CITY OF VACAVILLE - UTILITIES DEPARTMENT
PUBLIC WATER SYSTEM 48-10008

2016 TRIENNIAL REPORT ON WATER QUALITY RELATIVE TO PUBLIC HEALTH GOALS

Background Information

Provisions of the California Health and Safety Code (Reference No. 1) specify that water systems serving more than 10,000 service connections must prepare a brief, written report every three years that provides information on the "detection" of any contaminants above one or more Public Health Goals (PHGs) published by the state Office of Environmental Health Hazard Assessment (OEHHA). The report must also list the "detection" of any contaminant above the Maximum Contaminant Level Goals (MCLGs) set by the United States Environmental Protection Agency (USEPA) for all other contaminants until such time as OEHHA has published PHGs for those contaminants.

It is emphasized that the report only needs to provide information on the number of contaminants that a water system has found at a level exceeding a PHG or a MCLG.

The purpose of the legislation requiring these reports was to provide consumers with information on levels of contaminants even below the enforceable mandatory Maximum Contaminant Levels (MCLs) so they would be aware of whatever risks might be posed by the presence of these contaminants at levels below the MCLs. Additionally, each water system must provide an estimate of the cost to reduce the contaminant(s) to the PHG (or MCLG if there is no established PHG) regardless of how minimal the risk might be.

The law specifies what information is to be provided in the report. (See Reference No. 1)

If a constituent was detected in the City's water supply between 2013 and 2015 at a level exceeding an applicable PHG or MCLG, this report provides the information required by the law. Included is the numerical public health risk associated with the constituent's MCL, the highest level allowed in drinking water, the established PHG or MCLG (if no PHG), the category or type of risk to health that could be associated with each constituent, the best treatment technology available that could be used to reduce the constituent level, and an estimate of the cost to install that treatment if it is appropriate and feasible.

What Are MCLs, PHGs and MCLGs?

The USEPA and the California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) establish MCLs at very conservative levels to provide protection to consumers to result in a very low to negligible health risk for human water consumption. In other words, MCLs are the regulatory definition of what is "safe".

PHGs and MCLGs are often set lower than MCLs, at very low levels depending on the established health risk, and in the case of the USEPA, MCLGs are also set at zero for some constituents. Determination of health risk at these levels is theoretically based on risk assessments with multiple assumptions and mathematical extrapolations. Many contaminants are considered to be carcinogenic and USEPA's policy is to set the applicable MCLGs at zero because they are considered no amount of these constituents to be without risk. It is understood that zero is an unattainable goal and cannot be measured by available analytical methods. Note that by regulation, California's OEHHA cannot set a PHG at zero and therefore OEHHA must calculate a numerical level to address risk, even though it may be unattainable or impossible to measure. (Example: OEHHA has established the PHG for hexavalent chromium at 0.02 ppb, but the test Detection Limit for Reporting is 1.0 ppb).

It is important to keep in mind that PHGs and MCLGs are not enforceable. The Best Available Technology (BAT) to reach such low levels may not been defined and may not realistically be available. Accordingly, accurate cost estimates are difficult, if not impossible, and are highly speculative and theoretical. Therefore, cost estimates have limited value and may not warrant significant investment of agency time and money.

Water Quality Data Considered:

All of the water quality data collected by our water system between 2013 and 2015 for purposes of determining compliance with drinking water standards was considered. This data was summarized in our 2013, 2014, and 2015 Annual Water Quality Reports, which were mailed or made available to all of our customers before July 1st of each year following the monitoring year. Please note that triennial groundwater source monitoring was conducted in 2014, superseding 2011 triennial monitoring data that is referenced in the 2013 Annual Water Quality Report; only 2014 triennial groundwater data is required to be evaluated in this report. (Reference No. 2)

Guidelines Followed:

The Association of California Water Agencies (ACWA) formed a workgroup, which prepared guidelines for water providers to use in preparing these required reports. The ACWA guidelines were used in the preparation of this report. (Reference No. 3)

Best Available Treatment Technology and Cost Estimates:

Both the USEPA and SWRCB Division of Drinking Water have adopted what are known as BATs or Best Available Technologies, which are the best known methods of reducing contaminant levels to the MCL. Costs can be estimated for such technologies. However, since many PHGs and all MCLGs are set much lower than the MCL, it is not always possible or feasible to determine what treatment is needed to further reduce a constituent downward to or near the PHG or MCLG, many of which are set at zero. Estimating the costs to reduce a constituent to zero is difficult, if not impossible because it is not possible to verify by analytical means that the level has been lowered to zero. In some cases, installing treatment to try and further reduce very low levels of one constituent may have adverse effects on other aspects of water quality. (Reference No. 3)

Constituents Detected That Exceed a PHG or a MCLG:

The following are discussions regarding the five constituents: arsenic, coliform bacteria (total), hexavalent chromium, gross beta activity, and uranium that were detected in one or more of our drinking water sources at levels above the PHG, or if no PHG, above the MCLG.
(Reference 4 is a tabled summary).

Arsenic

Effective in January 2006, the federal arsenic MCL was lowered from 50 ppb to 10 ppb. California established the PHG for arsenic at 0.004 ppb in April 2004. This is far below the Detection Limit for Reporting (DLR) of 2 ppb, and is well below the level that can be reliably determined by current laboratory methods.

Arsenic is a naturally occurring element found in many types of rocks and soils. It is also sometimes found in runoff from orchards, and is sometimes found in glass and electronics production wastes. Erosion of natural deposits is the primary source of arsenic found in the water supply.

Level in City of Vacaville's Drinking Water
For the 2013 to 2015 period, the range of arsenic detected was between <2 ppb to 8.2 ppb, below the current 10 ppb MCL, but above the PHG of 0.004 ppb.

Health Risk Information
Some people who drink water containing arsenic in excess of the MCL over many years may experience skin damage or circulatory system problems, and may have an increased risk of getting cancer. Numerical health risk data on arsenic has been provided by OEHHA, the state agency responsible for providing that information. (Reference 3)

Best Available Technology (BAT) and Treatment Costs
The "best available technology" for arsenic removal is dependent on the water chemistry of the source water being treated. While research into new methods for removing arsenic continues, the current water treatment technology recommendations are:

- Ion exchange
- Granulated ferric oxide adsorption
- Coagulation and filtration
- Reverse osmosis

All of the effective BAT methods for arsenic removal require significant space, are expensive to install and operate, and would produce residual hazardous waste that would require costly disposal.

For the 2013 to 2015 time period, seven of the 11 ground water wells and both treated surface water sources exceeded the 2 ppb DLR for arsenic in one or more samples per source. Therefore, cost estimates would be based on BAT treatment of seven ground water wells and two surface water treatment plants.

Treatment cost estimates, based on assumptions stated previously, to install and operate individual arsenic removal systems for seven ground water wells, would range from approximately $2,350,000 to $8,460,000 per year, which includes annualized cost of construction plus annual operation and maintenance costs for ion exchange or granulated ferric oxide adsorption, ($1.85-$1.99 per 1,000 gallons), or reverse osmosis ($1.82 - $6.65 per 1,000 gallons), but does not include waste disposal. Additionally, treatment cost estimates to install and operate arsenic removal for the two surface water sources by coagulation/filtration ($0.37 per 1,000 gallons) would be approximately $1,110,000 per year. For water produced at 2015 levels, the treatment technology choices would depend on the ability of treatment to attain arsenic levels below the DLR of 2 ppb for each source. Some treatment options (ex. blending in a new reservoir) were not considered as they require more space than is available at the site, or the treatment option is not feasible or creates new problematic issues. This translates into an estimated additional annual cost of to $139 to $389 per service connection for the life of all of the treatment systems, depending on treatment technologies required. Please note that this cost estimate does not include hazardous waste transport and disposal costs, which are estimated to add between 30%-50% to the treatment cost estimates per service connection.

Coliform Bacteria (Total)

The Maximum Contaminant Level (MCL) in drinking water for coliform bacteria is 5% positive samples of all samples per month, and the MCLG is zero. Coliform bacteria are indicator organisms that are ubiquitous in nature and are not generally considered harmful. They are used because of the ease in monitoring and analysis. If a positive sample is found, it indicates a potential problem that needs to be investigated and further follow up sampling is done. It is not at all unusual for a system to have an occasional positive sample. It is difficult, if not impossible, to assure that a system will never get a positive sample. Coliform bacteria found in 5% or more of monthly samples is a warning of potential water distribution system problems.

Level in Drinking Water
Over the 2013 to 2015 period, City laboratory staff collected between 103 and 130 samples monthly throughout our distribution system for coliform bacteria analyses. Of the 4,082 routine samples collected, one sample was positive for total coliform bacteria and negative for fecal coliform bacteria (in February 2013); and the one sample location re-tested negative for all coliform bacteria on the next day. The one positive sample equates to a monthly maximum of 0.9% positive in 2013. There were no samples that tested positive for coliform bacteria in all of 2014 and 2015.

Health Risk Information
The coliform drinking water standard serves to minimize the possibility of the water containing pathogens, which are organisms that cause waterborne disease. Because coliform bacteria are only a surrogate indicator of the potential presence of pathogens, it is not possible to state a specific numerical health risk. While USEPA normally sets MCLGs "at a level where no known or anticipated adverse effects on persons would occur", they indicate that they cannot do so with coliform bacteria.

Best Available Technology (BAT) and Treatment Costs
The City chlorinates all drinking water to assure that the water served is microbiologically safe. The chlorine residual levels are carefully controlled to provide the best health protection without causing the water to have undesirable taste and odor or increasing the amount of disinfection byproducts in the drinking water. This careful balance of treatment processes is essential to continue supplying our customers with high quality safe drinking water. Other equally important measures that we have implemented include: an effective cross-connection control program, maintenance of a disinfectant residual throughout our water distribution system, an effective monitoring and surveillance program, and maintaining positive pressures in our water distribution system.

The City has already taken all of the steps described by the DDW as "best available technology" for coliform bacteria in Section 64447, Title 22, California Code of Regulations.

Hexavalent Chromium

Effective in January 2015, California established a new hexavalent chromium MCL at 10 ppb. Prior to this date, hexavalent chromium was included in the total chromium MCL at 50 ppb. California set the PHG for hexavalent chromium at 0.02 ppb in 2011. This is far below the Detection Limit for

Reporting (DLR) of 1 ppb, and is well below the level that can be reliably determined by current laboratory methods.

The hexavalent chromium found in Vacaville's groundwater supply is from erosion of naturally occurring minerals in the deep groundwater Tehama aquifer. Hexavalent chromium contamination can also result from the discharge from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production, and textile manufacturing facilities.

Level in City of Vacaville's Drinking Water
For the 2013 to 2015 period, the range of hexavalent chromium detected was between <1 ppb to 24 ppb, exceeding the 10 ppb MCL in five groundwater wells, and above the PHG of 0.02 ppb 10 of 11 wells, but was not detected above the 1 ppb DLR in either of the two surface water supplies.

Health Risk Information
Some people who drink water containing hexavalent chromium in excess of the MCL over many years may have an increased risk of getting cancer. Numerical health risk data on hexavalent chromium has been provided by OEHHA, the state agency responsible for providing that information. (Reference 2)

Best Available Technology (BAT) and Treatment Costs
The "best available technology" for hexavalent chromium removal is dependent on the water chemistry of the source water being treated. While research into new methods for removing hexavalent chromium continues, the current recommendations are:

- Ion exchange
- Reduction, Coagulation and filtration
- Reverse osmosis

All of the effective BAT methods for hexavalent chromium removal require significant space, are expensive to install and operate, and would produce residual hazardous waste that would require costly disposal.

For the 2013 to 2015 time period, 10 of the 11 groundwater wells exceeded the 1 ppb DLR for hexavalent chromium. Therefore, cost estimates would be based on BAT treatment of 10 groundwater wells.

Treatment cost estimates, based on assumptions stated previously, to install and operate individual hexavalent chromium removal systems for 10 ground water wells, would range from approximately $3,160,000 to $19,900,000 per year, which includes annualized cost of construction plus annual operation and maintenance costs for ion exchange ($1.62-$6.78 per 1,000 gallons), reduction-coagulation-filtration ($1.58-$9.95 per 1,000 gallons), or reverse osmosis ($1.82 - $6.65 per 1,000 gallons), but does not including significant hazardous waste disposal costs. For water produced at 2015 levels, the treatment technology choices would depend on the ability of treatment to attain hexavalent chromium levels below the DLR of 1 ppb for each source. Some treatment options (ex. blending in a new reservoir) were not considered as they require more space than is available at the site, or the treatment option is not feasible or creates new problematic issues. This translates into an estimated additional annual cost of to $117 to $736 per service connection for the life of all of the treatment systems, depending on treatment technologies required. Please note that this cost estimate does not include hazardous waste transport and disposal costs, which are estimated to add between 30%-50% to the treatment cost estimates per service connection.

Gross Beta Activity

California has set the MCL for gross beta activity at 50 pico Curies per liter (pCi/L), and has an USEPA MCLG of zero pCi/L. Gross Beta Activity naturally occurs in many types of rocks and soils. It is also sometimes found in the waste discharge from metal factories. Erosion of natural deposits is the primary source of Gross Beta activity found in the water supply.

Level in City of Vacaville's Drinking Water
The amount of gross beta activity found in the treated water is based detections in the deep groundwater wells; gross beta activity was not detected in the surface water sources. The last required testing of groundwater was conducted in 2011, with results ranging from "not detected" to 5 pCi/L. This is well below the 50 pCi/L MCL, but does exceed the MCLG of zero pCi/L.

Health Risk Information
Certain minerals are radioactive and may emit forms of radiation known as photons and beta radiation. Some people who drink water containing beta and photon emitters in excess of the MCL over many years may have an increased risk of getting cancer.

Best Available Technology (BAT) and Treatment Costs
Treating water containing naturally occurring radionuclides increases the radionuclide concentrations in the residual streams. The concentration of radionuclides in the waste stream, the type of waste produced (liquid or solid), and federal and state regulations will affect what disposal options are available to the system and what technology can be used for removal of the contaminant. BATs include:

- reverse osmosis
- lime softening
- ion exchange

Treatment cost estimates, based on assumptions stated previously, to install and operate individual gross beta removal systems for 4 ground water wells, would range from approximately $300,000 to 1,500,000 per year, which includes annualized cost of construction plus annual operation and maintenance costs for ion exchange ($1.62-$6.78 per 1,000 gallons), or reverse osmosis ($1.82 - $6.65 per 1,000 gallons), but does not including significant hazardous waste disposal costs. For water produced at 2015 levels, the treatment technology choices would depend on the ability of treatment to attain non-detect results for each source. Some treatment options (ex. lime softening, blending in a new reservoir) were not considered as they require more space than is available at the site, or the treatment option is not feasible or creates new problematic issues. This translates into an estimated additional annual cost of to $12 to $61 per service connection for the life of all of the treatment systems, depending on treatment technologies required. Please note that this cost estimate does not include hazardous waste transport and disposal costs, which are estimated to add between 30%-50% to the treatment cost estimates per service connection.

Uranium

California has set the MCL for uranium at 20 pico Curies per liter (pCi/L), with a PHG of 0.43 pCi/L. Erosion of natural deposits is the primary source of Uranium activity found in the water supply.

Level in City of Vacaville's Drinking Water
The amount of uranium found in the treated water is based detections in the deep groundwater wells; uranium was not detected in the surface water sources. The last required testing of

groundwater for uranium was conducted in 2011, with results ranging from 1.1 - 3.2 pCi/L. This is well below the 20 pCi/L MCL, but does exceed the PHG of 0.43 pCi/L.

Health Risk Information
Some people who drink water containing uranium in excess of the MCL over many years may have kidney problems or an increased risk of getting cancer.

Best Available Technology (BAT) and Treatment Costs
Treating water containing naturally occurring radionuclides increases the radionuclide concentrations in the residual streams. The concentration of radionuclides in the waste stream, the type of waste produced (liquid or solid), and federal and state regulations will affect what disposal options are available to the system and what technology can be used for removal of the contaminant. BATs include

- reverse osmosis
- lime softening
- ion exchange

Treatment cost estimates, based on assumptions stated previously, to install and operate individual uranium removal systems for all 11 ground water wells, would range from approximately $820,000 to 4,000,000 per year, which includes annualized cost of construction plus annual operation and maintenance costs for ion exchange ($1.62-$6.78 per 1,000 gallons), or reverse osmosis ($1.82 - $6.65 per 1,000 gallons), but does not including significant hazardous waste disposal costs. For water produced at 2015 levels, the treatment technology choices would depend on the ability of treatment to attain non-detect results for each source. The lime softening treatment option was not considered as it would likely create undesirable water quality in the distribution system. This translates into an estimated additional annual cost of to $33 to $163 per service connection for the life of all of the treatment systems, depending on treatment technologies required. Please note that this cost estimate does not include hazardous waste transport and disposal costs, which are estimated to add between 30%-50% to the treatment cost estimates per service connection.

RECOMMENDATIONS FOR FUTHER ACTIONS

The drinking water quality of the City of Vacaville meets or exceeds all state and federal drinking water MCL standards set to protect public health, with one exception for hexavalent chromium, whose MCL was recently lowered from 50 ppb (as total chromium) to 10 ppb in 2015, resulting in five City groundwater sources exceeding the new MCL. City staff are taking progressive actions to reduce the hexavalent chromium levels in the five groundwater wells in order to produce drinking water below the 10 ppb MCL by the regulatory deadline of January 1, 2020. Over the past year, the City has sent out multiple public notifications to water consumers of the hexavalent chromium MCL exceedances in water bills, in the local newspaper, and via the City's website. The latest information on progress toward meeting the new MCL for hexavalent chromium in the City's water sources can be accessed from the City's website at: http://www.cityofvacaville.com/index.aspx?page=810.

With regard to arsenic and total coliform bacteria contaminants identified in this report, which are already significantly below the health-based MCLs, additional costly treatment processes would be required and would result in minimal improvement in drinking water quality. Further, the effectiveness of the additional treatment processes to provide any significant reductions in constituent levels at these already low values is uncertain. Therefore, no treatment actions are proposed for arsenic and total coliform bacteria.

REFERENCES

1 - Excerpt from California Health & Safety Code: Section 116470 (b)
2 - City of Vacaville 2013, 2014 and 2015 Annual Water Quality Report to Consumers
3 - Association of California Water Agencies (ACWA) Suggested Guidelines for Preparation of Required Reports on PHG's - includes Health Risk Information for Public Health Goal Exceedance Reports and ACWA Cost Estimates
4 - Table of PHG Exceedances for 2013 to 2015
5 - Glossary of terms and abbreviations used in report

REFERENCE 1

Excerpt from California Health & Safety Code: Section 116470 (b)

State of California Health & Safety Code

Section 116470. Consumer Confidence Report

(a) As a condition of its operating permit, every public water system shall annually prepare a consumer confidence report and mail or deliver a copy of that report to each customer, other than an occupant, as defined in Section 799.28 of the Civil Code, of a recreational vehicle park. A public water system in a recreational vehicle park with occupants as defined in Section 799.28 of the Civil Code shall prominently display on a bulletin board at the entrance to or in the office of the park, and make available upon request, a copy of the report. The report shall include all of the following information:

(1) The source of the water purveyed by the public water system.
(2) A brief and plainly worded definition of the terms "maximum contaminant level," "primary drinking water standard," and "public health goal."
(3) If any regulated contaminant is detected in public drinking water supplied by the system during the past year, the report shall include all of the following information:
  (A) The level of the contaminant found in the drinking water, and the corresponding public health goal and primary drinking water standard for that contaminant.
  (B) Any violations of the primary drinking water standard that have occurred as a result of the presence of the contaminant in the drinking water and a brief and plainly worded statement of health concerns that resulted in the regulation of that contaminant.
  (C) The public water system's address and phone number to enable customers to obtain further information concerning contaminants and potential health effects.
(4) Information on the levels of unregulated contaminants, if any, for which monitoring is required pursuant to state or federal law or regulation.
(5) Disclosure of any variances or exemptions from primary drinking water standards granted to the system and the basis therefor.

(b) On or before July 1, 1998, and every three years thereafter, public water systems serving more than 10,000 service connections that detect one or more contaminants in drinking water that exceed the applicable public health goal, shall prepare a brief written report in plain language that does all of the following:

(1) Identifies each contaminant detected in drinking water that exceeds the applicable public health goal.
(2) Discloses the numerical public health risk, determined by the office associated with the maximum contaminant level for each contaminant identified in paragraph (1) and the numerical public health risk determined by the office associated with the public health goal for that contaminant.
(3) Identifies the category of risk to public health, including, but not limited to, carcinogenic, mutagenic, teratogenic, and acute toxicity, associated with the exposure to the contaminant in drinking water, and includes a brief plainly worded description of these terms.
(4) Describes the best available technology, if any is then available on a commercial basis, to remove the contaminant or reduce the concentration of the contaminant. The public water system may, solely at its own discretion, briefly describe actions that have been taken on its own, or by other entities, to prevent the introduction of the contaminant into drinking water supplies.

(5) Estimates the aggregate cost and the cost per customer of utilizing the technology described in paragraph (4), if any, to reduce the concentration of that contaminant in drinking water to a level at or below the public health goal.

(6) Briefly describes what action, if any, the local water purveyor intends to take to reduce the concentration of the contaminant in public drinking water supplies and the basis for that decision.

(c) Public water systems required to prepare a report pursuant to subdivision (b) shall hold a public hearing for the purpose of accepting and responding to public comment on the report. Public water systems may hold the public hearing as part of any regularly scheduled meeting.

(d) The department shall not require a public water system to take any action to reduce or eliminate any exceedance of a public health goal.

(e) Enforcement of this section does not require the department to amend a public water system's operating permit.

