agency, 1980 (USEPA method 900.0)
Uranium isotopes	Chemical separations and alpha-particle spectrometry	Eberline Analytical Services; Schedule 1130	American Society for Testing and Materials, 2002
Microbial constituents			
F-specific and somatic coliphage	Single-agar layer (SAL) and two-step enrichment methods	USGS Ohio Water Microbiology Laboratory	U.S. Environmental Protection Agency, 2001
Total and *Escherichia* coliform	Membrane filter technique with "MI agar"	USGS field measurement	U.S. Environmental Protection Agency, 2002b

Table A2. Preferred analytical schedules for constituents appearing on multiple schedules for ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[**Preferred analytical schedules** are the methods of analysis with the greatest accuracy and precision out of the ones used for the compound in question. MWH, Montgomery Watson Harza Laboratory; TML, U.S. Geological Survey Trace Metal Laboratory. **Abbreviations:** VOC, volatile organic compound]

Constituent (common name)	Primary constituent classification	Analytical schedules	Preferred analytical schedule
Results from preferred method reported			
Acetone	VOC	2020, 4024	2020
Diisopropyl ether	VOC	2020, 4024	2020
Ethyl *tert*-butyl ether (ETBE)	VOC	2020, 4024	2020
Methyl *tert*-butyl ether (MTBE)	VOC	2020, 4024	2020
Methyl *tert*-pentyl ether	VOC	2020, 4024	2020
Results from both methods reported			
1,2,3-Trichloropropane (1,2,3-TCP)	VOC	2020, MHW	MWH
Arsenic, total	Trace element	1948, TML	1948
Chromium, total	Trace element	1948, TML	1948
Iron, total	Trace element	1948, TML	1948

Table A3. Constituents detected in field blanks collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[V-codes are applied to organic constituents. V-coded data for ground-water samples are not considered detections for ground-water quality assessment because the constituents were detected in blanks at similar concentrations or were determined to be present due to contamination during sample collection. ≤ codes are applied to detections of inorganic constituents with concentrations less than or equal to the highest concentration measure in field blanks. **Abbreviations**: E, estimated value; pCi/L, picocuries per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; —, not detected; ≤, less than or equal to]

Constituent	Number of field blank detections/analyses	Concentrations detected in field blanks	Number of ground-water samples V-coded or ≤-coded
Organic constituents (µg/L)			
Toluene	2/5	E0.02, E0.02	5
1,2,4-Trimethylbenzene	0/5	—	5
Chloroform	1/5	E0.05	0
Nutrients and major ions (mg/L)			
Ammonia, as nitrogen	1/5	0.012	9
Nitrate + Nitrite, as nitrogen	1/5	E0.04	1
Orthophosphate, as phosphorus	1/5	E0.004	0
Total nitrogen	3/5	E0.06, 0.07, 0.11	6
Calcium	1/5	0.1	0
Magnesium	1/5	0.042	0
Trace elements (µg/L)			
Aluminum	1/5	1	8
Arsenic	1/5	E0.11	0
Barium	1/5	E0.07, 0.30	0
Chromium	4/5	E0.07, E0.08, 0.08, 0.42	7
Copper	2/5	0.65, 2.6	26
Lead	2/5	E0.11, 0.84	46
Manganese	1/5	E0.20	0
Mercury	1/5	0.02	15
Molybdenum	1/5	E0.10	0
Nickel	3/5	E0.03, E0.03, 0.63	5
Strontium	1/5	0.76	0
Tungsten	1/5	0.11	7
Vanadium	1/5	E0.02	0
Zinc	2/5	1.3, 5.2	18
Iron (total)[1]	2/5	3, 4	22
Iron (II)[1]	1/5	3	18
Radioactivity (pCi/L)			
Radium-226	1/1	0.0326 ± 0.0090	2

[1] Constituents analyzed by the USGS Trace Metal Laboratory in Boulder, Colorado, using research methods.