(f) Pending adoption of a public health goal by the Office of Environmental Health Hazard Assessment pursuant to subdivision (c) of Section 116365, and in lieu thereof, public water systems shall use the national maximum contaminant level goal adopted by the United States Environmental Protection Agency for the corresponding contaminant for purposes of complying with the notice and hearing requirements of this section.

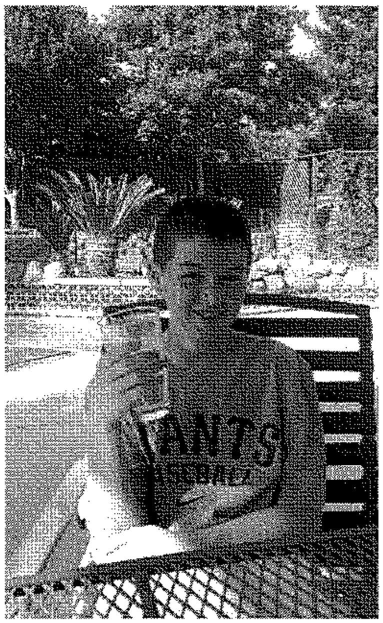
(g) This section is intended to provide an alternative form for the federally required consumer confidence report as authorized by 42 U.S.S. Section 300g-3(c).

REFERENCE 2

City of Vacaville 2013, 2014 and 2015 Annual Water Quality Report to Consumers

2013 CITY OF VACAVILLE

Water Quality Report to Consumers



Este informe contiene información muy importante sobre su aqua potable. Tradúzcalo o hable con alguien que lo entienda bien.

The City of Vacaville wants you, our customers, to know that your water system has met all water quality standards and is a safe and reliable drinking water supply. These standards are established by the U.S. Environmental Protection Agency (USEPA) and the California State Department of Public Health (DPH). In 2013 the City distributed over 6 billion gallons of drinking water. This water was subjected to extensive testing, not only for regulated contaminants, but many non-regulated chemical properties as well. More than 4,000 analyses were performed on drinking water samples in 2013.

In order to ensure that tap water is safe to drink, the USEPA and the DPH prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. DPH regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants doesn't necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (800) 426-4791, or visit the web site at http://www.epa.gov/safewater. If you have further questions, please contact the City Water Quality Laboratory Supervisor, Mindy Boele, by phone at (707) 469-6400 or by email at mindy.boele@cityofvacaville.com.

KEEP THE LEAD OUT

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. City of Vacaville is responsible for providing high quality drinking water, but can not always control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

SOURCES OF WATER AND CONTAMINANTS:

The sources of drinking water (both tap and bottled) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity. Vacaville's water supply consists of two surface water sources and 11 deep groundwater wells. Lake Berryessa surface water, conveyed through the Putah South Canal (PSC), provided 33% of the City's total consumption of water in 2013, and Sacramento Delta surface water, from the North Bay Aqueduct (NBA), provided an additional 39%. Groundwater from the 11 deep wells made up the balance (28%) of our water needs. Treatment of the surface water is divided between the Vacaville Water Treatment Plant (VWTP) and the North Bay Regional Water Treatment Plant (NBR). The VWTP treats PSC source water only, while the NBR plant, which is jointly owned by the cities of Vacaville and Fairfield, treats both PSC and NBA source water.

CONTAMINANTS THAT MAY BE PRESENT IN SOURCE WATER:

- Microbial contaminants, such as viruses and bacteria that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, that can be naturally-occurring or result from urban storm-water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Pesticides and herbicides that may come from a variety of sources such as agriculture, urban storm-water runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, that are by-products of industrial processes and petroleum production and can also come from gas stations, urban storm-water runoff, agricultural application, and septic systems.
- Radioactive contaminants that can be naturally-occurring or be the result of oil and gas production and mining activities.

ARSENIC IN DRINKING WATER: Vacaville Meets the Limit

While arsenic levels in your drinking water are less than the current USEPA standard of 10 ppb, the groundwater does contain very low levels of arsenic. These results are from samples taken in 2011 and 2013. The standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. The USEPA continues to research the health effects of low levels of arsenic, which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems.

HEALTH RELATED INFORMATION:

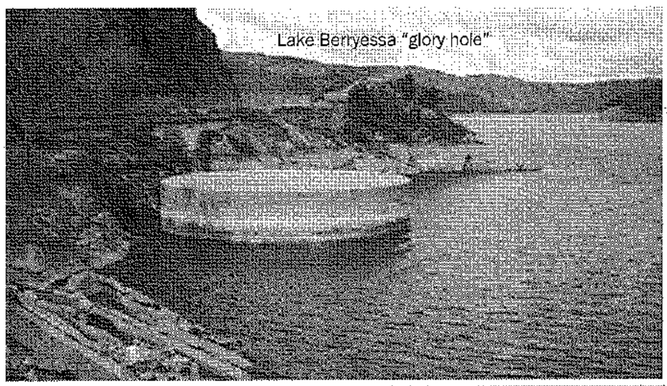
Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. USEPA and Center for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the USEPA's Safe Drinking Water Hotline(1-800-426-4791).

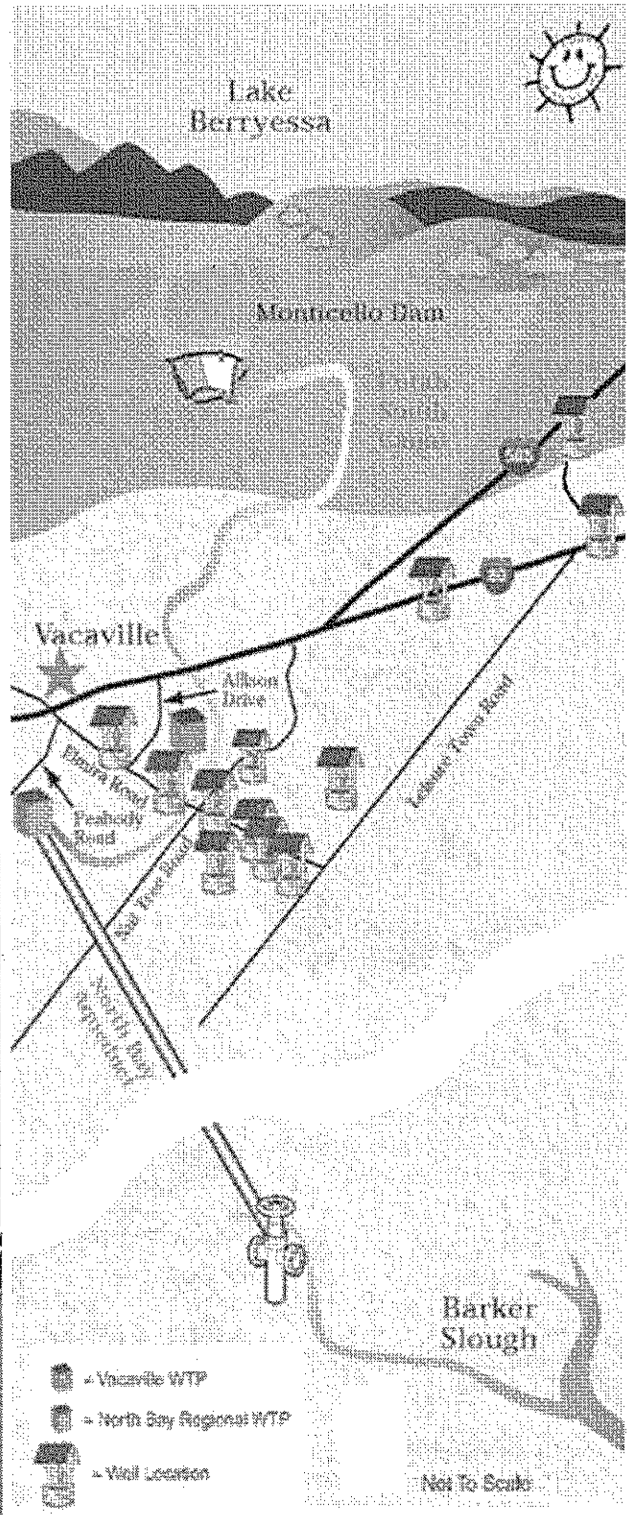
SOURCE WATER ASSESSMENTS AND VULNERABILITY SUMMARIES

A Source Water Assessment evaluates the quality of water that is used in a community drinking water supply. It is also used to determine the Potential Contributing Activities (PCAs) that occur within and nearby a source water supply. The PCAs are then compiled into a Vulnerability Summary report. The latest Summary report for the Sacramento Delta, including the North Bay Aqueduct (NBA), was updated in 2012. The source was considered to be most vulnerable to animal grazing activities, urban and agricultural runoff, recreational use and seawater intrusion.

The Solano County cities treating NBA water, in conjunction with the Solano County Water Agency, have implemented watershed management practices to improve water quality and reduce the significance of the potential contaminant sources. The latest Summary report for Putah South Canal (PSC) was completed in 2012. The results of the assessment survey indicated that PSC is most vulnerable to illegal activities/ unauthorized dumping and herbicide application. Management measures along the canal have been implemented that mitigate the risk for each of these PCAs.

The summaries for Vacaville's groundwater wells were performed in 2002, 2003, and 2005. The wells are considered most vulnerable to automobile gas stations, chemical and petroleum processing and storage, dry cleaners, septic systems, sewer collection systems, agricultural drainage, agricultural wells and irrigation wells. The wells offer various levels of protection from PCAs due to factors such as the aquifer, deep water table intakes, well construction features and physical barriers. A copy of the Source Water Assessments and Vulnerability Summaries can be obtained through the California DPH, Drinking Water Field Operations Branch, San Francisco District Office, 850 Marina Bay Parkway, Bldg P, 2nd Floor, Richmond, California 94804. You may request that a summary be sent to you by contacting Bob Brownwood, District Engineer, CDPH, at (510) 620-3474.


Lake Berryessa "glory hole"



Where your water comes from. Map is not to scale, but gives you a relative idea of the location of water sources for the City of Vacaville.

UCMR-3:

USEPA uses the Unregulated Contaminant Monitoring (UCM) program to collect data for contaminants suspected to be present in drinking water, but that do not have health-based standards set under the Safe Drinking Water Act (SDWA). Every five years EPA reviews the list of contaminants, largely based on the Contaminant Candidate List. The SDWA Amendments of 1996 provide for:

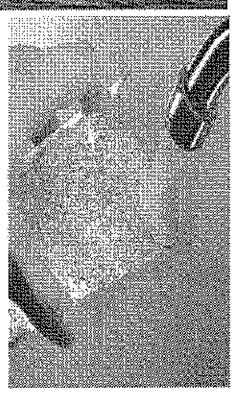
*Monitoring no more than 30 contaminants every five years.

*Storing analytical results in a National Contaminant Occurrence Database (NCOD).

*Monitoring only a representative sample of public water systems serving less than 10,000 people.

The UCM Program progressed in several stages. Currently, EPA manages the program directly as specified in the Unregulated Contaminant Monitoring Rule. The City of Vacaville performed sampling under UCMR1 in 2002, UCMR2 in 2010 and began the UCMR3 sampling in September of 2013.

The data collected allows the EPA to establish the need for continued monitoring and regulation of these constituents. Limits are established to be the most protective of the population.



PROTECT YOUR WATER SUPPLY

Polluted storm water potentially affects drinking water sources, which can affect public health and increase drinking water treatment costs. Please help protect your water supply by controlling household, landscaping, health care and automotive products that contain toxic chemicals. Reduce the use of toxic chemicals wherever possible (including fertilizers and pesticides) and be sure to properly recycle or dispose of waste. Everything that goes down a storm drain or sewer may potentially affect your local water supply. Never dispose of household, landscaping, health care or automotive products that contain toxic chemicals down the storm drain or in the sewer.

The following tables list all the drinking water contaminants that were detected during the most recent sampling for the consistuents. To read the tables, start with the far left column titled Constituent and read across the row. Units express the amount measured. MCL shows the highest amount of the substance allowed. PHG (MCLG) is the goal amount for that substance, which may be a lower amount than the amount allowed. The Range reports the lowest and highest amounts detected and the Average is the annual average. Contaminant Sources describes where the substance usually originates. To better understand the report, use the Legend that defines the terms used.

Table 1- SAMPLING RESULTS SHOWING THE DETECTION OF COLIFORM BACTERIA

Microbiological Contaminant	Highest No. of Detections	No. of Months in Violation	MCL	MCLG	Contaminant Sources
Total Coliform Bacteria	1	0	5% (1378 samples collected in 2013)	0	Naturally present in the environment.
Fecal Coliform Bacteria	0	0	A routine sample and a repeat sample detect for total coliform and either sample also detects for fecal coliform.	0	Human and animal fecal waste.

Table 2 - SAMPLING RESULTS SHOWING THE DETECTION OF LEAD AND COPPER

Constituent (reporting units)	No of samples (collected in 2011)	90th Percentile Detected	No. Sites exceeding AL	AL	PHG	Contaminant Sources
Lead (ppb) [a]	31	2.5	0	15	0.2	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm) [a]	31	0.2	0	1.3	0.3	Internal corrosion of household water plumbing systems; erosion of natural deposits; leaching from wood preservatives.

Table 3 - SAMPLING RESULTS FOR SODIUM AND HARDNESS [b]

Constituent (reporting units)	Sample date	GROUNDWATER		SURFACE WATER-NBA		SURFACE WATER-VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Hardness (ppm)	2013	81 - 310 [c]	173 [c]	75 - 196	134	170	170	Sum of polyvalent cations present in the water, generally magnesium and calcium, and are usually naturally occurring.
Sodium (ppm)	2013	41 - 75 [c]	55 [c]	17 - 31	24	9.8	9.8	Salt present in the water and is generally naturally occurring.

Table 4 - DETECTION OF CONTAMINANTS WITH A PRIMARY DRINKING WATER STANDARD

Constituent (reporting units)	MCL	PHG (MCLG)	GROUNDWATER		SURFACE WATER TREATED AT NBR		SURFACE WATER TREATED AT VWTP		Contaminant Sources
			Range	Average	Range	Average	Range	Average	
Aluminum (ppb)	1000	600	nd - 88 [c]	13 [c]	nd - 42	18	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Arsenic (ppb)	10	0.004	nd - 6.8	2.7	nd - 3.0	0.7	nd	nd	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes.
Barium (ppm)	1	2	0.07 - 0.14 [c]	0.1 [c]	0.03 - 0.04	0.04	nd	nd	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits.
Chromium (ppb)	50	(100)	1.0 - 23	12.3	nd - 0.2	nd	nd - 7.4	3.6	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits.
Fluoride (ppm) [d]	2	1	System wide monthly average = 0.82, minumum = 0.69, maximum = 1.04						Erosion of natural deposits; water additive that promotes strong teeth.
Nickel (ppb)	100	12	nd [c]	nd [c]	nd - 12	5	nd	nd	Erosion of natural deposits; discharge from metal factories.
Nitrate as NO3 (ppm)	45	45	1.8 - 19.8	8.6	nd - 2.0	0.5	nd	nd	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits.
Gross Beta Activity (pCi/L)	50	0	nd - 5.0 [c]	nd [c]	nd [c]	nd [c]	nd [c]	nd [c]	Decay of natural and man-made deposits.
Uranium (pCi/L)	20	0.43	1.1 - 3.2 [c]	1.7 [c]	nd [c]	nd [c]	nd [c]	nd [c]	Erosion of natural deposits.

Table 5 - DETECTION OF CONTAMINANTS WITH A SECONDARY DRINKING WATER STANDARD [e]

Constituent (reporting units)	MCL	GROUNDWATER		SURFACE WATER-NBA		SURFACE WATER-VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Aluminum (ppb)	200	nd - 88 [c]	13 [c]	nd - 42	18	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Color (units)	15	nd [c]	nd [c]	nd	nd	5	5	Naturally-occurring organic materials.
Iron (ppb)	300	nd - 89 [c]	14 [c]	nd	nd	69	69	Leaching from natural deposits; industrial wastes.
Manganese (ppb)	50	nd - 4.1 [c]	0.9 [c]	nd	nd	nd	nd	Leaching from natural deposits.
Odor- Threshold (units)	3	nd - 1.0 [c]	0.3 [c]	1.4	1.4	nd	nd	Naturally-occurring organic materials.
Silver (ppb)	100	nd [c]	nd [c]	nd - 12	6	nd	nd	Industrial discharges.
Turbidty (units) [f]	5	0.09 - 0.5 [c]	0.17 [c]	0.04 - 0.07	0.05	0.24	0.24	Soil runoff.
Total Dissolved Solids (ppm)	1000	290 - 540 [c]	362 [c]	157 - 245	196	210	210	Runoff/leaching from natural deposits.
Specific Conductance (uS/cm)	1600	480 - 820 [c]	608 [c]	274 - 428	342	340	340	Substances that form ions when in water; seawater influence.
Chloride (ppm)	500	8.1 - 37 [c]	16 [c]	10 - 17	14	7.3	7.3	Runoff/leaching from natural deposits; seawater influence.
Sulfate (ppm)	500	25 - 68 [c]	37 [c]	23 - 34	28	20	20	Runoff/leaching from natural deposits; seawater influence.

Table 6 - DETECTION OF UNREGULATED CONTAMINANTS (UCMR3)

Constituent (reporting units)	NL	PHG (MCLG)	Source Water		Distribution System Water		
			Range	Average	Range	Average	
Chlorate (ppb)	800	na	23-200	104	<20-180	104	Unregulated contaminant monitoring helps the EPA and the State determine where certain contaminants occur and whether the contaminants need to be regulated. **Chromium is a regulated primary drinking water standard which has also been included in the UCMR3 data gathering program.
Chromium (ppb) **	50	(100)	<0.2-23	10.7	<0.2-19	11.9	
Hexavalent Chromium (ppb)	na	0.020	0.07-20	8.7	0.1-16	7.5	
Molybdenum (ppb)	na	na	<1-3.4	1.6	<1-1.6	1.3	
Strontium (ppb)	na	na	110-570	345	120-420	256	
Vanadium (ppb)	50	na	1.9-31	14.2	2.5-24	12.8	

Table 7 - DETECTION OF DISINFECTION BYPRODUCTS

Constituent (reporting units)	MCL	PHG (MCLG)	Range	Average	Violations	Contaminant Sources
Total Trihalomethanes (ppb)	80	na	13 - 63	38	0	By-product of drinking water disinfection.
Halo-Acetic Acids (ppb)	60	na	10 - 54	19	0	By-product of drinking water disinfection.
Constituent (reporting units)	**MCL or MRDL**	**MCLG or MRDLG**	**Average**	**Minimum**	**Maximum**	**Contaminant Sources**
DBP Precursors/TOC (ppm)	tt	-	2.0	1.4	2.7	Various natural and man made sources.
Chlorine (ppm)	4	4	0.76	0.02	1.4	By-product of drinking water disinfection.

FOOTNOTES:

(a) This is the state action level for samples collected inside homes. The 90th percentile reflects the concentration of lead or copper at which 90% of the samples tested were found to have not exceeded. Household lead and copper results are from 2011. The next sampling is scheduled for Summer of 2014.

(b) There are no Drinking water standards (MCLs, PHGs or MCLGs) for these constituents, they are just reported for customer information. To convert hardness data from ppm to grains per gallon, divide by 17.

(c) Results from last samples collected in 2011.

(d) Not possible to differentiate water source. The City of Vacaville treats the water by adding fluoride to the naturally occuring level to help prevent dental caries in consumers. The fluoride levels in the treated water are maintained within the range of 0.7 - 1.3 ppm, as required by the California Department of Public Health regulations.

(e) There are no PHGs, MCLGs or mandatory standard health effects language for these constituents because secondary MCLs are set on the basis of aesthetics.

(f) Turbidity is a measure of the cloudiness of the water. We monitor it because it is a good indicator of water quality. High turbidity can hinder the effectiveness of disinfectants.

LEGEND

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water, Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. **Secondary MCLs** are set to protect the odor, taste, and appearance of drinking water.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the USEPA.

PHG (Public Health Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the Cal EPA.

MRDL (Maximum Residual Disinfectant Level): The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

AL & NL (Regulatory Action Level or Notification Level): The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

tt: (Treatment Technique): A required process intended to reduce the level of a contaminant in drinking water.

na: Not applicable or Not available.

nd: Not Detected.

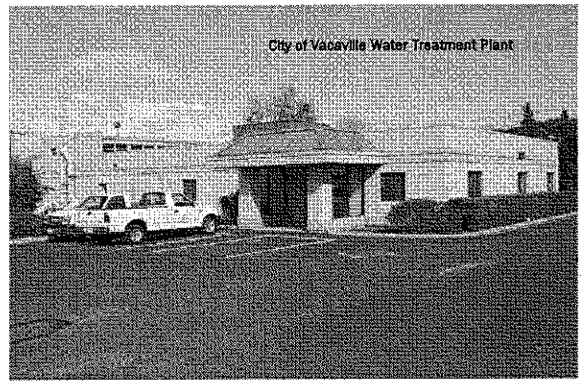
ntu: Nephelometric Turbidity Units. This is the standard unit for turbidity.

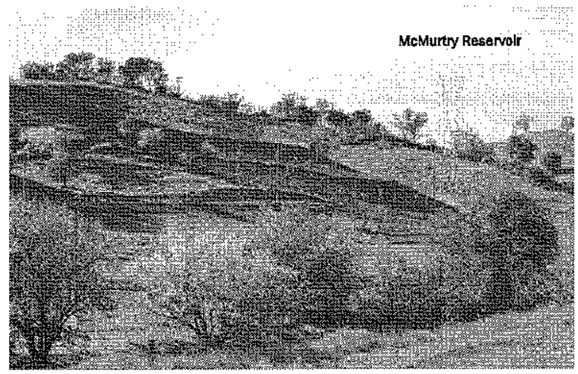
pCi/L: Pico Curies per Liter.

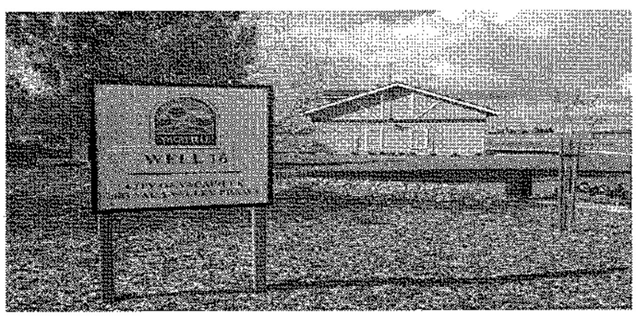
uS/cm: unit of measure for conductance.

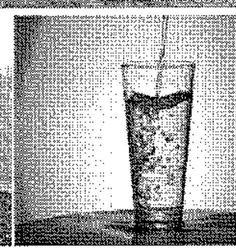
ppm: Parts Per Million or Milligrams Per Liter (mg/L).

ppb: Parts Per Billion or Micrograms Per Liter (ug/L).









Common Water Quality Issues in Public Supplies

TASTE AND ODOR
It is very difficult to separate taste from odor because these two human senses are so closely related. In addition to treatment additives, water can pick up tastes and odors from new pipe, from low usage in the treated water system or from natural substances in the source water. Tastes and odors in treated water are not harmful, but we do take steps to try and eliminate them.

CHLORINE SMELL
The most common complaint is a chlorine smell to the water. Chlorine is added to ensure that the water that makes it to your home or business is free of bacteria. The State allows us to have up to 4 parts per million chlorine residual in the drinking water; however, the City maintains the level around 0.8 parts per million with a maximum of 1.4 parts per million to reduce the taste and odor issues. Further reduction of taste and order can be achieved by point of use carbon filters, or by allowing water to sit in a pitcher in the refrigerator for an hour or so prior to use.

ROTTEN EGG SMELL
Also known as "sulfur odor", the rotten egg smell in water is caused by the reaction of sulfates and microorganisms in unchlorinated water. As the City's water is chlorinated, the actual cause of most sulfur odor issues comes from debris leftover in the sink p-trap below the water faucet where the odor is observed, which is easily resolved by flushing water down the p-trap to clear the odor-causing debris. If you still suspect the water supply to be the source of the smell, it is important to check to see whether the cold water also contains the odor, or just the hot water. Run the hot water to check for odor. Then move to another faucet and run the cold water. If the hot water alone has odor, then the odor is likely coming from the water heater, which may require a call to a plumber to resolve. If the cold water has an odor, then the source is in the cold water. Prior to calling the City to report a cold water rotten egg smell, be certain that the smell is not just gas trapped in the p-traps of your sewer drain system being pushed up as water flows to the sewer. If the smell is actually from the water, City water operators will want to know about the odor problem in order to resolve its source.

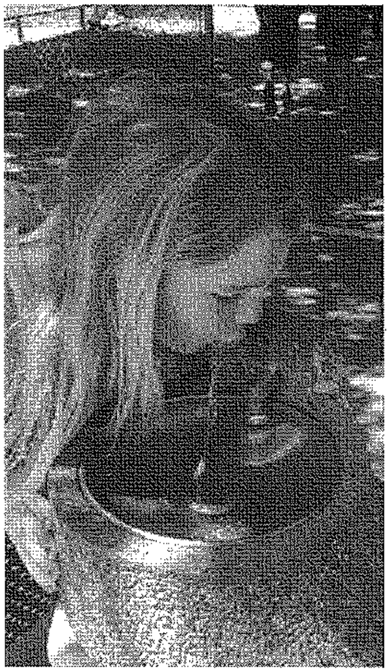
CLOUDY WATER
Cloudy water could be a result of dissolved air in the water, which is a common and harmless condition. To verify this, place the cloudy water in a glass and observe for 2 minutes. If it clears from the bottom up (you may be left with bubbles on the side of the glass and a small surface layer of bubbles), then you just have dissolved air in the water. If the cloudy water persists, or if you are noticing particles or unusual tastes or odors, please call us and a water operator will come check your water.

DISCOLORATION OF THE WATER
The discoloration is usually rust from aging pipes. It is not harmful, but is aesthetically displeasing. Discoloration of the water can be a result of disturbances in the water line due to using a hydrant improperly, installing new pipe, or shutting off the water to a local area for system maintenance. Home plumbing, especially in older homes, can also cause discoloration of the water.

HARD WATER
Hardness of the water varies from one part of the city to another. It is the main cause of white scaling and spotting on glassware. The higher the concentration of hardness causing minerals in your water, the more white scale you will notice on faucets and other water fixtures. Wiping down faucets and shower doors immediately after use if the best way to prevent hardness buildup.

2014
CITY OF VACAVILLE

Water Quality Report to Consumers



Este informe contiene información muy importante sobre su aqua potable. Tradúzcalo o hable con alguien que lo entienda bien.

The City of Vacaville (City) wants you, our customers, to know that your water system has met all water quality standards and is a safe and reliable drinking water supply. These standards are established by the U.S. Environmental Protection Agency (USEPA) and the California State Water Resources Control Board (State Board). In 2014 the City distributed over 5 billion gallons of drinking water. This water was subjected to extensive testing, not only for regulated contaminants, but for many non-regulated chemical properties as well. More than 4,000 analyses were performed on drinking water samples in 2014.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants doesn't necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (800) 426-4791. If you have further questions, please contact the Water Quality Laboratory Supervisor, Mindy Boele, by phone at (707) 469-6400 or by email at mindy.boele@cityofvacaville.com.

SOURCES OF WATER AND CONTAMINANTS:

The sources of drinking water (both tap and bottled) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity. Vacaville's water supply consists of two surface water sources and 11 deep groundwater wells. Lake Berryessa surface water, conveyed through Putah South Canal (PSC), provided 57% of the City's total consumption of water in 2014, and Sacramento Delta surface water, from the North Bay Aqueduct (NBA), provided an additional 9%. Groundwater from the 11 deep wells made up the balance (34%) of our water needs. Treatment of the surface water is divided between the Vacaville Water Treatment Plant (VWTP) and the North Bay Regional Water Treatment Plant (NBR). The VWTP treats PSC source water only, while the NBR plant, which is jointly owned by the cities of Vacaville and Fairfield, treats both PSC and NBA source water.

CONTAMINANTS THAT MAY BE PRESENT IN SOURCE WATER INCLUDE:

- Microbial contaminants, such as viruses and bacteria that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, that can be naturally-occurring or result from urban storm-water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Pesticides and herbicides that may come from a variety of sources such as agriculture, urban storm-water runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, that are by-products of industrial processes and petroleum production and can also come from gas stations, urban storm-water runoff, agricultural application, and septic systems.
- Radioactive contaminants that can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the USEPA and the State Board prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. State Board regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

HEALTH RELATED INFORMATION:

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. USEPA and Center for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the USEPA's Safe Drinking Water Hotline (1-800-426-4791).

KEEP THE LEAD OUT OF DRINKING WATER

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City is responsible for providing high quality drinking water but can not always control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

ARSENIC IN DRINKING WATER: Vacaville Meets the Limit

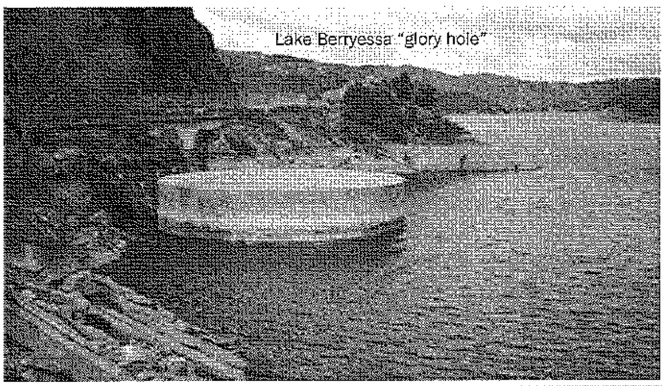
While your drinking water meets the federal and state standard for arsenic, it does contain low levels of arsenic. The arsenic standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. The USEPA continues to research the health effects of low levels of arsenic, which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems.

SOURCE WATER ASSESSMENTS AND VULNERABILITY SUMMARIES

A Source Water Assessment evaluates the quality of water that is used in a community drinking water supply. It is also used to determine the Potential Contributing Activities (PCAs) that occur within and nearby a source water supply. The PCAs are then compiled into a Vulnerability Summary report. The latest Summary report for the Sacramento Delta, including the North Bay Aqueduct (NBA), was updated in 2012. The source was considered to be most vulnerable to animal grazing activities, urban and agricultural runoff, recreational use and seawater intrusion.

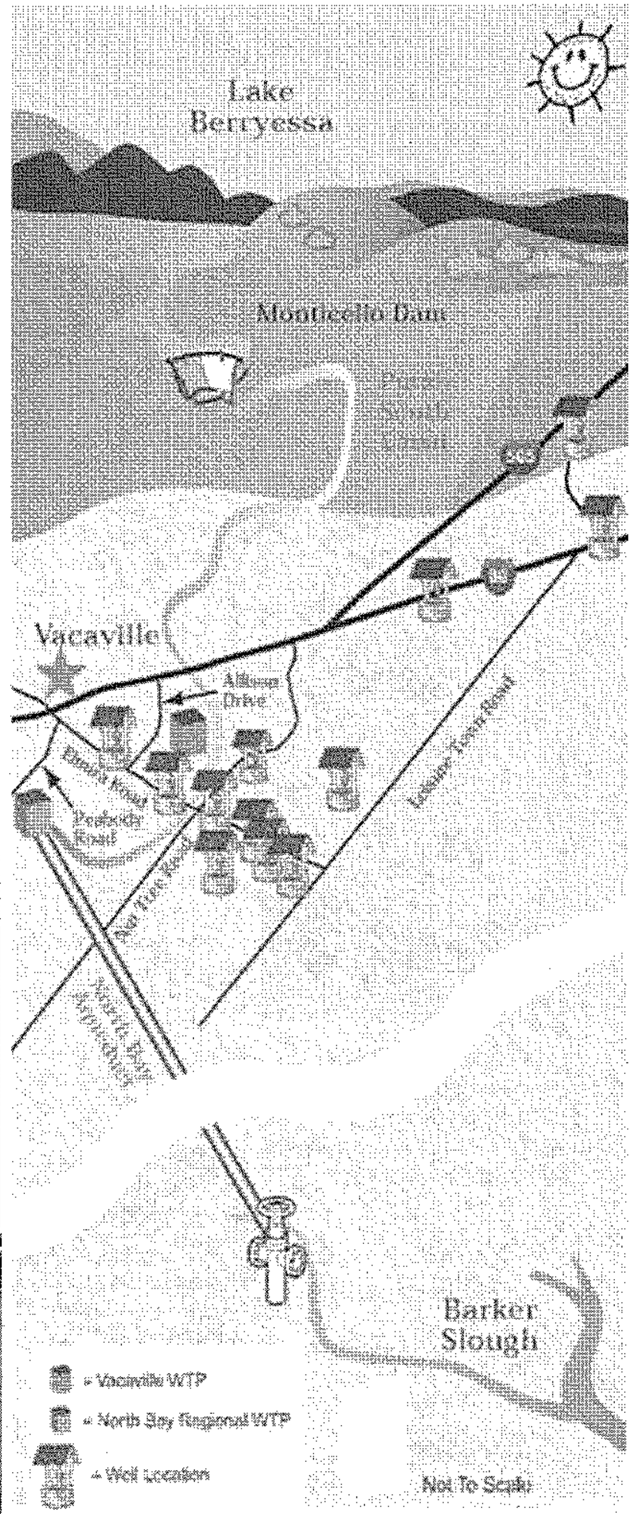
The Solano County cities treating NBA water, in conjunction with the Solano County Water Agency, have implemented watershed management practices to improve water quality and reduce the significance of the potential contaminant sources. The latest Summary report for Putah South Canal (PSC) was completed in 2012. The results of the assessment survey indicated that PSC is most vulnerable to illegal activities/unauthorized dumping and herbicide application. Management measures along the canal have been implemented that mitigate the risk for each of these PCAs.

The summaries for Vacaville's groundwater wells were performed in 2002, 2003, and 2005. The wells are considered most vulnerable to automobile gas stations, chemical and petroleum processing and storage, dry cleaners, septic systems, sewer collection systems, agricultural drainage, agricultural wells and irrigation wells. The wells offer various levels of protection from PCAs due to factors such as the aquifer, deep water table intakes, well construction features and physical barriers. A copy of the Source Water Assessments and Vulnerability Summaries can be obtained through the SWRCB, Division of Drinking Water (DDW), San Francisco District Office, 850 Marina Bay Parkway, Bldg P, 2nd Floor, Richmond, California 94804. You may request that a summary be sent to you by contacting Bob Brownwood, District Engineer, DDW, at (510) 620-3474.


Lake Berryessa "glory hole"

HEXAVALENT CHROMIUM IN DRINKING WATER

Chromium is a metallic chemical that occurs naturally in some of Vacaville's deep water aquifers, but can also enter drinking water sources through discharges of dye and paint pigments, wood preservatives, chrome plating, and leaching from hazardous waste sites. Chromium may be present in drinking water sources in two forms: trivalent chromium (chromium 3) and hexavalent chromium (chromium 6). Chromium 3 is found naturally in foods at low levels and is an essential human dietary nutrient. Chromium 6 is the toxic form of chromium, and has been found to cause cancer in humans when inhaled. The hazards of airborne chromium 6 in the workplace environment have been extensively documented yet there continues to be debate in the scientific community whether or not chromium 6 can cause cancer when ingested at levels found in drinking water. To be on the safe side of regulations, CA State Board has lowered the accepted level of Chromium 6 in drinking water to 10 parts per billion (ppb), whereas the USEPA limit is 100 ppb. Some of the City's source water wells have levels over 10 ppb and we are currently working with Division of Drinking Water (DDW) staff to investigate options to reduce the level of chromium 6 served to the residents of Vacaville.



Where your water comes from. Map is not to scale, but gives you a relative idea of the location of water sources for the City of Vacaville.

PROTECT YOUR WATER SUPPLY

Polluted storm water potentially affects drinking water sources, which can affect public health and increase drinking water treatment costs. Please help protect your water supply by controlling household, landscaping, health care and automotive products that contain toxic chemicals. Reduce the use of toxic chemicals wherever possible (including fertilizers and pesticides) and be sure to properly recycle or dispose of waste. Everything that goes down a storm drain or sewer may potentially affect your local water supply. Never dispose of household, landscaping, health care or automotive products that contain toxic chemicals down the storm drain or in the sewer.

The following tables list all the drinking water contaminants that were detected during the most recent sampling for the constituents. To read the tables, start with the far left column titled Constituent and read across the row. Units express the amount measured. MCL shows the highest amount of the substance allowed. PHG (MCLG) is the goal amount for that substance, which may be a lower amount than the amount allowed. The Range reports the lowest and highest amounts detected and the Average is the annual average. Contaminant Sources describe where the substance usually originates. To better understand the report, use the Legend that defines the terms used.

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Fecal Coliform Bacteria	0	0	A routine sample and a repeat sample detect for total coliform and either sample also detects for fecal coliform.	0	Human and animal fecal waste.

Table 2 – SAMPLING RESULTS SHOWING THE DETECTION OF LEAD AND COPPER

Constituent (reporting units)	No of samples (collected in 2014)	90th Percentile Detected	No. Sites exceeding AL	AL	PHG	Contaminant Sources
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Copper (ppm)[a]	36	0.2	0	1.3	0.3	Internal corrosion of household water plumbing systems; erosion of natural deposits; leaching from wood preservatives.

Table 3 – SAMPLING RESULTS FOR SODIUM AND HARDNESS [b]

Constituent (reporting units)	Sample date	GROUNDWATER		SURFACE WATER TREATED AT NBR		SURFACE WATER TREATED AT VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Hardness (ppm)	2014	71 - 310	149	123 - 187	167	170	170	Sum of polyvalent cations present in the water, generally magnesium and calcium, and are usually naturally occurring.
Sodium (ppm)	2014	39 - 75	55	12 - 34	19	14	14	Salt present in the water and is generally naturally occurring.

Table 4 – DETECTION OF CONTAMINANTS WITH A PRIMARY DRINKING WATER STANDARD

Constituent (reporting units)	MCL	PHG (MCLG)	GROUNDWATER		SURFACE WATER TREATED AT NBR		SURFACE WATER TREATED AT VWTP		Contaminant Sources
			Range	Average	Range	Average	Range	Average	
Aluminum (ppb)	1000	600	nd	nd	nd - 66	37	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Arsenic (ppb)	10	0.004	nd - 6.3	1.6	nd - 2.7	1.2	nd	nd	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes.
Barium (ppm)	1	2	0.07 - 0.14	0.1	0.04 - 0.05	0.04	nd	nd	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits.
Chromium (ppb)	50	(100)	nd - 23	12	nd - 1.1	0.3	nd	nd	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits.
Fluoride (ppm)[d]	2	1	System wide monthly average = 0.82, minumum = 0.70, maximum = 0.98						Erosion of natural deposits; water additive that promotes strong teeth.
Nickel (ppb)	100	12	nd	nd	nd	nd	nd	nd	Erosion of natural deposits; discharge from metal
Nitrate as NO3 (ppm)	45	45	1.9 - 16	6.8	nd - 4.4	1.5	nd	nd	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits.
Gross Beta Activity (pCi/L)	50	0	nd - 5.0[c]	nd[c]	nd[c]	nd[c]	nd[c]	nd[c]	Decay of natural and man-made deposits.
Uranium (pCi/L)	20	0.43	1.1 - 3.2[c]	1.7[c]	nd[c]	nd[c]	nd[c]	nd[c]	Erosion of natural deposits.

Table 5 - DETECTION OF CONTAMINANTS WITH A SECONDARY DRINKING WATER STANDARD [e]

Constituent (reporting units)	MCL	GROUNDWATER		SURFACE WATER TREATED AT NBR		SURFACE WATER TREATED AT VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Aluminum (ppb)	200	nd	nd	nd - 66	37	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Color (units)	15	nd -5	2	nd	nd	nd	nd	Naturally-occurring organic materials.
Iron (ppb)	300	nd	nd	nd	nd	nd	nd	Leaching from natural deposits; industrial wastes.
Manganese (ppb)	50	nd	nd	nd	nd	nd	nd	Leaching from natural deposits.
Odor- Threshold (units)	3	nd	nd	1.4	1.4	1	1	Naturally-occurring organic materials.
Silver (ppb)	100	nd	nd	nd	nd	nd	nd	Industrial discharges.
Turbidty (units)[f]	5	nd - 0.25	0.01	0.04 - 0.08	0.06	0.34	0.34	Soil runoff.
Total Dissolved Solids (ppm)	1000	290 - 540	350	184 - 222	204	210	210	Runoff/leaching from natural deposits.
Specific Conductance (uS/cm)	1600	440 - 800	581	358 - 382	372	380	380	Substances that form ions when in water; seawater influence.
Chloride (ppm)	500	7.9 - 35	15.1	10 - 15	12	10	10	Runoff/leaching from natural deposits; seawater influence.
Sulfate (ppm)	500	27 - 71	40	14 - 73	36	21	21	Runoff/leaching from natural deposits; seawater influence.

Table 6 - DETECTION OF UNREGULATED CONTAMINANTS (UCMR3)

Constituent (reporting units)	NL	PHG (MCLG)	Source Water		Distribution System Water		
			Range	Average	Range	Average	
Chlorate (ppb)	800	na	27 - 370	157	77 - 330	133	
Chromium (ppb) **	50	(100)	nd - 21	9.2	2.6 - 17	10.8	Unregulated contaminant monitoring helps the EPA and the State determine where certain contaminants occur and whether the contaminants need to be regulated. **Chromium is a regulated primary drinking water standard which has also been included in the UCMR3 data gathering program.
Hexavalent Chromium (ppb)	na	0.020	0.1 - 19	8	2.2 - 16	10.1	
Molybdenum (ppb)	na	na	nd - 1.7	0.5	nd - 2.1	1.1	
Strontium (ppb)	na	na	180 - 600	427	260 - 530	375	
Vanadium (ppb)	50	na	2.8 - 24	13	5.7 -23	15.4	

Table 7 - DETECTION OF DISINFECTION BYPRODUCTS

(reporting units)	MCL	(MCLG)	Range	Average	Violations	Contaminant Sources
Total Trihalomethanes (ppb)	80	na	3.3 - 49	29	0	By-product of drinking water disinfection.
Halo-Acetic Acids (ppb)	60	na	nd - 24	10	0	By-product of drinking water disinfection.
(reporting units)	MRDL	MRDLG	Average	Minimum	Maximum	Contaminant Sources
DBP Precursors/TOC (ppm)	tt	-	2.5	1.9	2.9	Various natural and man made sources.
Chlorine (ppm)	4	4	0.74	0.02	1.43	By-product of drinking water disinfection.

FOOTNOTES:

(a) This is the state action level for samples collected inside homes. The 90th percentile reflects the concentration of lead or copper at which 90% of the samples tested were found to have not exceeded. Household lead and copper results are from August 2014.

(b) There are no Drinking water standards (MCLs, PHGs or MCLGs) for these constituents, they are just reported for customer information. To convert hardness data from ppm to grains per gallon, divide by 17.

(c) Results from last samples collected in 2011.

(d) Not possible to differentiate water source. The City of Vacaville treats the water by adding fluoride to the naturally occuring level to help prevent dental caries in consumers. The fluoride levels in the treated water are maintained within the range of 0.7 - 1.3 ppm, as required by the California Department of Public Health regulations.

(e) There are no PHGs, MCLGs or mandatory standard health effects language for these constituents because secondary MCLs are set on the basis of aesthetics.

(f) Turbidity is a measure of the cloudiness of the water. We monitor it because it is a good indicator of water quality. High turbidity can hinder the effectiveness of disinfectants.