Table A4A. Quality-control summary for replicate analyses of organic constituents and constituents of special interest detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[MWH, Montgomery Watson Harza; SD, standard deviation; RSD, percent relative standard deviation; LRL, laboratory reporting limit; µg/L, micrograms per liter; nv, no measured values with SD greater then the LRL; —, none in category]

Constituent	Number of nondetections/ number of replicates	Number of SDs greater than the LRL/number of replicates with concentration less than five times the LRL	Concentrations of replicates with SDs greater than the LRL (environmental, replicate) (µg/L)
Volatile organic compounds and gasoline oxygenates (Schedules 2020 and 4204)			
1,3,-Dichlorobenzene	3/3	—	nv
Tetrahydrofuran	3/3	—	nv
Tetrachloroethene	3/3	—	nv
Dichloromethane	3/3	—	nv
1,2,4-Trimethylbenzene	3/3	—	nv
Carbon disulfide	2/3	1/1	E0.03, <0.06
Methyl *tert*-butyl ether	3/3	—	nv
Toluene	3/3	—	nv
Benzene	3/3	—	nv
Chloroform	3/3	—	nv
Bromodichloromethane	3/3	—	nv
Pesticides and pesticide degradates (Schedule 2003)			
Simazine	2/2	—	—
Atrazine	2/2	—	—
Hexazinone	2/2	—	—
Tebuthiuron	2/2	—	—
Deethylatrazine	2/2	—	—
Constituents of special interest (MWH Laboratory)			
Perchlorate	3/3	—	—

Table A4B. Quality-control summary for replicate analyses of major and minor ions and nutrients detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[SD, standard deviation; RSD, percent relative standard deviation in percent; LRL, laboratory reporting limit; mg/L, milligrams per liter; nv, no measured values with RSD greater than 10 percent or SD greater then the LRL; —, none in category]

Constituent	Number of nondetect or ≤-coded replicates	Number of SDs greater than the LRL/number of replicates with concentration less than five times LRL	Concentrations of replicates with SDs greater than the LRL (environmental, replicate) (mg/L)	Number of RSDs greater than 10 percent/number of replicates with concentration greater than five times LRL	Concentrations of replicates with RSDs greater than 10 percent (environmental, replicate) (mg/L)
Major and Minor Ions					
Calcium	—	—	nv	0/3	nv
Magnesium	—	0/1	nv	0/2	nv
Potassium	—	—	nv	0/3	nv
Sodium	—	—	nv	0/3	nv
Bromide	—	0/1	nv	0/2	nv
Chloride	—	—	nv	0/3	nv
Fluoride	—	0/1	nv	1/2	0.92, 2.82
Iodide	1	1/1	0.004, 0.01	0/1	nv
Sulfate	—	—	nv	0/3	nv
Silica	—	—	nv	0/3	nv
Total dissolved solids	—	—	nv	0/3	nv
Nutrients					
Phosphate	—	0/2	nv	0/1	nv
Total nitrogen	—	—	nv	1/3	1.37, 1.03
Nitrate plus nitrite	—	—	nv	0/3	nv
Ammonia	2	—	nv	0/1	nv
Nitrite	2	0/1	nv	—	nv
Dissolved organic carbon	—	0/2	nv	—	nv

Table A4C. Quality-control summary for replicate analyses of trace elements detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[LRL, laboratory reporting limit; RSD, percent relative standard deviation in percent; SD, standard deviation; USGS. U.S. Geological Survey. µg/L, micrograms per liter; nv, no measured values with RSD greater than 10 percent or SD greater then the LRL; —, none in category]