LEGEND

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water, Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. **Secondary MCLs** are set to protect the odor, taste, and appearance of drinking water.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the USEPA.

PHG (Public Health Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the Cal EPA.

MRDL (Maximum Residual Disinfectant Level): The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

AL or NL (Regulatory Action Level or Notification Level): The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

tt: (Treatment Technique): A required process intended to reduce the level of a contaminant in drinking water.

na: Not applicable or Not available.

nd: Not Detected.

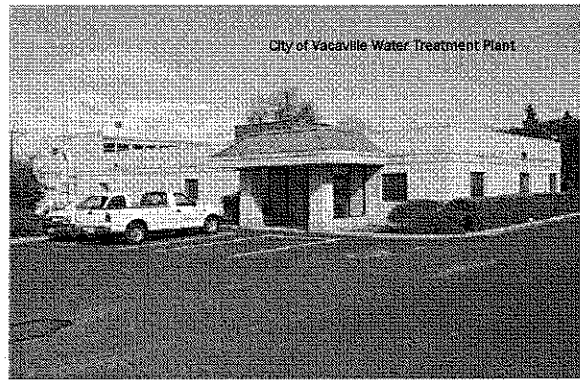
ntu: Nephelometric Turbidity Units. This is the standard unit for turbidity.

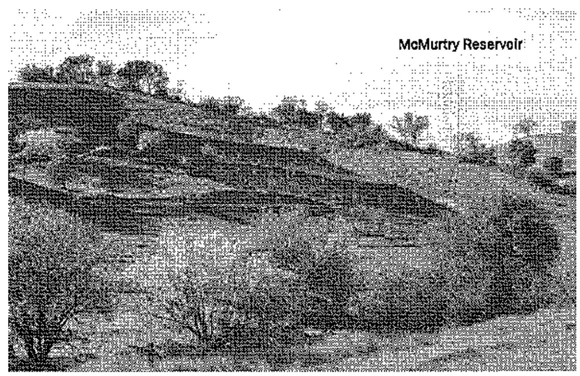
pCi/L: Pico Curies per Liter.

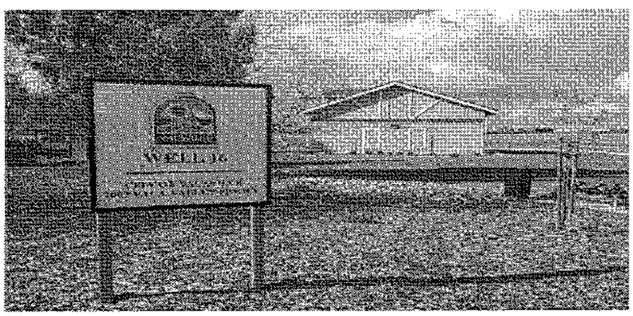
uS/cm: unit of measure for conductance.

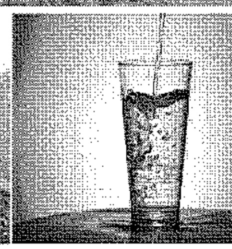
ppm: Parts Per Million or Milligrams Per Liter (mg/L).

ppb: Parts Per Billion or Micrograms Per Liter (ug/L).


City of Vacaville Water Treatment Plant


McMurtry Reservoir





WATER CONSERVATION EFFORTS

The State of California has entered a fourth consecutive year of low rainfall totals, leading Governor Brown to declare a series of drought emergency regulations. Although the City of Vacaville benefits from multiple sources of potable water, we are requesting that everyone do their part to conserve water. So far, Vacaville residents have reduced their use of water by an average of 15 percent from 2013. If you go to The City's Water Conservation webpage, you will find the latest information regarding the Emergency Drought Regulations issued by the state and how it may impact you; the City's current water use restrictions and enforcement policies; how to determine your water usage; how to report water waste or other concerns to the City; and a variety of water savings tips on how you can save water in your home with links to other sites and resources. The link to that page is: http://www.cityofvacaville.com/savingwater

POLICY ON NONDISCRIMINATION ON THE BASIS OF DISABILITY

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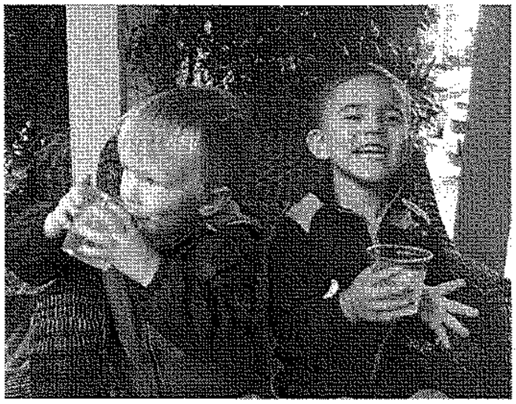
2015 CITY OF VACAVILLE

Water Quality Report to Consumers

The City of Vacaville (City) wants you, our customers, to know that your water system has met all water quality standards and is a safe and reliable drinking water supply. These standards are established by the U.S. Environmental Protection Agency (USEPA) and the California State Water Resources Control Board (SWRCB). In 2015 the City distributed over 4.3 billion gallons of drinking water. This water was subjected to extensive testing, not only for regulated contaminants, but for many non-regulated chemical properties as well. More than 5,600 analyses were performed on drinking water samples in 2015.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants doesn't necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (800) 426-4791. If you have further questions, please contact the Water Quality Laboratory Supervisor, Mindy Boele, by phone at (707) 469-6400 or by email at mindy.boele@cityofvacaville.com.



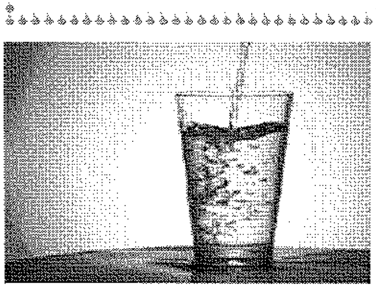
HEALTH RELATED INFORMATION:

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. USEPA and Center for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the USEPA's Safe Drinking Water Hotline

Este informe contiene información muy importante sobre su aqua potable. Tradúzcalo o hable con alguien que lo entienda bien.

ARSENIC IN DRINKING WATER: Vacaville Meets the Limit

While your drinking water meets the federal and state standard for arsenic, it does contain low levels of arsenic. The arsenic standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. The USEPA continues to research the health effects of low levels of arsenic, which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems.



SOURCES OF WATER AND CONTAMINANTS:

The sources of drinking water (both tap and bottled) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity. Vacaville's water supply consists of two surface water sources and 11 deep groundwater wells. Lake Berryessa surface water, conveyed through Putah South Canal (PSC), provided 47% of the City's total consumption of water in 2015, and Sacramento Delta surface water, from the North Bay Aqueduct (NBA), provided an additional 13%. Groundwater from the 11 deep wells made up the balance (40%) of our water needs. Treatment of the surface water is divided between the Vacaville Water Treatment Plant (VWTP) and the North Bay Regional Water Treatment Plant (NBR). The VWTP treats PSC source water only, while the NBR plant, which is jointly owned by the cities of Vacaville and Fairfield, treats both PSC and NBA source water.

CONTAMINANTS THAT MAY BE PRESENT IN SOURCE WATER INCLUDE:

- Microbial contaminants, such as viruses and bacteria that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, that can be naturally-occurring or result from urban storm-water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Pesticides and herbicides that may come from a variety of sources such as agriculture, urban storm-water runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, that are by-products of industrial processes and petroleum production and can also come from gas stations, urban storm-water runoff, agricultural application, and septic systems.
- Radioactive contaminants that can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the USEPA and the State Board prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. State Board regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

The following tables list all the drinking water contaminants that were detected during the most recent sampling for the constituents. To read the tables, start with the far left column titled Constituent and read across the row. Units express the amount measured. MCL shows the highest amount of the substance allowed. PHG (MCLG) is the goal amount for that substance, which may be a lower amount than the amount allowed. The Range reports the lowest and highest amounts detected and the Average is the annual average. Contaminant Sources describe where the substance usually originates. To better understand the report, use the Legend that defines the terms used.

Table 1- SAMPLING RESULTS SHOWING THE DETECTION OF COLIFORM BACTERIA

Microbiological Contaminant	Highest No. of Detections	No. of Months in Violation	MCL	MCLG	Contaminant Sources
Total Coliform Bacteria	0	0	5% (1351 samples collected in 2015)	0	Naturally present in the environment.
Fecal Coliform Bacteria	0	0	A routine sample and a repeat sample detect for total coliform and either sample also detects for fecal coliform.	0	Human and animal fecal waste.

Table 2 - SAMPLING RESULTS SHOWING THE DETECTION OF LEAD AND COPPER

Constituent (reporting units)	No of samples (collected in 2014)	90th Percentile Detected	No. Sites exceeding AL	AL	PHG	Contaminant Sources
Lead (ppb) [a]	31	2.5	0	15	0.2	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm)[a]	31	0.2	0	1.3	0.3	Internal corrosion of household water plumbing systems; erosion of natural deposits; leaching from wood preservatives.

Table 3 - SAMPLING RESULTS FOR SODIUM AND HARDNESS [b]

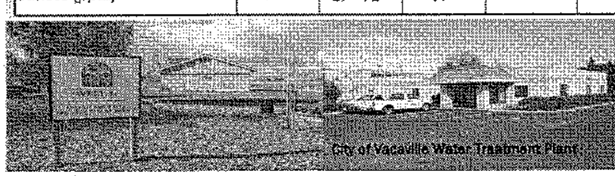
Constituent (reporting units)	Sample date	GROUNDWATER		SURFACE WATER TREATED AT NBR		SURFACE WATER TREATED AT VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Hardness (ppm)	2015	71 - 310[c]	172[c]	136 - 183	157	180	180	Sum of polyvalent cations present in the water, generally magnesium and calcium, and are usually naturally occurring.
Sodium (ppm)	2015	39 - 75[c]	54[c]	16 - 39	30	16	16	Salt present in the water and is generally naturally occurring.

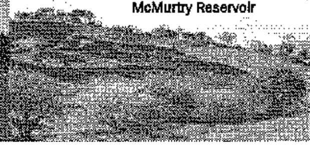
Table 4 - DETECTION OF CONTAMINANTS WITH A PRIMARY DRINKING WATER STANDARD

Constituent (reporting units)	MCL	PHG (MCLG)	GROUNDWATER		SURFACE WATER TREATED AT NBR		SURFACE WATER TREATED AT VWTP		Contaminant Sources
			Range	Average	Range	Average	Range	Average	
Aluminum (ppb)	1000	600	nd [c]	nd [c]	30 - 50	39.3	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Arsenic (ppb)	10	0.004	nd - 6.3[c]	1[c]	nd - 2.5	0.6	nd	nd	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes.
Barium (ppm)	1	2	0.07 - 0.14[c]	0.1[c]	0.04 - 0.05	0.04	nd	nd	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits.
Chromium (ppb)	50	(100)	nd - 24[c]	9[c]	nd	nd	nd	nd	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits.
Hexavalent Chromium (ppb)	10	0.02	nd - 22.5	10	NA	NA	NA	NA	Erosion of natural deposits; discharge from electroplating factories, leather tanneries, wood preservation, chemical synthesis, refractory production and textile manufacturing facilities.
Fluoride (ppm)[d]	2	1	Systemwide annual average = 0.84, minumum = 0.11, maximum = 1.0						Erosion of natural deposits; water additive that promotes strong teeth.
Nickel (ppb)	100	12	nd[c]	nd[c]	nd	nd	nd	nd	Erosion of natural deposits; discharge from metal factories.
Nitrate as N (ppm)	10	10	0.4 - 3.7	1.8	nd - 0.12	0.02	nd	nd	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits.
Selenium (ppb)	50	30	nd - 2.7[c]	0.7[c]	nd	nd	nd	nd	Erosion of natural deposits; discharge from petroleum, glass and metal refineries; discharge from mines and chemical manufacturers; runoff from livestock lots (feed additive).
Gross Beta Activity (pCi/L)	50	0	nd - 5.0[g]	nd[g]	nd[g]	nd[g]	nd[g]	nd[g]	Decay of natural and man-made deposits.
Uranium (pCi/L)	20	0.43	1.1 - 3.2[g]	1.7[g]	nd[g]	nd[g]	nd[g]	nd[g]	Erosion of natural deposits.

Table 5 - DETECTION OF CONTAMINANTS WITH A SECONDARY DRINKING WATER STANDARD [e]

Constituent (reporting units)	MCL	GROUNDWATER		SURFACE WATER TREATED AT NBR		SURFACE WATER TREATED AT VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Aluminum (ppb)	200	nd [c]	nd [c]	30 - 50	39.3	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Color (units)	15	nd - 5.0[c]	2[c]	nd	nd	nd	nd	Naturally-occurring organic materials.
Iron (ppb)	300	nd [c]	nd [c]	nd	nd	nd	nd	Leaching from natural deposits; industrial wastes.
Manganese (ppb)	50	nd [c]	nd [c]	nd	nd	nd	nd	Leaching from natural deposits.
Odor- Threshold (units)	3	nd [c]	nd [c]	1.4	1.4	1.5	1.5	Naturally-occurring organic materials.
Silver (ppb)	100	nd [c]	nd [c]	nd	nd	nd	nd	Industrial discharges.
Turbidty (units)[f]	5	nd - 0.25[c]	0.03[c]	0.06 - 0.07	0.06	0.16	0.16	Soil runoff.
Total Dissolved Solids (ppm)	1000	290 - 540[c]	374[c]	223 - 288	251	200	200	Runoff/leaching from natural deposits.
Specific Conductance (uS/cm)	1600	440 - 800[c]	565[c]	383 - 468	413	380	380	Substances that form ions when in water; seawater influence.
Chloride (ppm)	500	7.9 - 35[c]	17[c]	12 - 27	20	13	13	Runoff/leaching from natural deposits; seawater influence.
Sulfate (ppm)	500	27 - 71[c]	44[c]	16 - 55	35	21	21	Runoff/leaching from natural deposits; seawater influence.


City of Vacaville Water Treatment Plant

McMurtry Reservoir


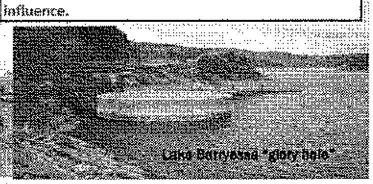

Lake Berryessa "glory hole"

Table 6 - DETECTION OF UNREGULATED CONTAMINANTS (UCMR3)			Combination of samples collected in 2014 and 2015			
			Source Water		Distribution System Water	
Constituent (reporting units)	NL	PHG (MCLG)	Range	Average	Range	Average
Chlorate (ppb)	800	na	27-230	149	77-330	133
Chromium (ppb) **	50	(100)	<0.2-23	10.2	0.9-17	9
Hexavalent Chromium (ppb)	na	0.020	0.07-19	8	0.07-16	8.4
Molybdenum (ppb)	na	na	<1-3.3	0.8	<1-2.1	0.9
Strontium (ppb)	na	na	160-600	408	220-530	354
Vanadium (ppb)	50	na	3.4-30	14.4	4.6-23	13.3

Unregulated contaminant monitoring helps the USEPA and the Cal EPA determine where certain contaminants occur and whether the contaminants need to be regulated.
**Chromium is a regulated primary drinking water standard which has also been included in the UCMR3 data gathering program.

Table 7 - DETECTION OF DISINFECTION BYPRODUCTS						
(reporting units)	MCL	(MCLG)	Range	Average	Violations	Contaminant Sources
Total Trihalomethanes (ppb)	80	na	0 - 65	47.6	0	By-product of drinking water disinfection.
Halo-Acetic Acids (ppb)	60	na	0 - 35	14	0	By-product of drinking water disinfection.
(reporting units)	MRDL	MRDLG	Average	Minimum	Maximum	Contaminant Sources
DBP Precursors/TOC (ppm)	tt	-	2.4	1.9	2.8	Various natural and man-made sources.
Chlorine (ppm)	4	4	0.72	nd	1.74	By-product of drinking water disinfection.

Violation of an MCL				
Violation	Explanation	Duration	Actions Taken to Correct the Violation	Health Effects Language
Annual Average of Hexavalent Chromium tested greater than 10 ppb	The City has 5 groundwater wells that have an annual average between 10-22 ppb.	The testing requirement and new MCL for hexavalent chromium began on July 1, 2014.	The City has a compliance plan with the Division of Drinking Water to get the wells within MCL compliance by January 1, 2020.	Some people who drink water containing hexavalent chromium in excess of the MCL over many years may have an increased risk of getting cancer.

LEGEND

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible.

Secondary MCLs are set to protect the odor, taste, and appearance of drinking water.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the USEPA.

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na: Not Applicable or Not Available.

nd: Not Detected.

ntu: Nephelometric Turbidity Units. This is the standard unit for turbidity.

pCi/L: Pico Curies per Liter.

FOOTNOTES:

(a) This is the state action level for samples collected inside homes. The 90th percentile reflects the concentration of lead or copper at which 90% of the samples tested were found to have not exceeded. Household lead and copper results are from 2014. The next sampling is scheduled for Summer of 2017.

(b) There are no drinking water standards (MCLs, PHGs or MCLGs) for these constituents, they are just reported for customer information. To convert hardness data from ppm to grains per gallon, divide by 17.

(c) Results from last samples collected in 2014.

(d) Not possible to differentiate water source. The City of Vacaville treats the water by adding fluoride to the naturally occuring level to help prevent dental caries in consumers. The fluoride levels in the treated water are maintained within the range of 0.7 - 1.3 ppm, as required by the Division of Drinking Water regulations.

(e) There are no PHGs, MCLGs or mandatory standard health effects language for these constituents because secondary MCLs are set on the basis of aesthetics.

(f) Turbidity is a measure of the cloudiness of the water. We monitor it because it is a good indicator of water quality. High turbidity can hinder the effectiveness of disinfectants.

(g) Results from last samples collected in 2011.

Walter V. Graham Aquatic Center

WATER CONSERVATION EFFORTS

The State of California entered its fifth consecutive year of drought, although rainfall beginning in the fall of 2015 signaled some potential relief for parts of the state and hope for a return to normal precipitation in the coming years. Although the City of Vacaville's water conservation targets have been amended, and the City continues to benefit from multiple sources of potable water, we are requesting that everyone continue to do their part to conserve water. On the City's Water Conservation webpage you will find the latest information regarding the drought regulations issued by the state and how it may impact you; the City's current water use restrictions and enforcement policies; how to determine your water usage; how to report water waste or other concerns to the City; and a variety of water savings tips on how you can save water in your home with links to other sites and resources. The link to that page is: http://www.cityofvacaville.com/savingwater. Thanks again for doing your part to conserve our most precious resource!

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SOURCE WATER ASSESSMENTS AND VULNERABILITY SUMMARIES

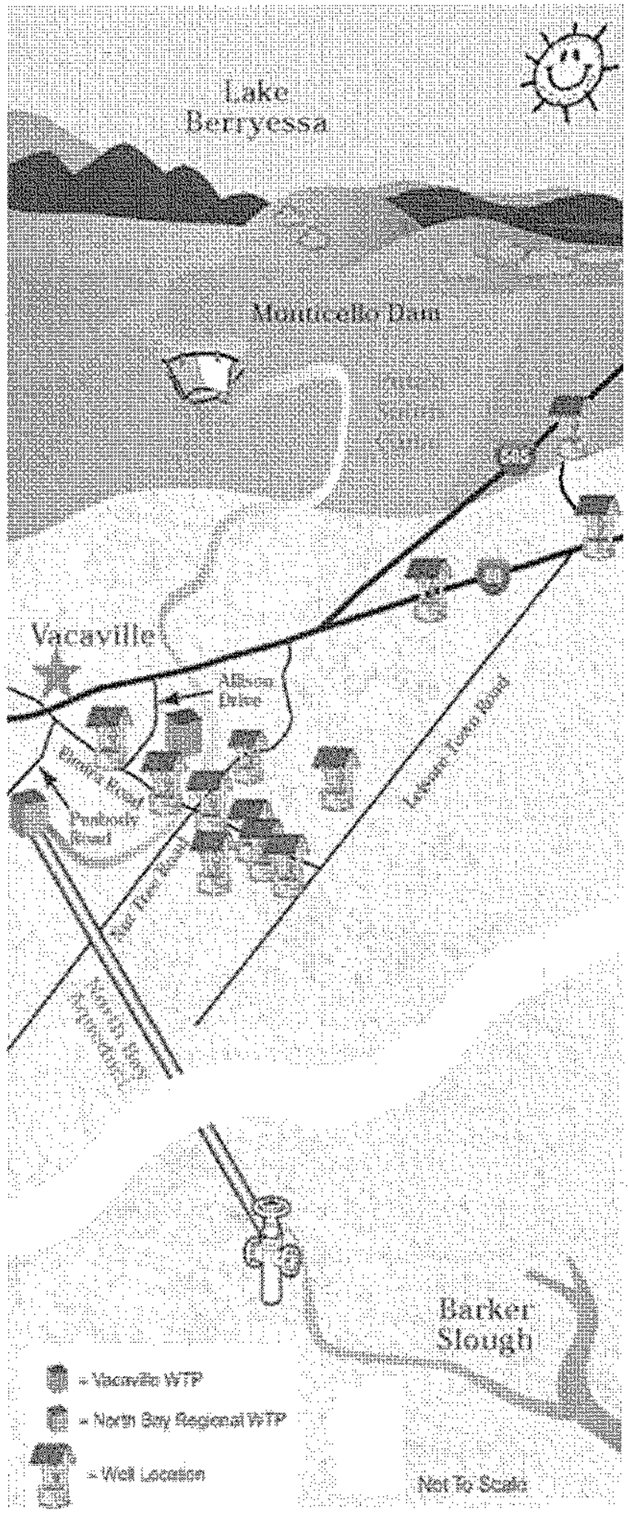
A Source Water Assessment evaluates the quality of water that is used in a community drinking water supply. It is also used to determine the Potential Contributing Activities (PCAs) that occur within and nearby a source water supply. The PCAs are then compiled into a Vulnerability Summary report. The latest Summary report for the Sacramento Delta, including the North Bay Aqueduct (NBA), was updated in 2012. The source was considered to be most vulnerable to animal grazing activities, urban and agricultural runoff, recreational use and seawater intrusion.