Constituent	Number of nondetect or ≤-coded replicates	Number of SDs greater than the LRL/number of replicates with concentration less than five times LRL	Concentrations of replicates with SDs greater than the LRL (environmental, replicate) (µg/L)	Number of RSDs greater than 10 percent/number of replicates with concentration greater than five times LRL	Concentrations of replicates with RSDs greater than 10 percent (environmental, replicate) (µg/L)
			Trace Elements (Schedule 1948)		
Aluminum	1	0/1	nv	0/2	nv
Antimony	1	0/2	nv	—	nv
Arsenic	—	—	nv	0/3	nv
Barium	—	0/1	nv	0/2	nv
Beryllium	3	—	nv	—	nv
Boron	—	—	nv	1/3	193, 162
Cadmium	2	0/1	nv	—	nv
Chromium	—	0/2	nv	0/1	nv
Cobalt	2	0/1	nv	—	nv
Copper	2	0/1	nv	—	nv
Iron	1	0/1	nv	1/1	38, 46
Lead	3	—	nv	—	nv
Lithium	—	—	nv	0/3	nv
Manganese	1	0/2	nv	—	nv
Mercury	3	—	nv	—	nv
Molybdenum	—	—	nv	1/3	3.9, 3.3
Nickel	2	0/1	nv	—	nv
Selenium	—	0/2	nv	0/1	nv
Silver	3	—	nv	—	nv
Strontium	—	—	nv	0/3	nv
Thallium	3	—	nv	—	nv
Tungsten	—	0/1	nv	1/2	10.7, 6.2
Uranium	—	—	nv	0/3	nv
Vanadium	—	—	nv	0/3	nv
Zinc	1	0/1	nv	0/1	nv
			USGS Trace Metals Laboratory		
Iron, total	2	—	nv	1/1	9, 56
Iron (II)	3	—	nv	—	nv
Chromium, total	2	—	nv	0/1	nv
Chromium (VI)	2	—	nv	0/1	nv
Arsenic, total	—	0/1	nv	1/2	8.8, 14
Arsenic (III)	3	—	nv	—	nv

Table A4D. Quality-control summary for replicate analyses of radiochemical constituents detected in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[pCi/L, picocuries per liter; nv, no values with non-overlapping ranges]

Constituent	Number of nonoverlapping values/number of replicates	Activites for replicates with nonoverlapping values (environmental, replicate) (pCi/L)
Radon-222	1/1	1860 ± 19, 1950 ± 19
Tritium	0/2	nv

Table A5A. Quality-control summary of matrix-spike recoveries for volatile organic compounds (VOCs) and gasoline oxygenates and degradates in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

Constituent	Number of spiked samples	Recovery (percent)		
		Minimum	Maximum	Median
Acetone[1]	4	108	112	111
Acrylonitrile	3	102	110	110
tert-Amyl alcohol	1	101	101	101
Benzene	3	96	109	109
Bromobenzene	3	98	102	102
Bromochloromethane	3	108	114	114
Bromodichloromethane (THM)[2]	3	106	115	113
Bromoethene	3	101	128	122
Bromoform (tribromomethane, THM)	3	100	116	105
Bromomethane	3	89	102	102
2-Butanone (ethyl methyl ketone)	3	101	107	105
tert-Butyl alcohol (TBA)	3	97	97	97
Butylbenzene (*n*-Butylbenzene)	3	81	108	97
sec-Butylbenzene	3	89	113	111
tert-Butylbenzene	3	103	120	119
Carbon disulfide[2]	3	68	88	82
Chlorobenzene	3	90	108	106
Chloroethane	3	106	117	117
Chloroform (trichloromethane) (THM)[2]	3	106	115	113
Chloromethane	3	85	113	106
3-Chloropropene	3	109	124	122
2-Chlorotoluene	3	89	109	106
4-Chlorotoluene	3	87	109	106
Dibromochloromethane (THM)	3	106	106	106
1,2-Dibromo-3-chloropropane (DBCP)	3	99	103	101
1,2-Dibromoethane (EDB)	3	104	109	106
Dibromomethane	3	102	109	109
1,2-Dichlorobenzene	3	104	104	104
1,3-Dichlorobenzene[2]	3	102	109	106
1,4-Dichlorobenzene	3	94	106	106
trans-1,4-Dichloro-2-butene	3	97	103	101
Dichlorodifluoromethane (CFC-12)	3	53	132	115
1,1-Dichloroethane	3	113	117	115
1,2-Dichloroethane	3	104	118	111
1,1-Dichloroethene	3	91	113	106
cis-1,2-Dichloroethene	3	94	115	113
trans-1,2-Dichloroethene	3	96	117	117
Dichloromethane (methylene chloride)[2]	3	106	106	106
1,1-Dichloropropene	3	84	112	109
1,2-Dichloropropane	3	98	106	104
1,3-Dichloropropane	3	106	106	106
cis-1,3-Dichloropropene	3	83	100	93
trans-1,3-Dichloropropene	3	95	106	106
2,2-Dichloropropane	3	87	100	100
Diethyl ether	3	91	107	107
Diisopropyl ether[1]	4	86	108	107
Ethylbenzene	3	85	113	109
Ethyl *tert*-butyl ether (ETBE, *tert*-butyl ethyl ether)[1]	4	75	108	100
Ethyl methacrylate	3	86	96	93
o-Ethyl toluene (2-Ethyltoluene)	3	85	106	104
Hexachlorobutadiene	3	77	85	85