The Solano County cities treating NBA water, in conjunction with the Solano County Water Agency, have implemented watershed management practices to improve water quality and reduce the significance of the potential contaminant sources. The latest Summary report for Putah South Canal (PSC) was completed in 2012. The results of the assessment survey indicated that PSC is most vulnerable to illegal activities/unauthorized dumping and herbicide application. Management measures along the canal have been implemented that mitigate the risk for each of these PCAs.

The summaries for Vacaville's groundwater wells were performed in 2002, 2003, and 2005. The wells are considered most vulnerable to automobile gas stations, chemical and petroleum processing and storage, dry cleaners, septic systems, sewer collection systems, agricultural drainage, agricultural wells and irrigation wells. The wells offer various levels of protection from PCAs due to factors such as the aquifer, deep water table intakes, well construction features and physical barriers. A copy of the Source Water Assessments and Vulnerability Summaries can be obtained through the SWRCB, Division of Drinking Water (DDW), San Francisco District Office, 850 Marina Bay Parkway, Bldg P, 2nd Floor, Richmond, California 94804. You may request that a summary be sent to you by contacting the Division of Drinking Water, SWRCB at (510) 620-3474.

KEEP THE LEAD OUT OF DRINKING WATER

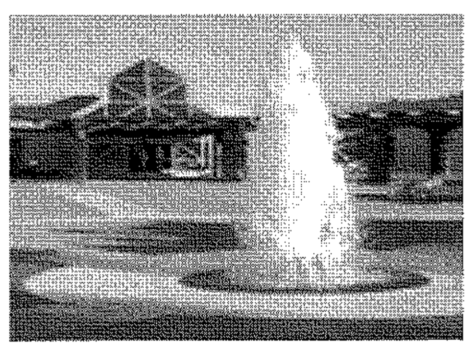
If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. The City is responsible for providing high quality drinking water but can not always control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.



Where your water comes from. Map is not to scale, but gives you a relative idea of the location of water sources for the City of Vacaville.

PROTECT YOUR WATER SUPPLY

Polluted storm water potentially affects drinking water sources, which can affect public health and increase drinking water treatment costs. Please help protect your water supply by controlling household, landscaping, health care and automotive products that contain toxic chemicals. Reduce the use of toxic chemicals wherever possible (including fertilizers and pesticides) and be sure to properly recycle or dispose of waste. Everything that goes down a storm drain or sewer may potentially affect your local water supply. Never dispose of household, landscaping, health care or automotive products that contain toxic chemicals down the storm drain or in the sewer.



HEXAVALENT CHROMIUM IN VACAVILLE'S DRINKING WATER

Chromium is a metallic chemical that occurs naturally in some of Vacaville's deeper ground water aquifers.

Chromium may be present in water sources in two forms: trivalent chromium (Cr+3) and hexavalent chromium (Cr+6). Chromium+3 is found naturally in foods at low levels and is an essential human dietary nutrient and is often medically prescribed to maintain healthy insulin metabolism. Chromium+6 is the toxic form of chromium, and has been found to cause cancer in humans when inhaled, and is suspected to cause cancer when ingested. When Cr+6 is ingested, the acidity of the human digestive system naturally converts Cr+6 to Cr+3. As such, there continues to be a debate in the scientific community whether or not Cr+6 can cause cancer when ingested at part per billion (ppb) levels found in drinking water. Conservatively, the California State Water Board lowered the acceptable level of Cr+6 in drinking water from 50 ppb to 10 ppb in 2015, whereas the USEPA limit continues to be 100 ppb. Five of the City's eleven source water wells have Cr+6 between 10 ppb and 24 ppb, and we are currently working with Division of Drinking Water (DDW) staff to treat and/or modify the five source water wells to produce drinking water with Cr+6 less than 10 ppb by the lawful deadline of January 1, 2020.

FREQUENTLY ASKED QUESTIONS REGARDING HEXAVALENT CHROMIUM

City staff have received hundreds of calls and messages from concerned citizens regarding Cr+6 in the drinking water. Below are the three most common inquiries. For additional Frequently Asked Questions, see the City's website at: http://www.cityofvacaville.com/index.aspx?page=810

Q. How long has Cr+6 been in Vacaville groundwater?
A. Cr+6 was first detected in Vacaville well water about 15 years ago. Prior to that, the City was unable to test for it. As science has improved, so too has the testing. Since the Cr+6 in Vacaville's groundwater is from the naturally occurring Cr+6 in the soil, it is believed that Cr+6 has always been in the groundwater in Vacaville.

Q. What can be done to lower or remove Cr+6 from the water?
A. The City is looking at a variety of options at this point. The three newer wells have long service lives ahead of them. As a result, the City has been evaluating treatment solution pilot studies and is planning to install its first specialized Cr+6 treatment system at one of these wells in 2017. Additional treatment systems are planned over the next four years as part of the City's compliance plan. The typical cost for these treatment systems is over $1 million each.

Common Water Quality Issues in Public Supplies

TASTE AND ODOR

It is very difficult to separate taste from odor because these two human senses are so closely related. In addition to treatment additives, water can pick up tastes and odors from new pipe, from low usage in the treated water system or from natural substances in the source water. Tastes and odors in treated water are not harmful, but we do take steps to try and eliminate them.

CHLORINE SMELL

The most common complaint is a chlorine smell to the water. Chlorine is added to ensure that the water that makes it to your home or business is free of bacteria. The State allows us to have up to 4 parts per million chlorine residual in the drinking water; however, the City maintains the level around 0.8 parts per million with a maximum of 1.4 parts per million to reduce the taste and odor issues. Further reduction of taste and order can be achieved by point of use carbon filters, or by allowing water to sit in a pitcher in the refrigerator for an hour or so prior to use.

ROTTEN EGG SMELL

Also known as "sulfur odor", the rotten egg smell in water is caused by the reaction of sulfates and microorganisms in unchlorinated water. As the City's water is chlorinated, the actual cause of most sulfur odor issues comes from debris leftover in the sink p-trap below the water faucet where the odor is observed, which is easily resolved by flushing water down the p-trap to clear the odor-causing debris. If you still suspect the water supply to be the source of the smell, it is important to check to see whether the cold water also contains the odor, or just the hot water. Run the hot water to check for odor. Then move to another faucet and run the cold water. If the hot water alone has odor, then the odor is likely coming from the water heater, which may require a call to a plumber to resolve. If the cold water has an odor, then the source is in the cold water. Prior to calling the City to report a cold water rotten egg smell, be certain that the smell is not just gas trapped in the p-traps of your sewer drain system being pushed up as water flows to the sewer. If the smell is actually from the water, City water operators will want to know about the odor problem in order to resolve its source.

CLOUDY WATER

Cloudy water could be a result of dissolved air in the water, which is a common and harmless condition. To verify this, place the cloudy water in a glass and observe for 2 minutes. If it clears from the bottom up (you may be left with bubbles on the side of the glass and a small surface layer of bubbles), then you just have dissolved air in the water. If the cloudy water persists, or if you are noticing particles or unusual tastes or odors, please call us and a water operator will come check your water.

DISCOLORATION OF THE WATER

The discoloration is usually rust from aging pipes. It is not harmful, but is aesthetically displeasing. Discoloration of the water can be a result of disturbances in the water line due to using a hydrant improperly, installing new pipe, or shutting off the water to a local area for system maintenance. Home plumbing, especially in older homes, can also cause discoloration of the water.

HARD WATER

Hardness of the water varies from one part of the city to another. It is the main cause of white scaling and spotting on glassware. The higher the concentration of hardness causing minerals in your water, the more white scale you will notice on faucets and other water fixtures. Wiping down faucets and shower doors immediately after use if the best way to prevent hardness buildup.

REFERENCE 3

Association of California Water Agencies (ACWA)
Suggested Guidelines for Preparation of
Required Reports on PHG's

(Includes Health Risk Information for Public Health Goal Exceedance Reports
and ACWA Cost Estimate)

Association of
California Water Agencies
Since 1910
Leadership · Advocacy · Information · Service

March 2016

Suggested Guidelines for Preparation of Required Reports on PUBLIC HEALTH GOALS (PHGs) to satisfy requirements of California Health and Safety Code Section 116470(b)

Background

Public water systems serving more than 10,000 service connections must prepare a brief, written report in plain language by July 1, 2016 that gives information on the "detection" of any contaminants above the Public Health Goals (PHGs) published by the state Office of Environmental Health Hazard Assessment (OEHHA). The report must also list the "detection" of any contaminant above the Maximum Contaminant Level Goals (MCLGs) set by United States Environmental Protection Agency (USEPA) for all other contaminants until such time as OEHHA has published PHGs for those contaminants.

It is emphasized that the report only needs to provide information on the number of contaminants that a water system has found at a level exceeding a PHG or a MCLG.

The purpose of the legislation requiring these reports was to provide consumers with information on levels of contaminants even below the enforceable mandatory Maximum Contaminant Levels (MCLs) so they would be aware of whatever risks might be posed by the presence of these contaminants at levels below the MCLs. Additionally, each water system must provide an estimate of the cost to reduce the contaminant(s) to the PHG (or MCLG if there is no PHG) regardless of how minimal the risk might be.

The following should be considered when preparing the mandated reports:

1. The USEPA and the California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) establish MCLs at very conservative levels to provide protection to consumers against all but very low to negligible risk. In other words, MCLs are the regulatory definition of what is "safe." Adopted MCLs are still the criteria for being in compliance, not those proposed or possible in the future, and certainly not MCLGs or PHGs.

2. MCLGs and PHGs are often set at very low levels depending on the established health risk, and in the case of USEPA, MCLGs are also set at zero for some

contaminants. Determination of health risk at these low levels is theoretical based on risk assessments with multiple assumptions and mathematical extrapolations. Many contaminants are considered to be carcinogenic and USEPA's policy is to set the applicable MCLGs at zero because they consider no amount of these contaminants to be without risk. It is understood by all that zero is an unattainable goal and cannot be measured by the practically available analytical methods. Note that by regulation, OEHHA cannot set a PHG at zero and must calculate a numerical level to address risk, even though it may be unattainable or impossible to measure.

3. PHGs and MCLGs are not enforceable. The Best Available Technology (BAT) to reach such low levels has not been defined and may not realistically be available. Accurate cost estimates are difficult, if not impossible, and are highly speculative and theoretical. Therefore, they have limited value and may not warrant significant investment of agency time and money.

These reports are unique to California. They are required in addition to the extensive public reporting of water quality information that California water utilities have been doing for many years and in addition to the federally mandated Consumer Confidence Reports (CCRs). Hence, it should be kept in mind that IN ADDITION to this required report, each utility will continue reporting ANNUALLY in great depth on the quality of the water it serves.

The guidance herein is intended to assist water suppliers in completing the required reports in a responsible manner without expending excessive amounts of resources that are better used to comply with the many regulatory mandates designed to ensure safe drinking water.

Guidance on preparing these reports is needed because the legislative language does not spell out all of the detailed answers to questions that arise. Neither the DDW nor OEHHA have issued any guidelines regarding the report. In fact, while OEHHA has a mandate to determine and provide information on "numerical health risk," they otherwise have no involvement or authority regarding the report.

The DDW as the primary enforcing agency of all provisions of the Health and Safety Code relative to drinking water systems has the authority to ensure that public water systems comply with the report requirement. DDW requests that utilities report in writing as to how they have complied with the fundamental requirements of this section, which are:

1) Prepare a brief written report,
2) Hold a public hearing (meeting), and
3) Notify DDW that the meeting was held and the report is available.

Detailed Guidelines:

I. Who must prepare a PHG report?

California Health and Safety (H&S) Code, Section 116470(b) is clear that a system ONLY needs to do a report IF it has at least 10,000 service connections AND IF it exceeds one or more PHGs or MCLGs. Also, a public hearing is NOT required if a report does not have to be prepared.

Utilities that do NOT have to do the report may choose to submit an information item to their governing board advising them that no report is required.

This report is required every three years.

II. Wholesalers (<10,000 service connections) are NOT required to do a PHG report.

DDW has clarified that wholesalers who do not directly serve more than 10,000 service connections are not required to meet the PHG report requirements of California H&S Code, Section 116470(b).

III. Timing, Notification, Meetings

A. Timing and Meeting: The report must be prepared by July 1, 2016. A public hearing, which can be held as part of any regularly scheduled meeting, should be held sometime after July 1 and prior to reporting to DDW. DDW has indicated that the public hearing "should be held within a reasonable time after the report's completion" so the information is current. The purpose of the hearing is to "accept and respond to" public comment. The governing board or council of public water agencies would also likely approve the staff report at that time. This would represent endorsement by the board of the part of the report where any action (or no action) would be proposed regarding reduction of contaminants to levels lower than required for compliance with MCLs.

B. Notification: There is no requirement to send a copy of the report to the public. Public agencies must "notice" public hearings so this hearing would be subject to the normal notice requirements (i.e., number of days advance, publishing in appropriate newspaper, etc.) The notice would appropriately indicate the report is the subject of the hearing and indicate it is available for the public to review or to get a copy upon request.

(NOTE: Investor owned utilities will likely have to schedule a special "meeting" since they are not subject to the same meeting notice requirements and may not have any authority to hold a "public hearing" per se. Their notification of the public could however be similar to public agencies, i.e., publication of legal notice in newspaper of general circulation.)

C. Submission of Reports: DDW does not specifically require that a copy of the report be submitted to them.

IV. Interpretations

A. What contaminants must be covered?

A table of relevant current PHGs, MCLGs, MCLs, and Detection Limits for purposes of Reporting (DLRs) is attached to this guidance as Attachment No. 1.

1. Only contaminants that **have an existing MCL** AND were "detected" at a level that "exceeds" the PHG or, where there is no PHG, the Federal MCLG, need to be included in the report. (See guidance below on "detected" and "exceed")

2. All contaminants that, **as of December 31, 2015**, have Primary Drinking Water Standards (PDWS) set by California **AND** have an equivalent PHG or a MCLG. This includes chemical, microbiological and radiological constituents. PDWS may be either MCLs or Treatment Techniques (TT). For example, the Surface Water Treatment Rule (SWTR) is a TT for the following contaminants: *Giardia lamblia*, viruses, *Cryptosporidium*, *Legionella* and heterotrophic bacteria (HPC). A TT is set when it is not possible to reliably analyze for the contaminant of concern (the SWTR) or when it is not feasible or appropriate to set a numerical standard (the Lead & Copper Rule).

3. It does NOT include contaminants such as radon for which USEPA has considered adopting an MCL nor does it include any contaminants DDW plans to regulate in the future.

   It does NOT include contaminants for which there is no final PHG or MCLG as of December 31, 2015 nor does it include any secondary MCLs (i.e., TDS, SO_4, Na, etc).

B. What data are to be used for the report due by July 1, 2016?

1. It is recommended that the data used should be from the 3 consecutive calendar years prior to the year the report is prepared. For example, the 2016 report would be based on the analytical data from samples taken in 2013, 2014, and 2015. The data should be the same as that used by the drinking water agency in determining compliance with DDW requirements. In most cases this would be after blending or treatment. Individual well data would only be used if the well feeds directly to the distribution system.

2. For utilities that purchase water from another agency or from a wholesaler, it is suggested that the same guidance or ground rules be followed as for the CCRs. If the only source for a retail system is treated water from a wholesaler and that water contains a constituent above a PHG or MCLG, the retailer should use its own distribution system monitoring data. For systems with both its own sources of water and purchased water, the retailer should evaluate its own distribution system compliance monitoring and compare the annual average value with the PHG or MCLG.

C. What do the terms "detect" and "exceed" mean in the context of the required report?

1. Keep in mind that there are no regulations that relate to "meeting" or "complying with" PHGs. The logical approach would be to use the same procedures and requirements that the California Title 22 Regulations specify for determining compliance with MCLs. For example, if Title 22 or DDW guidance specifies that the average of a group of samples be compared to the MCL for compliance purposes, the same averaging should be used to compare to the PHG or MCLG. For most constituents (coliform is an exception), compliance with MCLs is measured at the "point of entry" to the distribution system. This means that, for the most part, the analytical results for each well must be evaluated separately and compared to the MCLG or PHG. If wells are blended or treated before delivery to the system, the judgment as to whether there was a "detection exceeding the MCLG or PHG" should be based on the "point of entry" data just as for compliance with MCLs.

2. Be sure to report the PHG (or MCLG) as a number equal to or greater than 1.0 as specified in the State Consumer Confidence Report Guidance for Water Suppliers. It is recommended that all data be converted to

match CCR data. Attachment No. 1 concentration numbers are given as mg/L, unless otherwise noted.

3. Keep in mind that if a utility determines that a constituent has been found at a level exceeding the PHG or MCLG, a cost estimate is mandated. A utility would ordinarily be required to perform a cost estimate only if it is clear that the MCL has been clearly exceeded, not just momentarily, or on one sample. In the same way, only when the PHG/MCLG level is clearly exceeded should a cost estimate be calculated and reported.

4. Significant figures, analytical detection limits, reporting limits, and different methods of determining compliance, all affect the assessment of which constituents were "detected" above the PHG or the MCLG.

5. Results that are reported below the State regulatory Detection Limit for Purposes of Reporting (DLR - See Title 22, CCR, Sections 64432 & 64445.1 and other DDW guidance on compliance reporting) should be treated as 0 (zero) which is accepted DDW practice. USEPA also recommends treating ND as zero.

6. As in all cases of reporting results to the state, the results of analyses should be rounded to reflect the appropriate number of significant figures. (EXAMPLE: For coliform bacteria, the MCLG is 0% samples positive per month which indicates one significant figure. So, if during 2013, a system had a positive sample but the percentage of samples positive for the month was <0.49%, this could be rounded to one significant figure, as the MCLG is expressed, so it would be rounded to 0%.) (SECOND EXAMPLE: For a constituent like PCBs where the MCL is 0.5 ppb and the DLR is 0.5 ppb, how do you determine if you exceeded the MCLG of "zero"? Webster defines "zero" as "having no measurable or otherwise determinable value" which in effect is the DLR. So for PCBs, if the average of results for a given well is less than the DLR, the value would be reported as "zero". Note that by regulation OEHHA cannot set a PHG at zero and must calculate a numerical level to address risk.)

7. In averaging the results for a constituent over a specified period during which some of the data is less than the DLR, the average value obtained should be rounded to the appropriate significant figure before comparing to the PHG or MCLG. (EXAMPLE: If a well were sampled for PCE and 0.6 ppb was found and the resample showed 0.6 ppb, it would constitute a confirmed positive detection. But if 3 additional compliance samples were taken from the well and all had less than 0.5 ppb, which is the DLR,

then averaging the 5 samples would give an average of 0.24 ppb, which would be rounded to zero. So the average from the well does not exceed the PHG of 0.06 ppb and no cost estimate would be needed for this well.)

D. What does the term "best available technology" (BAT) mean as used in this portion of the law?

1. While a specific definition of the term is not in the State Health & Safety Code, the accepted meaning in all other sections is that it refers to a technology to achieve compliance with MCLs. In fact, where "best available technology" is listed or explained (Sections 64447, 64447.2 & 64447.4), the usage is "for achieving compliance with the MCLs." This is also true for BAT specified in federal regulations.

2. However, in Section 116470(b)(4), the term refers to "BAT," if any is available on a commercial basis, to remove or reduce the concentration of the contaminant. Specifically, (b)(5) requires cost estimates of using the technology described in (b)(4) to "reduce the contaminant...to a level at or below the" PHG (or MCLG).

3. Obviously, where MCLGs are set at zero, there may not be commercially available technology to reach a non-detectable level. This should be clearly stated in the report. Since there is little data readily available to "estimate" cost of treatment to achieve absolute zero levels, rough estimates of "BAT" as defined in law might be used with a clearly written caveat that use of this "BAT" may still not achieve the PHG or MCLG and the costs may be significantly higher to do so.

E. How should the report deal with coliform?

The United States Environmental Protection Agency (USEPA) has revised the 1989 Total Coliform Rule (TCR). The Revised Total Coliform Rule (RTCR) offers a meaningful opportunity for greater public health protection beyond the 1989 TCR. The 1989 TCR provisions (listed below) remain effective until March 31, 2016. PWSs and primacy agencies must comply with the requirements of the RTCR beginning April 1, 2016. Information in the 2016 PHG report still follows the current TCR provisions. As such, ACWA will provide information on the new requirements in the 2019 PHG Triennial Report Guidance.

TCR provisions still applicable until April 1, 2016:

1. Keep in mind that the MCL is a monthly percent of positive samples (not to exceed 5%) and no actual numbers of coliform are determined or are

required to be determined. The MCLG of zero (0) is therefore appropriately interpreted as zero percent of samples per month, NOT zero samples positive. (For example, if the system did not exceed 0.5% positive samples in any month, the system would not exceed the MCLG of 0 because anything less than 0.5% would be rounded down to 0, which is consistent with the significant figure of the MCLG.)