Table A5A. Quality-control summary of matrix-spike recoveries for volatile organic compounds (VOCs) and gasoline oxygenates and degradates in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

Constituent	Number of spiked samples	Recovery (percent)		
		Minimum	Maximum	Median
Hexachloroethane	3	102	107	107
2-Hexanone (*n*-Butyl methyl ketone)	3	96	110	108
Isopropylbenzene	3	91	117	115
Methyl acetate	1	108	108	108
Methyl acrylate	3	96	104	104
Methyl acrylonitrile	3	104	117	115
Methyl *tert*-butyl ether (MTBE)[1,2]	4	86	106	102
Methyl iodide (iodomethane)	3	97	109	103
Methyl methacrylate	3	82	91	91
4-Methyl-2-pentanone (MIBK, isobutyl methyl ketone)	3	89	104	104
Methyl *tert*-pentyl ether[1]	4	85	108	106
Naphthalene	3	91	99	96
n-Propylbenzene	3	85	113	111
Styrene	3	8	106	88
1,1,1,2-Tetrachloroethane	3	104	111	106
1,1,2,2-Tetrachloroethane	3	102	109	106
Tetrachloroethene (PCE)[2]	3	96	113	113
Tetrachloromethane (carbon tetrachloride)	3	104	120	118
Tetrahydrofuran[2]	3	101	117	112
1,2,3,4-Tetramethylbenzene	3	84	105	98
1,2,3,5-Tetramethylbenzene (isodurene)	3	99	113	113
Toluene[2]	3	96	104	100
1,2,3-Trichlorobenzene	3	92	106	106
1,2,4-Trichlorobenzene	3	85	99	92
1,1,1-Trichloroethane (TCA)	3	113	117	117
1,1,2-Trichloroethane	3	102	109	104
Trichloroethene (TCE)	3	96	104	102
Trichlorofluoromethane (CFC-11)	3	111	131	130
1,2,3-Trichloropropane (1,2,3-TCP)	3	106	111	109
1,1,2-Trichlorotrifluoroethane (CFC-113)	3	85	109	96
1,2,3-Trimethylbenzene	3	105	116	105
1,2,4-Trimethylbenzene[2]	3	92	119	119
1,3,5-Trimethylbenzene	3	92	110	110
Vinyl chloride	3	96	128	117
m- and *p*-Xylene	3	93	114	113
o-Xylene	3	83	106	104

[1] Constituents on schedules 2020 and 4024; only values from schedule 2020 are reported because it is the preferred analytical schedule.

[2] Constituents detected in ground-water samples.

Table A5B. Quality-control summary of matrix-spike recoveries for pesticides and pesticide degradates in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spiked samples	Recovery (percent)		
		Minimum	Maximum	Median
1-Naphthol	2	28	30	29
2,6-Diethylaniline	2	92	105	99
2-Chloro-2',6'-diethylacetanilide	2	99	109	104
2-Chloro-4-isopropylamino-6-amino-*s*-triazine (deethylatrazine) [1]	2	35	39	37
2-Ethyl-6-methylaniline	2	87	96	91
3,4-Dichloroaniline	2	75	90	82
4-Chloro-2-methylphenol	2	55	65	60
Acetochlor	2	110	117	113
Alachlor	2	105	111	108
Atrazine[1]	2	92	97	95
Azinphos-methyl	2	98	104	101
Azinphos-methyl oxygen analog	2	40	56	48
Benfluralin, water	2	71	85	78
Carbaryl	2	110	132	121
Chlorpyrifos	2	96	99	98
Chlorpyrifos oxygen analog	2	9	30	20
cis-Permethrin	2	71	72	72
Cyfluthrin	2	67	75	71
Cypermethrin	2	68	72	70
DCPA	2	104	105	104
Desulfinyl fipronil	2	100	110	105
Desulfinylfipronil amide	2	98	108	103
Diazinon	2	96	104	100
Diazinon oxygen analog	2	90	93	92
Dichlorvos	2	19	30	24
Dicrotophos	2	30	47	38
Dieldrin	2	87	117	102
Dimethoate	2	36	36	36
Ethion	2	88	103	95
Ethion monoxon	2	100	103	101
Fenamiphos	2	110	112	111
Fenamiphos sulfone	2	82	91	86
Fenamiphos sulfoxide	2	47	50	48
Fipronil	2	109	112	111
Fipronil sulfide	2	90	108	99
Fipronil sulfone	2	79	87	83
Fonofos	2	93	97	95
Hexazinone[1]	2	72	78	75
Iprodione	2	0	0	0
Isofenphos	2	111	116	113
Malaoxon	2	85	96	91
Malathion	2	98	116	107
Metalaxyl	2	100	107	104
Methidathion	2	91	100	95