2. If it is determined that the system has exceeded the MCLG of zero % for coliform bacteria, the following factors are pertinent to deciding what action, if any, is appropriate to consider and estimate costs for:

   a. Exceeding zero % coliform bacteria in any month, in and of itself, would not normally constitute the need for any treatment or action;
   b. There is no action that could be taken that with any certainty could ensure that the system would always have 0% coliform every single month;
   c. The "best available technology" (to meet the MCL, not the MCLG) is specified by DDW in Title 22, CCR, Section 64447 and for the most part is already followed by many systems;
   d. The one single action that would most likely decrease the possibility of a system having zero % positive coliform would be to significantly increase the disinfectant residual. This would likely result in increased Disinfection Byproducts (DBPs) which have adverse health consequences. This focuses on the risk-tradeoff issue – protection from acute risks versus potential harm from chronic risks. The limits to the amount of disinfectant residual allowed in the distribution system are the maximum residual disinfectant levels (MRDLs) as established by the Disinfectants and Disinfection Byproducts Rule (D/DBPR).
   e. Utilities should point out the positive, proactive steps they take to prevent coliform contamination in the distribution system including such steps as preventive maintenance, main flushing, special monitoring, residual maintenance and testing, cross-connection control, etc.

F. How should the report handle the MCLGs of zero for *Giardia lamblia*, *Cryptosporidium*, *Legionella* and viruses?

1. The MCL for pathogenic micro-organisms is a TT (i.e., the SWTR). No monitoring is mandated for the organisms because there are no standardized methods for testing or the analyses are not timely (like virus testing – 30 days) to provide public health protection.

2. For these reasons, since the intent of the TT (SWTR) is to protect against these pathogens, it can properly be assumed that if the SWTR is met, that the utility has met the MCLG because there is no uniform way to assess possible pathogen levels.

3. For utilities doing voluntary monitoring of pathogens (such as Giardia and Cryptosporidium), the results are appropriately considered research or for operational purposes, and not for compliance purposes.

G. How should the report deal with Lead and Copper?

1. Any lead or copper values below the respective DLR should be reported as zero.

2. For lead from at the tap monitoring, if the 90 percentile lead value is ND or <0.005 mg/l, then you should assume you do not exceed the lead PHG of 0.2 ppb.

3. For copper from at the tap monitoring, if the 90 percentile copper value is not above 300 ppb, then you have not exceeded the copper PHG.

4. While not precisely stated in the regulations, best available technology for Lead and Copper compliance is a TT (in lieu of MCLs) of "optimized corrosion control." For larger systems with >10,000 service connections, this depends on a series of steps involving sampling, reports, studies, etc. If a system meets the requirements of having optimized corrosion control, but still has a 90 percentile lead or copper value above the PHGs, it is not clear what additional steps could be considered, particularly without causing other potential water quality problems. It may be appropriate to explain this in a straight-forward manner rather than putting in "hypothetical" cost figures.

H. Must the report deal with Total Trihalomethanes (TTHMs) or Haloacetic Acids (HAAS)?

No. MCLG/PHG exceedances must be reported only for those contaminants that have a primary drinking water standard in place and an associated MCLG/PHG. Although EPA has adopted MCLGs for some individual THMs and HAAs (such as dibromochloromethane or dichloroacetic acid), there are no MCLs in effect for these individual constituents. Likewise, EPA has adopted standards for the cumulative byproduct groups but there are no MCLGs or PHGs established for the groups. In California, DDW has adopted an MCL for both cumulative byproduct groups, but there are no associated PHGs. (Note: OEHHA published a draft PHG of 0.8 ppb for total trihalomethanes in September 2010 but it had not been finalized as of December 31, 2015).

However, individual MCLs and MCLGs for bromate and chlorite exist, so they must be included in the report if detected.

I. How should water utilities handle gross alpha and uranium?

When looking at the results of any radionuclide monitoring done in the 3-year period to be covered by the report, there are several things to keep in mind:

As indicated in C.1 of this Guidance, where averaging is done to determine compliance with MCLs, it should also be done in considering PHGs. This is important for radionuclides because compliance is often based on averaging.

Unlike most other constituents, laboratories doing radionuclides report some results that are LOWER than the state DLR. Title 22, 64442 (h)(3)(c) states: "If a sample result is LESS than the DLR in Table 64442, ZERO shall be used to calculate the annual average……." Also, it says for Gross Alpha: "……1/2 of the DLR shall be used to calculate the annual average."

Where Gross Alpha analyses are used in lieu of analyzing for uranium, Radium 226 or 228, the procedure outlined in Title 22, 64442(f) should be followed. (Note: The 95% confidence limit is often reported by labs as MDA95.)

J. Do utilities have to report detections of Hexavalent Chromium?

Hexavalent chromium has both an MCL of 10 ppb and a PHG of 0.02 ppb in California. This is in addition to the MCL and MCLG for Total Chromium. Water systems should have monitoring data for hexavalent chromium in 2015, which means there will be one year's worth of data to average.

V. Disclosure of Numerical Public Health Risk Associated with PHGs/MCLs and Identification of Category of Risk

H&S Code, Section 116470(b)(2) requires the report to disclose the numerical public health risk associated with both the maximum contaminant level and public health goal for each contaminant detected in drinking water that exceeds the public health goal, and Section 116470(b)(3) requires an identification of the category of risk to public health associated with exposure to the contaminant. In February 2016, OEHHA prepared and published an updated "Health Risk Information for Public Health Goal Exceedance Reports" document. It is included as Attachment No. 2, and can be accessed at http://oehha.ca.gov/water/phg/pdf/2016phgexceedancereport012816.pdf.

V. Cost Estimates

The most difficult aspect of the required report is estimating the cost of treatment. Agencies are urged to keep in mind that because of the advisory nature of the report, the non-enforceable aspect of PHGs and MCLGs, and the highly speculative applicability of technology to achieve “zero” levels, only very preliminary cost estimating is appropriate and necessary.

Remember that a cost estimate is only required for a constituent if you determine that it was “detected” above the PHG or MCLG. If the MCLG is zero and the result (after approximation, averaging, rounding) is less than the DLR, no cost estimate is needed. (Remember that many DLRs are LOWER than the PHG so “detection” above the DLR does not necessarily mean that it is above the PHG.)
The cost estimates should not be low estimates because that would give a mistaken impression that achieving “zero” levels would have a lower price tag when the amount of uncertainty and unknowns would be very high. Given the uncertainties, it might be appropriate to consider reporting a range of costs.

For the 2016 guidance, ACWA is providing a revision of its previous treatment cost information.

Attachment No. 3 to this guidance includes several tables which provide "ranges" of costs for installing and operating several treatment technologies. These data have been gathered from a variety of sources and represent estimates for different size systems, different sources, and different constituents targeted for reduction by the treatment.
Table 1 represents the results of a 2012 ACWA Survey of its member agencies. This has been revised using the average 2015 ENR Cost Index.
Table 2 includes data from several agencies that was gathered separately from the 2012 ACWA survey. This has been revised using the average 2015 ENR Cost Index.
Table 3 is treatment cost data from previous ACWA Guidance documents with the costs updated to 2012. This has been revised using the average 2015 ENR Cost Index.
Table 4 is a summary of a 2011 report for the SWRCB on the cost of treatment to address nitrate. This table is provided for reference only, and has not been updated.
Table 5 is a summary of a Water Research Foundation Project final report on cost of removal technologies for treatment of perchlorate. This table is provided for reference only, and has not been updated.

The law specifies that the report should only “estimate the aggregate cost and the cost per customer of utilizing the technology” to reduce the level down to the PHG. There is no specification of what is to be estimated: Initial construction cost, annualized costs of construction and O&M, or another way of expressing cost. It is suggested that each utility may do it the way they report other costs. (EXAMPLES: 1. Initial Cost of Construction, including % increases for each of design, planning, CEQA, permitting, contingency, etc =$10 million or $1000 per customer plus an ongoing O&M Cost of $1 million or $100 per customer, forever; 2. Annualized Cost of Construction plus O&M = $2 million or $200 per customer.)

All possible technologies do not have to be evaluated for each constituent to compare costs. For example if GAC and RO are both possible treatment technologies to try to lower the level of a particular contaminant to the "zero" PHG/MCLG level, it is appropriate to specify and estimate costs for the technology that would likely be used, keeping in mind there are significant uncertainties based on a variety of factors. If the utility has multiple contaminants to address in the report, one technology (i.e., RO) may address them all, so a cost estimate for RO only could suffice.

General "order of magnitude" estimates are adequate. It is assumed that ALL costs including capital, land, construction, engineering, planning, environmental, contingency and O&M costs should be included but general assumptions can be made for most of these items.

If a system chooses to do its own cost estimating rather than use the costs in Attachment No. 3, it is recommended that generally available cost estimating guides be used such as from USEPA, WRF, AWWA, ASCE, or textbooks, manuals, journals.

The following is a list of excellent, relatively current references that might be used:

(1) Implementation of Arsenic Treatment Systems, Part 1. Process Selection; Awwa Research Foundation and U.S.E.P.A, Published by AwwaRF and AWWA, 2002,
(2) Implementation of Arsenic Treatment Systems, Part 2: Design Considerations, Operation and Maintenance, Awwa Research Foundation, Published by AwwaRF and AWWA, 2002,
(3) State-of-Science on Perchlorate Treatment Technologies, Final Report for Water Research Foundation project #4359, 2011,
(4) An Assessment of the State of Nitrate Treatment Alternatives, AWWA, June 2011, Chad Siedel and Craig Gorman, Jacobs Engineering Group, Inc.,
(5) Performance and Cost Analysis of Arsenic Treatment in California, October, 2009, JAWRA, UC Davis, Hilkert, Young, Green and Darby.

USEPA includes cost data in the Federal Register for each regulation when it is proposed or adopted. (NOTE: USEPA estimates generally do not consider state-specific concerns and some costs have been known to be underestimated in the past so costs should be increased appropriately and based on utility experience.) The experience of other utilities in your area that have installed treatment to meet MCLs or data reported in journals is valuable as well.

Utilities may also choose to have their engineering consultants prepare these very general cost estimates.

VI. Sample Hypothetical Report

Attachment No. 4 is an attempt to show what a PHG required report might look like for a "hypothetical" water system that serves more than 10,000 service connections and had one or more PHG/MCLG exceedances in the 3-year period ending December 31, 2015. It is NOT the only way the report might be done. The sample is based on these guidelines. If there appears to be a conflict between the sample and the guidelines, the guidelines should be followed.

If you have any questions about these guidelines or any of the attachments, contact Adam Walukiewicz Robin, ACWA, at 916-441-4545.

ATTACHMENT NO. 1

2016 PHG Triennial Report: Calendar Years 2013-2014-2015

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants

(Units are in milligrams per liter (mg/L), unless otherwise noted.)

Last Update: December 29, 2015

(Reference last update 9/23/2015: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.shtml)

This table includes:

- DDW's maximum contaminant levels (MCLs)
- DDW's detection limits for purposes of reporting (DLRs)
- Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA)
- PHGs for NDMA and 1,2,3-Trichloropropane (both are unregulated) are at the bottom of this table
- The federal MCLG for chemicals without a PHG, microbial contaminants, and the DLR for 1,2,3-TCP

Constituent	MCL	DLR	PHG or (MCLG)	Date of PHG
Chemicals with MCLs in 22 CCR §64431 —Inorganic Chemicals				
Aluminum	1	0.05	0.6	2001
Antimony	0.006	0.006	0.02	1997
Antimony	--	--	0.0007	2009 draft
Arsenic	0.010	0.002	0.000004	2004
Asbestos (MFL = million fibers per liter; for fibers >10 microns long)	7 MFL	0.2 MFL	7 MFL	2003
Barium	1	0.1	2	2003
Beryllium	0.004	0.001	0.001	2003
Cadmium	0.005	0.001	0.00004	2006
Chromium, Total - OEHHA withdrew the 1999 0.0025 mg/L PHG in Nov 2001	0.05	0.01	(0.100)	
Chromium, Hexavalent (Chromium-6)	0.01	0.001	0.00002	2011
Cyanide	0.15	0.1	0.15	1997
Fluoride	2	0.1	1	1997
Mercury (inorganic)	0.002	0.001	0.0012	1999 (rev2005)*
Nickel	0.1	0.01	0.012	2001
Nitrate (as N)	10 as N	0.4	45 as NO3 (=10 as N)	1997
Nitrite (as N)	1 as N	0.4	1 as N	1997
Nitrate + Nitrite (as N)	10 as N	0.4	10 as N	1997
Perchlorate	0.006	0.004	0.001	2015
Selenium	0.05	0.005	0.03	2010
Thallium	0.002	0.001	0.0001	1999 (rev2004)
Copper and Lead, 22 CCR §64672.3				
Values referred to as MCLs for lead and copper are not actually MCLs; instead, they are called "Action Levels" under the lead and copper rule				
Copper	1.3	0.05	0.3	2008
Lead	0.015	0.005	0.0002	2009

ATTACHMENT NO. 1

Constituent	MCL	DLR	PHG or (MCLG)	Date of PHG
Radionuclides with MCLs in 22 CCR §64441 and §64443—Radioactivity [units are picocuries per liter (pCi/L), unless otherwise stated; n/a = not applicable]				
Gross alpha particle activity - OEHHA concluded in 2003 that a PHG was not practical	15	3	(zero)	n/a
Gross beta particle activity - OEHHA concluded in 2003 that a PHG was not practical	4 mrem/yr	4	(zero)	n/a
Radium-226	--	1	0.05	2006
Radium-228	--	1	0.019	2006
Radium-226 + Radium-228	5	--	(zero)	--
Strontium-90	8	2	0.35	2006
Tritium	20,000	1,000	400	2006
Uranium	20	1	0.43	2001
Chemicals with MCLs in 22 CCR §64444—Organic Chemicals				
(a) Volatile Organic Chemicals (VOCs)				
Benzene	0.001	0.0005	0.00015	2001
Carbon tetrachloride	0.0005	0.0005	0.0001	2000
1,2-Dichlorobenzene	0.6	0.0005	0.6	1997 (rev2009)
1,4-Dichlorobenzene (p-DCB)	0.005	0.0005	0.006	1997
1,1-Dichloroethane (1,1-DCA)	0.005	0.0005	0.003	2003
1,2-Dichloroethane (1,2-DCA)	0.0005	0.0005	0.0004	1999 (rev2005)
1,1-Dichloroethylene (1,1-DCE)	0.006	0.0005	0.01	1999
cis-1,2-Dichloroethylene	0.006	0.0005	0.1	2006
trans-1,2-Dichloroethylene	0.01	0.0005	0.06	2006
Dichloromethane (Methylene chloride)	0.005	0.0005	0.004	2000
1,2-Dichloropropane	0.005	0.0005	0.0005	1999
1,3-Dichloropropene	0.0005	0.0005	0.0002	1999 (rev2006)
Ethylbenzene	0.3	0.0005	0.3	1997
Methyl tertiary butyl ether (MTBE)	0.013	0.003	0.013	1999
Monochlorobenzene	0.07	0.0005	0.07	2014
Styrene	0.1	0.0005	0.0005	2010
1,1,2,2-Tetrachloroethane	0.001	0.0005	0.0001	2003
Tetrachloroethylene (PCE)	0.005	0.0005	0.00006	2001
Toluene	0.15	0.0005	0.15	1999
1,2,4-Trichlorobenzene	0.005	0.0005	0.005	1999
1,1,1-Trichloroethane (1,1,1-TCA)	0.2	0.0005	1	2006
1,1,2-Trichloroethane (1,1,2-TCA)	0.005	0.0005	0.0003	2006
Trichloroethylene (TCE)	0.005	0.0005	0.0017	2009
Trichlorofluoromethane (Freon 11)	0.15	0.005	1.3	2014
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	1.2	0.01	4	1997 (rev2011)
Vinyl chloride	0.0005	0.0005	0.00005	2000
Xylenes	1.75	0.0005	1.8	1997

ATTACHMENT NO. 1

Constituent	MCL	DLR	PHG or (MCLG)	Date of PHG
(b) Non-Volatile Synthetic Organic Chemicals (SOCs)				
Alachlor	0.002	0.001	0.004	1997
Atrazine	0.001	0.0005	0.00015	1999
Bentazon	0.018	0.002	0.2	1999 (rev2009)
Benzo(a)pyrene	0.0002	0.0001	0.000007	2010
Carbofuran	0.018	0.005	0.0017	2000
Carbofuran	--	--	0.0007	2015 draft
Chlordane	0.0001	0.0001	0.00003	1997 (rev2006)
Dalapon	0.2	0.01	0.79	1997 (rev2009)
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	0.00001	0.0000017	1999
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.07	0.01	0.02	2009
Di(2-ethylhexyl)adipate	0.4	0.005	0.2	2003
Di(2-ethylhexyl)phthalate (DEHP)	0.004	0.003	0.012	1997
Dinoseb	0.007	0.002	0.014	1997 (rev2010)
Diquat	0.02	0.004	0.015	2000
Diquat	--	--	0.006	2015 draft
Endrin	0.002	0.0001	0.0018	1999 (rev2008)
Endrin	--	--	0.0003	2015 draft
Endothal	0.1	0.045	0.094	2014
Ethylene dibromide (EDB)	0.00005	0.00002	0.00001	2003
Glyphosate	0.7	0.025	0.9	2007
Heptachlor	0.00001	0.00001	0.000008	1999
Heptachlor epoxide	0.00001	0.00001	0.000006	1999
Hexachlorobenzene	0.001	0.0005	0.00003	2003
Hexachlorocyclopentadiene	0.05	0.001	0.002	2014
Lindane	0.0002	0.0002	0.000032	1999 (rev2005)
Methoxychlor	0.03	0.01	0.00009	2010
Molinate	0.02	0.002	0.001	2008
Oxamyl	0.05	0.02	0.026	2009
Pentachlorophenol	0.001	0.0002	0.0003	2009
Picloram	0.5	0.001	0.5	1997
Picloram	--	--	0.166	2015 draft
Polychlorinated biphenyls (PCBs)	0.0005	0.0005	0.00009	2007
Simazine	0.004	0.001	0.004	2001
2,4,5-TP (Silvex)	0.05	0.001	0.003	2014
2,3,7,8-TCDD (dioxin)	$3x10^{-8}$	$5x10^{-9}$	$5x10^{-11}$	2010
Thiobencarb	0.07	0.001	0.07	2000
Thiobencarb	--	--	0.042	2015 draft
Toxaphene	0.003	0.001	0.00003	2003

ATTACHMENT NO. 1

Constituent	MCL	DLR	PHG or (MCLG)	Date of PHG
Chemicals with MCLs in 22 CCR §64533—Disinfection Byproducts				
Total Trihalomethanes	0.080	--		
Total Trihalomethanes	--	--	0.0008	2010 draft
Bromodichloromethane	--	0.0010	(zero)	--
Bromoform	--	0.0010	(zero)	--
Chloroform	--	0.0010	(0.07)	--
Dibromochloromethane	--	0.0010	(0.06)	--
Haloacetic Acids (five) (HAA5)	0.060	--	--	--
Monochloroacetic Acid	--	0.0020	(0.07)	--
Dichloroacetic Adic	--	0.0010	(zero)	--
Trichloroacetic Acid	--	0.0010	(0.02)	--
Monobromoacetic Acid	--	0.0010	--	--
Dibromoacetic Acid	--	0.0010	--	--
Bromate	0.010	0.0050 or 0.0010[a]	0.0001	2009
Chlorite	1.0	0.020	0.05	2009
Microbiological Contaminants (TT = Treatment Technique)				
Coliform % positive samples	%	5	(zero)	
*Cryptosporidium***		TT	(zero)	
*Giardia lamblia***		TT	(zero)	
*Legionella***		TT	(zero)	
Viruses**		TT	(zero)	
Chemicals with PHGs established in response to DDW requests. These are not currently regulated drinking water contaminants.				
N-Nitrosodimethylamine (NDMA)	--	--	0.000003	2006
1,2,3-Trichloropropane	--	0.000005	0.0000007	2009

Notes:

[a] DDW will maintain a 0.0050 mg/L DLR for bromate to accommodate laboratories that are using EPA Method 300.1. However, laboratories using EPA Methods 317.0 Revision 2.0, 321.8, or 326.0 must meet a 0.0010 mg/L MRL for bromate and should report results with a DLR of 0.0010 mg/L per Federal requirements.

*OEHHA's review of this chemical during the year indicated (rev20XX) resulted in no change in the PHG

** Surface water treatment = TT

Available at: http://oehha.ca.gov/water/phg/pdf/2016phgexceedancereport012816.pdf

Health Risk Information for Public Health Goal Exceedance Reports

Prepared by

Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

February 2016

Under the Calderon-Sher Safe Drinking Water Act of 1996 (the Act), water utilities are required to prepare a report every three years for contaminants that exceed public health goals (PHGs) (Health and Safety Code Section 116470 (b)(2)). The numerical health risk for a contaminant is to be presented with the category of health risk, along with a plainly worded description of these terms. The cancer health risk is to be calculated at the PHG and at the California maximum contaminant level (MCL). This report is prepared by the Office of Environmental Health Hazard Assessment (OEHHA) to assist the water utilities in meeting their requirements.

PHGs are concentrations of contaminants in drinking water that pose no significant health risk if consumed for a lifetime. PHGs are developed and published by OEHHA (Health and Safety Code Section 116365) using current risk assessment principles, practices and methods.

Numerical health risks. Table 1 presents health risk categories and cancer risk values for chemical contaminants in drinking water that have PHGs.

The Act requires that OEHHA publish PHGs based on health risk assessments using the most current scientific methods. As defined in statute, PHGs for non-carcinogenic chemicals in drinking water are set at a concentration "at which no known or anticipated adverse health effects will occur, with an adequate margin of safety." For carcinogens, PHGs are set at a concentration that "does not pose any significant risk to health." PHGs provide one basis for revising MCLs, along with cost and technological feasibility. OEHHA has been publishing PHGs since 1997 and the entire list published to date is shown in Table 1.

Table 2 presents health risk information for contaminants that do not have PHGs but have state or federal regulatory standards. The Act requires that, for chemical contaminants with California MCLs that do not yet have PHGs, water utilities use the federal maximum contaminant level goal (MCLG) for the purpose of complying with the requirement of public notification. MCLGs, like PHGs, are strictly health based and include a margin of safety. One difference, however, is that the MCLGs for carcinogens are set at zero because the US Environmental Protection Agency (US EPA) assumes there is no absolutely safe level of exposure to such chemicals. PHGs, on the other hand, are set at a level considered to pose no *significant* risk of cancer; this is usually a no more than one-in-one-million excess cancer risk (1×10^{-6}) level for a lifetime of exposure. In Table 2, the cancer risks shown are based on the US EPA's evaluations.

For more information on health risks: The adverse health effects for each chemical with a PHG are summarized in a PHG technical support document. These documents are available on the OEHHA Web site (http://www.oehha.ca.gov). Also, technical fact sheets on most of the chemicals having federal MCLs can be found at http://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants.

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Alachlor	carcinogenicity (causes cancer)	0.004	NA[5]	0.002	NA
Aluminum	neurotoxicity and immunotoxicity (harms the nervous and immune systems)	0.6	NA	1	NA
Antimony	digestive system toxicity (causes vomiting)	0.02	NA	0.006	NA
Arsenic	carcinogenicity (causes cancer)	0.000004 (4×10^{-6})	1×10^{-6} (one per million)	0.01	2.5×10^{-3} (2.5 per thousand)
Asbestos	carcinogenicity (causes cancer)	7 MFL[6] (fibers >10 microns in length)	1×10^{-6}	7 MFL (fibers >10 microns in length)	1×10^{-6} (one per million)
Atrazine	carcinogenicity (causes cancer)	0.00015	1×10^{-6}	0.001	7×10^{-6} (seven per million)

[1] Based on the OEHHA PHG technical support document unless otherwise specified. The categories are the hazard traits defined by OEHHA for California's Toxics Information Clearinghouse (online at: http://oehha.ca.gov/multimedia/green/pdf/GC_Regtext011912.pdf).
[2] mg/L = milligrams per liter of water or parts per million (ppm)
[3] Cancer Risk = Upper estimate of excess cancer risk from lifetime exposure. Actual cancer risk may be lower or zero. 1×10^{-6} means one excess cancer case per million people exposed.
[4] MCL = maximum contaminant level.
[5] NA = not applicable. Risk cannot be calculated. The PHG is set at a level that is believed to be without any significant public health risk to individuals exposed to the chemical over a lifetime.
[6] MFL = million fibers per liter of water.

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Barium	cardiovascular toxicity (causes high blood pressure)	2	NA	1	NA
Bentazon	hepatotoxicity and digestive system toxicity (harms the liver, intestine, and causes body weight effects[7])	0.2	NA	0.018	NA
Benzene	carcinogenicity (causes leukemia)	0.00015	1×10^{-6}	0.001	7×10^{-6} (seven per million)
Benzo[a]pyrene	carcinogenicity (causes cancer)	0.000007 (7×10^{-6})	1×10^{-6}	0.0002	3×10^{-5} (three per hundred thousand)
Beryllium	digestive system toxicity (harms the stomach or intestine)	0.001	NA	0.004	NA
Bromate	carcinogenicity (causes cancer)	0.0001	1×10^{-6}	0.01	1×10^{-4} (one per ten thousand)
Cadmium	nephrotoxicity (harms the kidney)	0.00004	NA	0.005	NA
Carbofuran	reproductive toxicity (harms the testis)	0.0017	NA	0.018	NA

[7] Body weight effects are an indicator of general toxicity in animal studies.

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Carbon tetrachloride	carcinogenicity (causes cancer)	0.0001	1×10^{-6}	0.0005	5×10^{-6} (five per million)
Chlordane	carcinogenicity (causes cancer)	0.00003	1×10^{-6}	0.0001	3×10^{-6} (three per million)
Chlorite	hematotoxicity (causes anemia) neurotoxicity (causes neurobehavioral effects)	0.05	NA	1	NA
Chromium, hexavalent	carcinogenicity (causes cancer)	0.00002	1×10^{-6}	0.01	5×10^{-4} (five per ten thousand)
Copper	digestive system toxicity (causes nausea, vomiting, diarrhea)	0.3	NA	1.3 (AL[8])	NA
Cyanide	neurotoxicity (damages nerves) endocrine toxicity (affects the thyroid)	0.15	NA	0.15	NA
Dalapon	nephrotoxicity (harms the kidney)	0.79	NA	0.2	NA

[8] AL = action level. The action levels for copper and lead refer to a concentration measured at the tap. Much of the copper and lead in drinking water is derived from household plumbing (The Lead and Copper Rule, Title 22, California Code of Regulations [CCR] section 64672.3).

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
1,2-Dibromo-3-chloropropane (DBCP)	carcinogenicity (causes cancer)	0.0000017 (1.7×10^{-6})	1×10^{-6}	0.0002	1×10^{-4} (one per ten thousand)
1,2-Dichloro-benzene (o-DCB)	hepatotoxicity (harms the liver)	0.6	NA	0.6	NA
1,4-Dichloro-benzene (p-DCB)	carcinogenicity (causes cancer)	0.006	1×10^{-6}	0.005	8×10^{-7} (eight per ten million)
1,1-Dichloro-ethane (1,1-DCA)	carcinogenicity (causes cancer)	0.003	1×10^{-6}	0.005	2×10^{-6} (two per million)
1,2-Dichloro-ethane (1,2-DCA)	carcinogenicity (causes cancer)	0.0004	1×10^{-6}	0.0005	1×10^{-6} (one per million)
1,1-Dichloro-ethylene (1,1-DCE)	hepatotoxicity (harms the liver)	0.01	NA	0.006	NA
1,2-Dichloro-ethylene, cis	nephrotoxicity (harms the kidney)	0.1	NA	0.006	NA
1,2-Dichloro-ethylene, trans	hepatotoxicity (harms the liver)	0.06	NA	0.01	NA
Dichloromethane (methylene chloride)	carcinogenicity (causes cancer)	0.004	1×10^{-6}	0.005	1×10^{-6} (one per million)
2,4-Dichloro-phenoxyacetic acid (2,4-D)	hepatotoxicity and nephrotoxicity (harms the liver and kidney)	0.02	NA	0.07	NA

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
1,2-Dichloro-propane (propylene dichloride)	carcinogenicity (causes cancer)	0.0005	1×10^{-6}	0.005	1×10^{-5} (one per hundred thousand)
1,3-Dichloro-propene (Telone II®)	carcinogenicity (causes cancer)	0.0002	1×10^{-6}	0.0005	2×10^{-6} (two per million)
Di(2-ethylhexyl) adipate (DEHA)	developmental toxicity (disrupts development)	0.2	NA	0.4	NA
Diethylhexyl-phthalate (DEHP)	carcinogenicity (causes cancer)	0.012	1×10^{-6}	0.004	3×10^{-7} (three per ten million)
Dinoseb	reproductive toxicity (harms the uterus and testis)	0.014	NA	0.007	NA
Dioxin (2,3,7,8-TCDD)	carcinogenicity (causes cancer)	5×10^{-11}	1×10^{-6}	3×10^{-8}	6×10^{-4} (six per ten thousand)
Diquat	ocular toxicity (harms the eye) developmental toxicity (causes malformation)	0.015	NA	0.02	NA
Endothall	digestive system toxicity (harms the stomach or intestine)	0.094	NA	0.1	NA
Endrin	hepatotoxicity (harms the liver) neurotoxicity (causes convulsions)	0.0018	NA	0.002	NA

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Ethylbenzene (phenylethane)	hepatotoxicity (harms the liver)	0.3	NA	0.3	NA
Ethylene dibromide	carcinogenicity (causes cancer)	0.00001	1×10^{-6}	0.00005	5×10^{-6} (five per million)
Fluoride	musculoskeletal toxicity (causes tooth mottling)	1	NA	2	NA
Glyphosate	nephrotoxicity (harms the kidney)	0.9	NA	0.7	NA
Heptachlor	carcinogenicity (causes cancer)	0.000008 (8×10^{-6})	1×10^{-6}	0.00001	1×10^{-6} (one per million)
Heptachlor epoxide	carcinogenicity (causes cancer)	0.000006 (6×10^{-6})	1×10^{-6}	0.00001	2×10^{-6} (two per million)
Hexachloroben-zene	carcinogenicity (causes cancer)	0.00003	1×10^{-6}	0.001	3×10^{-5} (three per hundred thousand)
Hexachloro-cyclopentadiene (HCCPD)	digestive system toxicity (causes stomach lesions)	0.002	NA	0.05	NA
Lead	developmental neurotoxicity (causes neurobehavioral effects in children) cardiovascular toxicity (causes high blood pressure) carcinogenicity (causes cancer)	0.0002	$<1\times10^{-6}$ (PHG is not based on this effect)	0.015 (AL[8])	2×10^{-6} (two per million)

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Lindane (γ-BHC)	carcinogenicity (causes cancer)	0.000032	1×10^{-6}	0.0002	6×10^{-6} (six per million)
Mercury (inorganic)	nephrotoxicity (harms the kidney)	0.0012	NA	0.002	NA
Methoxychlor	endocrine toxicity (causes hormone effects)	0.00009	NA	0.03	NA
Methyl tertiary-butyl ether (MTBE)	carcinogenicity (causes cancer)	0.013	1×10^{-6}	0.013	1×10^{-6} (one per million)
Molinate	carcinogenicity (causes cancer)	0.001	1×10^{-6}	0.02	2×10^{-5} (two per hundred thousand)
Monochloro-benzene (chlorobenzene)	nephrotoxicity (harms the kidney)	0.07	NA	0.07	NA
Nickel	developmental toxicity (causes increased neonatal deaths)	0.012	NA	0.1	NA
Nitrate	hematotoxicity (causes methemoglobinemia)	45 as nitrate	NA	10 as nitrogen (=45 as nitrate)	NA
Nitrite	hematotoxicity (causes methemoglobinemia)	1 as nitrogen	NA	1 as nitrogen	NA

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Nitrate and Nitrite	hematotoxicity (causes methemoglobinemia)	10 as nitrogen	NA	10 as nitrogen	NA
N-nitroso-dimethyl-amine (NDMA)	carcinogenicity (causes cancer)	0.000003 (3×10^{-6})	1×10^{-6}	none	NA
Oxamyl	general toxicity (causes body weight effects)	0.026	NA	0.05	NA
Pentachloro-phenol (PCP)	carcinogenicity (causes cancer)	0.0003	1×10^{-6}	0.001	3×10^{-6} (three per million)
Perchlorate	endocrine toxicity (affects the thyroid) developmental toxicity (causes neurodevelop-mental deficits)	0.001	NA	0.006	NA
Picloram	hepatotoxicity (harms the liver)	0.5	NA	0.5	NA
Polychlorinated biphenyls (PCBs)	carcinogenicity (causes cancer)	0.00009	1×10^{-6}	0.0005	6×10^{-6} (six per million)
Radium-226	carcinogenicity (causes cancer)	0.05 pCi/L	1×10^{-6}	5 pCi/L (combined $Ra^{226+228}$)	1×10^{-4} (one per ten thousand)
Radium-228	carcinogenicity (causes cancer)	0.019 pCi/L	1×10^{-6}	5 pCi/L (combined $Ra^{226+228}$)	3×10^{-4} (three per ten thousand)

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Selenium	integumentary toxicity (causes hair loss and nail damage)	0.03	NA	0.05	NA
Silvex (2,4,5-TP)	hepatotoxicity (harms the liver)	0.003	NA	0.05	NA
Simazine	general toxicity (causes body weight effects)	0.004	NA	0.004	NA
Strontium-90	carcinogenicity (causes cancer)	0.35 pCi/L	1×10^{-6}	8 pCi/L	2×10^{-5} (two per hundred thousand)
Styrene (vinylbenzene)	carcinogenicity (causes cancer)	0.0005	1×10^{-6}	0.1	2×10^{-4} (two per ten thousand)
1,1,2,2-Tetrachloro-ethane	carcinogenicity (causes cancer)	0.0001	1×10^{-6}	0.001	1×10^{-5} (one per hundred thousand)
Tetrachloro-ethylene (perchloro-ethylene, or PCE)	carcinogenicity (causes cancer)	0.00006	1×10^{-6}	0.005	8×10^{-5} (eight per hundred thousand)
Thallium	integumentary toxicity (causes hair loss)	0.0001	NA	0.002	NA
Thiobencarb	general toxicity (causes body weight effects) hematotoxicity (affects red blood cells)	0.07	NA	0.07	NA

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Toluene (methylbenzene)	hepatotoxicity (harms the liver) endocrine toxicity (harms the thymus)	0.15	NA	0.15	NA
Toxaphene	carcinogenicity (causes cancer)	0.00003	1×10^{-6}	0.003	1×10^{-4} (one per ten thousand)
1,2,4-Trichloro-benzene	endocrine toxicity (harms adrenal glands)	0.005	NA	0.005	NA
1,1,1-Trichloro-ethane	neurotoxicity (harms the nervous system), reproductive toxicity (causes fewer offspring) hepatotoxicity (harms the liver) hematotoxicity (causes blood effects)	1	NA	0.2	NA
1,1,2-Trichloro-ethane	carcinogenicity (causes cancer)	0.0003	1×10^{-6}	0.005	2×10^{-5} (two per hundred thousand)
Trichloro-ethylene (TCE)	carcinogenicity (causes cancer)	0.0017	1×10^{-6}	0.005	3×10^{-6} (three per million)
Trichlorofluoro-methane (Freon 11)	accelerated mortality (increase in early death)	1.3	NA	0.15	NA

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category[1]	California PHG (mg/L)[2]	Cancer Risk[3] at the PHG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
1,2,3-Trichloro-propane (1,2,3-TCP)	carcinogenicity (causes cancer)	0.0000007 (7×10^{-7})	1×10^{-6}	none	NA
1,1,2-Trichloro-1,2,2-trifluoro-ethane (Freon 113)	hepatotoxicity (harms the liver)	4	NA	1.2	NA
Tritium	carcinogenicity (causes cancer)	400 pCi/L	1×10^{-6}	20,000 pCi/L	5×10^{-5} (five per hundred thousand)
Uranium	carcinogenicity (causes cancer)	0.43 pCi/L	1×10^{-6}	20 pCi/L	5×10^{-5} (five per hundred thousand)
Vinyl chloride	carcinogenicity (causes cancer)	0.00005	1×10^{-6}	0.0005	1×10^{-5} (one per hundred thousand)
Xylene	neurotoxicity (affects the senses, mood, and motor control)	1.8 (single isomer or sum of isomers)	NA	1.75 (single isomer or sum of isomers)	NA

Table 2: Health Risk Categories and Cancer Risk Values for Chemicals without California Public Health Goals

Chemical	Health Risk Category[1]	U.S. EPA MCLG[2] (mg/L)	Cancer Risk[3] @ MCLG	California MCL[4] (mg/L)	Cancer Risk @ California MCL
Disinfection byproducts (DBPS)					
Chloramines	acute toxicity (causes irritation) digestive system toxicity (harms the stomach) hematotoxicity (causes anemia)	4[5,6]	NA[7]	none	NA
Chlorine	acute toxicity (causes irritation) digestive system toxicity (harms the stomach)	4[5,6]	NA	none	NA
Chlorine dioxide	hematotoxicity (causes anemia) neurotoxicity (harms the nervous system)	0.8[5,6]	NA	none	NA
Disinfection byproducts: haloacetic acids (HAA5)					
Chloroacetic acid	general toxicity (causes body and organ weight changes[8])	0.07	NA	none	NA

[1] Health risk category based on the U.S. EPA MCLG document or California MCL document unless otherwise specified.
[2] MCLG = maximum contaminant level goal established by U.S. EPA.
[3] Cancer Risk = Upper estimate of excess cancer risk from lifetime exposure. Actual cancer risk may be lower or zero. 1×10^{-6} means one excess cancer case per million people exposed.
[4] California MCL = maximum contaminant level established by California.
[5] Maximum Residual Disinfectant Level Goal, or MRDLG.
[6] The federal Maximum Residual Disinfectant Level (MRDL), or highest level of disinfectant allowed in drinking water, is the same value for this chemical.
[7] NA = not available.
[8] Body weight effects are an indicator of general toxicity in animal studies.

Table 2: Health Risk Categories and Cancer Risk Values for Chemicals without California Public Health Goals

Chemical	Health Risk Category[1]	U.S. EPA MCLG[2] (mg/L)	Cancer Risk[3] @ MCLG	California MCL[4] (mg/L)	Cancer Risk @ California MCL
Dichloroacetic acid	carcinogenicity (causes cancer)	0	0	none	NA
Trichloroacetic acid	hepatotoxicity (harms the liver)	0.02	0	none	NA
Bromoacetic acid	NA	none	NA	none	NA
Dibromoacetic acid	NA	none	NA	none	NA
Total haloacetic acids	carcinogenicity (causes cancer)	none	NA	0.06	NA
Disinfection byproducts: trihalomethanes (THMs)					
Bromodichloro-methane (BDCM)	carcinogenicity (causes cancer)	0	0	none	NA
Bromoform	carcinogenicity (causes cancer)	0	0	none	NA
Chloroform	hepatotoxicity and nephrotoxicity (harms the liver and kidney)	0.07	NA	none	NA
Dibromo-chloromethane (DBCM)	hepatotoxicity, nephrotoxicity, and neurotoxicity (harms the liver, kidney, and nervous system)	0.06	NA	none	NA
Total trihalomethanes (sum of BDCM, bromoform, chloroform and DBCM)	carcinogenicity (causes cancer), hepatotoxicity, nephrotoxicity, and neurotoxicity (harms the liver, kidney, and nervous system)	none	NA	0.08	NA

Table 2: Health Risk Categories and Cancer Risk Values for Chemicals without California Public Health Goals

Chemical	Health Risk Category[1]	U.S. EPA MCLG[2] (mg/L)	Cancer Risk[3] @ MCLG	California MCL[4] (mg/L)	Cancer Risk @ California MCL
Radionuclides					
Gross alpha particles[9]	carcinogenicity (causes cancer)	0 (^{210}Po included)	0	15 pCi/L[10] (includes ^{226}Ra but not radon and uranium)	up to $1x10^{-3}$ (for ^{210}Po, the most potent alpha emitter
Beta particles and photon emitters[9]	carcinogenicity (causes cancer)	0 (^{210}Pb included)	0	50 pCi/L (judged equiv. to 4 mrem/yr)	up to $2x10^{-3}$ (for ^{210}Pb, the most potent beta-emitter)

[9] MCLs for gross alpha and beta particles are screening standards for a group of radionuclides. Corresponding PHGs were not developed for gross alpha and beta particles. See the OEHHA memoranda discussing the cancer risks at these MCLs at http://oehha.studio-weeren.com/media/downloads/water/chemicals/phg/grossalphahealth.pdf.

[10] pCi/L = picocuries per liter of water.

ATTACHMENT NO. 3
Table 1
Reference: 2012 ACWA PHG Survey

COST ESTIMATES FOR TREATMENT TECHNOLOGIES
(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated Unit Cost 2012 ACWA Survey Indexed to 2015* ($/1,000 gallons treated)
1	Ion Exchange	Coachella Valley WD, for GW, to reduce Arsenic concentrations. 2011 costs.	1.99
2	Ion Exchange	City of Riverside Public Utilities, for GW, for Perchlorate treatment.	0.96
3	Ion Exchange	Carollo Engineers, anonymous utility, 2012 costs for treating GW source for Nitrates. Design souce water concentration: 88 mg/L NO_3. Design finished water concentration: 45 mg/L NO_3. Does not include concentrate disposal or land cost.	0.72
4	Granular Activated Carbon	City of Riverside Public Utilities, GW sources, for TCE, DBCP (VOC, SOC) treatment.	0.48
5	Granular Activated Carbon	Carollo Engineers, anonymous utility, 2012 costs for treating SW source for TTHMs. Design souce water concentration: 0.135 mg/L. Design finished water concentration: 0.07 mg/L. Does not include concentrate disposal or land cost.	0.34
6	Granular Activated Carbon, Liquid Phase	LADWP, Liquid Phase GAC treatment at Tujunga Well field. Costs for treating 2 wells. Treament for 1,1 DCE (VOC). 2011-2012 costs.	1.47
7	Reverse Osmosis	Carollo Engineers, anonymous utility, 2012 costs for treating GW source for Nitrates. Design souce water concentration: 88 mg/L NO_3. Design finished water concentration: 45 mg/L NO_3. Does not include concentrate disposal or land cost.	0.78
8	Packed Tower Aeration	City of Monrovia, treatment to reduce TCE, PCE concentrations. 2011-12 costs.	0.42
9	Ozonation+ Chemical addition	SCVWD, STWTP treatment plant includes chemical addition + ozone generation costs to reduce THM/HAAs concentrations. 2009-2012 costs.	0.09

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated Unit Cost 2012 ACWA Survey Indexed to 2015* ($/1,000 gallons treated)
10	Ozonation+ Chemical addition	SCVWD, PWTP treatment plant includes chemical addition + ozone generation costs to reduce THM/HAAs concentrations, 2009-2012 costs.	0.19
11	Coagulation/Filtration	Soquel WD, treatment to reduce manganese concentrations in GW. 2011 costs.	0.73
12	Coagulation/Filtration Optimization	San Diego WA, costs to reduce THM/Bromate, Turbidity concentrations, raw SW a blend of State Water Project water and Colorado River water, treated at Twin Oaks Valley WTP.	0.83
13	Blending (Well)	Rancho California WD, GW blending well, 1150 gpm, to reduce fluoride concentrations.	0.69
14	Blending (Wells)	Rancho California WD, GW blending wells, to reduce arsenic concentrations, 2012 costs.	0.56
15	Blending	Rancho California WD, using MWD water to blend with GW to reduce arsenic concentrations. 2012 costs.	0.67
16	Corrosion Inhibition	Atascadero Mutual WC, corrosion inhibitor addition to control aggressive water. 2011 costs.	0.09

*Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average building costs of 2015 and 2012. The adjustment factor was derived from the ratio of 2015 Index/2012 Index.