Table A5B. Quality-control summary of matrix-spike recoveries for pesticides and pesticide degradates in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.—Continued

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spiked samples	Recovery (percent)		
		Minimum	Maximum	Median
Methyl paraoxon	2	50	56	53
Methyl parathion	2	97	99	98
Metolachlor	2	112	112	112
Metribuzin	2	86	92	89
Myclobutanil	2	94	106	100
Pendimethalin	2	110	115	112
Phorate	2	61	78	69
Phorate oxygen analog	2	110	112	111
Phosmet	2	12	31	21
Phosmet oxygen analog	2	10	28	19
Prometon	2	90	103	96
Prometryn	2	111	111	111
Pronamide	2	98	105	101
Simazine[1]	2	94	103	99
Tebuthiuron[1]	2	100	131	115
Terbufos	2	103	130	116
Terbufos oxygen analog sulfone	2	70	84	77
Terbuthylazine	2	103	110	106
Trifluralin	2	75	95	85

[1] Constituents detected in ground-water samples.

Table A5C. Quality-control summary of matrix spike recoveries for constituents of special interest in ground-water samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[Acceptable recovery range is between 70 and 130 percent]

Constituent	Number of spiked samples	Recovery (percent)
1,2,3-Trichloropropane[1]	1	102
N-Nitrosodimethylamine (NDMA)	1	110

[1]Constituents detected in ground-water samples.

Table A6. Quality-control summary of surrogate recoveries for volatile organic compounds and gasoline oxygenates and degradates, pesticides and pesticide degradates and constituents of special interest, in samples collected for the Owens and Indian Wells Valleys Groundwater Ambient Monitoring and Assessment (GAMA) study, California, September–December 2006.

[**Abbreviations:** MWH, Montgomery Watson Harza Laboratory; VOC, volatile organic compound; na, not analyzed]

Surrogate	Analytical schedule	Constituent or constituent class analyzed	Blank samples				Ground-water samples			
			Number of analyses	Median recovery (percent)	Numer of surrogate recoveries		Number of analyses	Median recovery (percent)	Number of surrogate recoveries	
					Below 70 percent	Above 130 percent			Below 70 percent	Above 130 percent
1-Bromo-4-fluorobenzene	2020, 4024	Oxygenate	7	79	0	0	78	91	0	0
1,2-Dichloroethane-*d*4	2020, 4024	Oxygenate	7	111	0	1	78	119	0	9
Isobutyl alcohol-*d*6	4024	Gasoline oxygenate	1	86	0	0	10	84	0	0
Toluene-*d*8	2020, 4024	Oxygenate	7	96	0	0	78	98	0	0
Diazinon-*d*10	2003	Pesticide and degradate	4	102	0	0	70	104	0	0
alpha-HCH-*d*6	2003	Pesticide and degradate	4	94	0	0	70	90	0	0
Toluene-*d*8	MWH	1,2,3-TCP	9	98	0	0	67	99	0	0
NDMA-*d*6	MWH	NDMA	9	78	2	0	67	85	6	0

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Manuscript approved for publication, February 12, 2009
Prepared by the USGS Publishing Network,
Publishing Service Center, Sacramento, California

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