ATTACHMENT NO. 3
Table 2
Reference: Other Agencies

COST ESTIMATES FOR TREATMENT TECHNOLOGIES
(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated Unit Cost 2012 Other References Indexed to 2015* ($/1,000 gallons treated)
1	Reduction - Coagulation-Filtration	Reference: February 28, 2013, Final Report Chromium Removal Research, City of Glendale, CA. 100-2000 gpm. Reduce Hexavalent Chromium to 1 ppb.	1.58 - 9.95
2	IX - Weak Base Anion Resin	Reference: February 28, 2013, Final Report Chromium Removal Research, City of Glendale, CA. 100-2000 gpm. Reduce Hexavalent Chromium to 1 ppb.	1.62 - 6.78
3	IX	Golden State Water Co., IX w/disposable resin, 1 MGD, Perchlorate removal, built in 2010.	0.50
4	IX	Golden State Water Co., IX w/disposable resin, 1000 gpm, perchlorate removal (Proposed; O&M estimated).	1.08
5	IX	Golden State Water Co., IX with brine regeneration, 500 gpm for Selenium removal, built in 2007.	7.08
6	GFO/Adsorption	Golden State Water Co., Granular Ferric Oxide Resin, Arsenic removal, 600 gpm, 2 facilities, built in 2006.	1.85 -1.98
7	RO	Reference: Inland Empire Utilities Agency : Chino Basin Desalter. RO cost to reduce 800 ppm TDS, 150 ppm Nitrate (as NO3); approx. 7 mgd.	2.43
8	IX	Reference: Inland Empire Utilities Agency : Chino Basin Desalter. IX cost to reduce 150 ppm Nitrate (as NO3); approx. 2.6 mgd.	1.35

9	Packed Tower Aeration	Reference: Inland Empire Utilities Agency : Chino Basin Desalter. PTA-VOC air stripping, typical treated flow of approx. 1.6 mgd.	0.41
10	IX	Reference: West Valley WD Report, for Water Recycling Funding Program, for 2.88 mgd treatment facility. IX to remove Perchlorate, Perchlorate levels 6-10 ppb. 2008 costs.	0.56 - 0.80
11	Coagulation Filtration	Reference: West Valley WD, includes capital, O&M costs for 2.88 mgd treatment facility- Layne Christensen packaged coagulation Arsenic removal system. 2009-2012 costs.	0.37
12	FBR	Reference: West Valley WD/Envirogen design data for the O&M + actual capitol costs, 2.88 mgd fluidized bed reactor (FBR) treatment system, Perchlorate and Nitrate removal, followed by multimedia filtration & chlorination, 2012. NOTE: The capitol cost for the treatment facility for the first 2,000 gpm is $23 million annualized over 20 years with ability to expand to 4,000 gpm with minimal costs in the future. $17 million funded through state and federal grants with the remainder funded by WVWD and the City of Rialto.	1.67 - 1.76

*Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average building costs of 2015 and 2012. The adjustment factor was derived from the ratio of 2015 Index/2012 Index.

ATTACHMENT NO. 3
Table 3
Reference: Updated 2012 ACWA Cost of Treatment Table

COST ESTIMATES FOR TREATMENT TECHNOLOGIES
(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated 2012 Unit Cost Indexed to 2015* ($/1,000 gallons treated)
1	Granular Activated Carbon	Reference: Malcolm Pirnie estimate for California Urban Water Agencies, large surface water treatment plants treating water from the State Water Project to meet Stage 2 D/DBP and bromate regulation, 1998	0.57-1.08
2	Granular Activated Carbon	Reference: Carollo Engineers, estimate for VOC treatment (PCE), 95% removal of PCE, Oct. 1994,1900 gpm design capacity	0.26
3	Granular Activated Carbon	Reference: Carollo Engineers, est. for a large No. Calif. surf. water treatment plant (90 mgd capacity) treating water from the State Water Project, to reduce THM precursors, ENR construction cost index = 6262 (San Francisco area) - 1992	1.25
4	Granular Activated Carbon	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility for VOC and SOC removal by GAC, 1990	0.49-0.71
5	Granular Activated Carbon	Reference: Southern California Water Co. - actual data for "rented" GAC to remove VOCs (1,1-DCE), 1.5 mgd capacity facility, 1998	2.24
6	Granular Activated Carbon	Reference: Southern California Water Co. - actual data for permanent GAC to remove VOCs (TCE), 2.16 mgd plant capacity, 1998	1.46
7	Reverse Osmosis	Reference: Malcolm Pirnie estimate for California Urban Water Agencies, large surface water treatment plants treating water from the State Water Project to meet Stage 2 D/DBP and bromate regulation, 1998	1.68-3.22
8	Reverse Osmosis	Reference: Boyle Engineering, RO cost to reduce 1000 ppm TDS in brackish groundwater in So. Calif., 1.0 mgd plant operated at 40% of design flow, high brine line cost, May 1991	3.98
9	Reverse Osmosis	Reference: Boyle Engineering, RO cost to reduce 1000 ppm TDS in brackish groundwater in So. Calif., 1.0 mgd plant operated at 100% of design flow, high brine line cost, May 1991	2.45
10	Reverse Osmosis	Reference: Boyle Engineering, RO cost to reduce 1000 ppm TDS in brackish groundwater in So. Calif., 10.0 mgd plant operated at 40% of design flow, high brine line cost, May 1991	2.65
11	Reverse Osmosis	Reference: Boyle Engineering, RO cost to reduce 1000 ppm TDS in brackish groundwater in So. Calif., 10.0 mgd plant operated at 100% of design flow, high brine line cost, May 1991	2.05
12	Reverse Osmosis	Reference: Arsenic Removal Study, City of Scottsdale, AZ - CH2M Hill, for a 1.0 mgd plant operated at 40% of design capacity, Oct. 1991	6.65

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated 2012 Unit Cost Indexed to 2015* ($/1,000 gallons treated)
13	Reverse Osmosis	Reference: Arsenic Removal Study, City of Scottsdale, AZ - CH2M Hill, for a 1.0 mgd plant operated at 100% of design capacity, Oct. 1991	3.92
14	Reverse Osmosis	Reference: Arsenic Removal Study, City of Scottsdale, AZ - CH2M Hill, for a 10.0 mgd plant operated at 40% of design capacity, Oct. 1991	2.94
15	Reverse Osmosis	Reference: Arsenic Removal Study, City of Scottsdale, AZ - CH2M Hill, for a 10.0 mgd plant operated at 100% of design capacity, Oct. 1991	1.82
16	Reverse Osmosis	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility with RO to remove nitrate, 1990	1.83-3.22
17	Packed Tower Aeration	Reference: Analysis of Costs for Radon Removal... (AWWARF publication), Kennedy/Jenks, for a 1.4 mgd facility operating at 40% of design capacity, Oct. 1991	1.06
18	Packed Tower Aeration	Reference: Analysis of Costs for Radon Removal... (AWWARF publication), Kennedy/Jenks, for a 14.0 mgd facility operating at 40% of design capacity, Oct. 1991	0.56
19	Packed Tower Aeration	Reference: Carollo Engineers, estimate for VOC treatment (PCE) by packed tower aeration, without off-gas treatment, O&M costs based on operation during 329 days/year at 10% downtime, 16 hr/day air stripping operation, 1900 gpm design capacity, Oct. 1994	0.28
20	Packed Tower Aeration	Reference: Carollo Engineers, for PCE treatment by Ecolo-Flo Enviro-Tower air stripping, without off-gas treatment, O&M costs based on operation during 329 days/year at 10% downtime, 16 hr/day air stripping operation, 1900 gpm design capacity, Oct. 1994	0.29
21	Packed Tower Aeration	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility - packed tower aeration for VOC and radon removal, 1990	0.45-0.74
22	Advanced Oxidation Processes	Reference: Carollo Engineers, estimate for VOC treatment (PCE) by UV Light, Ozone, Hydrogen Peroxide, O&M costs based on operation during 329 days/year at 10% downtime, 24 hr/day AOP operation, 1900 gpm capacity, Oct. 1994	0.55
23	Ozonation	Reference: Malcolm Pirnie estimate for CUWA, large surface water treatment plants using ozone to treat water from the State Water Project to meet Stage 2 D/DBP and bromate regulation, *Cryptosporidium* inactivation requirements,1998	0.13-0.26
24	Ion Exchange	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility - ion exchange to remove nitrate, 1990	0.61-0.80

*Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average building costs of 2015 and 2012. The adjustment factor was derived from the ratio of 2015 Index/2012 Index.

ATTACHMENT NO. 4

SAMPLE "HYPOTHETICAL" PUBLIC HEALTH GOAL REPORT AND TRANSMITTAL MEMORANDUM

NOTE: It is suggested that the Report take the form of a communication to the utility's Governing Board or management since the report does not have to be submitted to any government oversight agency. It is suggested that a transmittal memo from staff to the Board should succinctly summarize the report and indicate what action is needed, which as a minimum includes the scheduling of a public hearing and the formal public notice of the hearing.

SAMPLE MEMORANDUM TRANSMITTING REPORT TO GOVERNING BOARD:

TO: Governing Board, SoftWater Public Water Utility District

FROM: Betty Bestwater, General Manager

SUBJECT: Required Report on Public Health Goals

Attached for your approval is the final draft of a report prepared by staff comparing our district's drinking water quality with public health goals (PHGs) adopted by California EPA's Office of Environmental Health Hazard Assessment (OEHHA) and with maximum contaminant level goals (MCLGs) adopted by the USEPA. PHGs and MCLGs are not enforceable standards and no action to meet them is mandated.

SB 1307 (Calderone-Sher; effective 1-1-97) added new provisions to the California Health and Safety Code which mandate that a report be prepared by July 1, 1998, and every three years thereafter. The attached report is intended to provide information to the public in addition to the annual Consumer Confidence Report (CCR) mailed to each customer.

Our water system complies with all of the health-based drinking water standards and maximum contaminant levels (MCLs) required by the California Division of Drinking Water and the USEPA. No additional actions are recommended. *(If staff plans to recommend any action to further lower constituent levels, these actions should be noted here.)*

The new law requires that a public hearing be held (which can be part of a regularly scheduled public meeting) for the purpose of accepting and responding to public comment on the report. This public hearing will be scheduled as part of our regular board (or council, etc) meeting scheduled for ____________and will be noticed as required for public hearings.

Signed_____________________________ General Manager

SOFTWATER PUBLIC WATER UTILITY DISTRICT REPORT ON DISTRICT'S WATER QUALITY RELATIVE TO PUBLIC HEALTH GOALS

(Note: The names, data, and analytical values cited in this sample report are hypothetical and each utility would need to substitute its own data and adjust the comments accordingly. The constituents discussed are only examples of some that water utilities may have to address in this report. This is not the only way the report can be structured.)

Background:

Provisions of the California Health and Safety Code (Reference No. 1) specify that larger (>10,000 service connections) water utilities prepare a special report by July 1, 2016 if their water quality measurements have exceeded any Public Health Goals (PHGs). PHGs are non-enforceable goals established by the Cal-EPA's Office of Environmental Health Hazard Assessment (OEHHA). The law also requires that where OEHHA has not adopted a PHG for a constituent, the water suppliers are to use the MCLGs adopted by USEPA. Only constituents which have a California primary drinking water standard and for which either a PHG or MCLG has been set are to be addressed. (Reference No. 2 is a list of all regulated constituents with the MCLs and PHGs or MCLGs.)

There are a few constituents that are routinely detected in water systems at levels usually well below the drinking water standards for which no PHG nor MCLG has yet been adopted by OEHHA or USEPA including Total Trihalomethanes. These will be addressed in a future required report after a PHG has been adopted.

The new law specifies what information is to be provided in the report. (See Reference No. 1)

If a constituent was detected in the District's water supply between 2013 and 2015 at a level exceeding an applicable PHG or MCLG, this report provides the information required by the law. Included is the numerical public health risk associated with the MCL and the PHG or MCLG, the category or type of risk to health that could be associated with each constituent, the best treatment technology available that could be used to reduce the constituent level, and an estimate of the cost to install that treatment if it is appropriate and feasible.

(Note: If "numerical health risk" data is not available from OEHHA, insert the following: "OEHHA is required to provide numerical health risk information, but has not done so in time to include it in this report").

What Are PHGs?

PHGs are set by the California Office of Environmental Health Hazard Assessment (OEHHA) which is part of Cal-EPA and are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the USEPA or the California Division of Drinking Water in setting drinking water standards (MCLs) are considered in setting the PHGs. These factors include analytical detection capability, treatment technology available, benefits and costs. The PHGs are not enforceable and are not required to be met by any public water system. MCLGs are the federal equivalent to PHGs.

Water Quality Data Considered:

All of the water quality data collected by our water system between 2013 and 2015 for purposes of determining compliance with drinking water standards was considered. This data was all summarized in our 2013, 2014, and 2015 Consumer Confidence Reports which were mailed to all of our customers in ___. (Reference No. 3)

Guidelines Followed:

The Association of California Water Agencies (ACWA) formed a workgroup which prepared guidelines for water utilities to use in preparing these newly required reports. The ACWA guidelines were used in the preparation of our report. No guidance was available from state regulatory agencies.

Best Available Treatment Technology and Cost Estimates:

Both the USEPA and DDW adopt what are known as BATs or Best Available Technologies which are the best known methods of reducing contaminant levels to the MCL. Costs can be estimated for such technologies. However, since many PHGs and all MCLGs are set much lower than the MCL, it is not always possible nor feasible to determine what treatment is needed to further reduce a constituent downward to or near the PHG or MCLG, many of which are set at zero. Estimating the costs to reduce a constituent to zero is difficult, if not impossible because it is not possible to verify by analytical means that the level has been lowered to zero. In some cases, installing treatment to try and further reduce very low levels of one constituent may have adverse effects on other aspects of water quality.

Constituents Detected That Exceed a PHG or a MCLG:

The following is a discussion of constituents that were detected in one or more of our drinking water sources at levels above the PHG, or if no PHG, above the MCLG.

Trichloroethylene (TCE): There is no PHG for TCE but the MCLG set by the USEPA is zero. The MCL or drinking water standard for TCE is 0.005 mg/l. We have detected TCE in 2 of our 20 wells at a level of 0.002 mg/l in Well No. 1 and at 0.003 mg/l in Well No. 8. The levels detected were below the MCLs at all times. The category of health risk associated with TCE, and the reason that a drinking water standard was adopted for it, is that people who drink water containing TCE above the MCL throughout their lifetime could experience an increased risk of getting cancer. DDW says that "Drinking water which meets this standard (the MCL) is associated with little to none of this risk and should be considered safe with respect to TCE." *(NOTE: This language is taken from the DDW Blue Book of drinking water law and regulations, Section 64468.2, Title 22, CCR.)* The numerical health risk for a MCLG of zero is zero. The BAT for TCE to lower the level below the MCL is either Granular Activated Carbon (GAC)or Packed Tower Aeration (PTA). Since the TCE level in these two wells is already below the MCL, GAC with a long empty bed contact time (EBCT) would likely be required to attempt to lower the TCE level to zero. The estimated cost to install and operate such a treatment system on both Wells No. 1 and No. 8 that would reliably reduce the TCE level to zero would be approximately $_____ initial construction cost with additional O&M cost of $______per year. This would result in an assumed increased cost for each customer of $______year.

Coliform Bacteria:

In the month of October, 2014, we collected 58 samples from our distribution system for coliform analysis. Of these samples, 1.5% were positive for coliform bacteria.
(Note: An alternative might be: "During 2014, we collected between 55 and 60 samples each month for coliform analysis. Occasionally, a sample was found to be positive for coliform bacteria but check samples were negative and follow up actions were taken. A maximum of 2.4% of these samples were positive in any month.")

The MCL for coliform is 5% positive samples of all samples per month and the MCLG is zero. The reason for the coliform drinking water standard is to minimize the possibility of the water containing pathogens which are organisms that cause waterborne disease. Because coliform is only a surrogate indicator of the potential presence of pathogens, it is not possible to state a specific numerical health risk. While USEPA normally sets MCLGs "at a level where no known or anticipated adverse effects on persons would occur", they indicate that they cannot do so with coliforms.

REFERENCE 4

Table of PHG Exceedance for 2013 to 2015

REFERENCE 4

TRIENNIAL PUBLIC HEALTH GOAL (PHG) EXCEEDENCES : 2013-2015

MPN/100 mL = Most Probable Number per 100 mL sample; ppb = parts per billion; pCi/L = pico curies per liter

DATE	SUBSTANCE	UNITS	MCL	PHG (MCLG)	RANGE of DETECTION	WATER SOURCE	SOURCES OF CONTAMINANT IN DRINKING WATER	HEALTH EFFECTS
2011*	**Gross Beta Activity**	**pCi/L**	**50**	**(0)**	**nd - 5.0**	Ground Water Wells 3, 8, 9 & 14	Decay of natural and man-made deposits	Certain minerals are radioactive and may emit forms of radiation known as photons and beta radiation. Some people who drink water containing beta and photon emitters in excess of the MCL over many years may have an increased risk of getting cancer.
2011*	**Uranium (pCi/L)**	**pCi/L**	**20**	**0.4**	**1.1 - 3.2**	Ground Water Wells 2, 3, 6, 7, 8, 9, 13,14,15, & 16	Erosion of natural deposits	Some people who drink water containing uranium in excess of the MCL over many years may have kidney problems or an increased risk of getting cancer.
2013	**Coliform Bacteria (Total)**	**MPN/ 100 mL**	**5%**	**(0)**	Distribution system-wide highest monthly value = **0.9% (February 2013)**	Distribution System	Naturally present in the environment.	Indicator of possible presence of potentially-harmful bacteria.
2013	**Arsenic**	**ppb**	**10**	**0.004**	**5.5 - 7.0**	Ground Water Well 16	Naturally occurring in environment.	Some people who drink water containing arsenic in excess of the MCL over many years may experience skin damage or circulatory problems and may have an increased risk of cancer.
2014	**Arsenic**	**ppb**	**10**	**0.004**	**nd - 6.3**	Ground Water Wells 14, 15, 16	Naturally occurring in environment.	Some people who drink water containing arsenic in excess of the MCL over many years may experience skin damage or circulatory problems and may have an increased risk of cancer.
2015	**Hexavalent Chromium**	**ppb**	**10**	**0.02**	**nd - 24**	Ground Water Wells 1, 2, 3, 5, 8, 9, 13,14,15, & 16	Erosion of natural deposits	Some people who drink water containing hexavalent chromium in excess of the MCL over many years may experience an increased risk of gastrointestinal cancer.
2015	**Arsenic**	**ppb**	**10**	**0.004**	**5.2 - 7.6**	Ground Water Well 16	Naturally occurring in the environment.	Some people who drink water containing arsenic in excess of the MCL over many years may experience skin damage or circulatory problems and may have an increased risk of cancer.

* Groundwater monitoring required every 9 years; Next sampling scheduled for year 2020.

REFERENCE 5

Glossary of terms and abbreviations used in report

REFERENCE 5

GLOSSARY OF WATER QUALITY TERMS

Best Available Technology (BAT)	The best available treatment techniques or other means available for achieving compliance with MCL.
Health Risks	Health risks with respect to Public Health Goals are based on long-term exposures to low levels of contaminants as would occur with drinking water, rather than high doses from a single or short-term exposure. The health risk category describes the type of health risk. Types of health risks include chronic toxicity (shortened life span, thyroid effects, liver effects, or kidney effects), acute toxicity (gastrointestinal effects), carcinogenicity (cancer), and reproductive toxicity.
Maximum Contaminant Level (MCL)	The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to PHGs as is economically and technologically feasible. Unless stated otherwise, the term MCL in this report refers to primary MCL.
Maximum Contaminant Level Goal (MCLG)	The level of a contaminant in drinking water below which there is no observable adverse effect to human health. MCLGs are similar to California PHGs, but not equivalent. MCLGs are non-enforceable goals established by the U.S. EPA based solely on health considerations for non-carcinogenic constituents. For all carcinogenic constituents (i.e. those chemicals known or suspected of causing cancer), U.S. EPA's policy is to set the MCLG at zero.
Numeric Health Risk	Describes the cancer risk. At the California MCL no cancer risk is calculated from chemicals considered "noncarcinogens." For carcinogens, PHGs are set at a concentration that does not pose any significant risk of cancer; this is usually a one-in-one-million excess cancer risk ($1x10^{-6}$).
One-in-one-million Risk Level	At the "one-in-one-million" risk level, not more than one person in a population of one million people drinking the water daily for 70 years would be expected to develop cancer as a result of exposure to that chemical in the water.
Parts per billion (ppb)	The weight of a chemical dissolved in a volume of water. Equivalent to micrograms per liter (ug/L).
Parts per million (ppm)	The weight of a chemical dissolved in a volume of water. Equivalent to milligrams per liter (mg/L).
Picocuries per liter (pCi/L)	A measure of radiation in a liter of water.
Public Health Goal (PHG)	The concentration of a contaminant in drinking water below which no known or anticipated adverse health effects will occur with an adequate margin of safety. This level is based on estimates that would pose a significant risk to individuals, including the most sensitive subpopulations, consuming water every day over an entire lifetime. PHGs are unique to California and are established by the Office of Environmental Health Hazard Assessment (OEHHA), a subdivision of the California Environmental Protection Agency.

List of Abbreviations and Acronyms

AL	Action Level
BAT	Best Available Treatment
CDHS	California Department of Health Services
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
OEHHA	Office of Environmental Health Hazard Assessment
PHG	Public Health Goal
SWP	State Water Project
TDS	Total Dissolved Solids
THM	Trihalomethanes
USEPA	United States Environmental Protection Agency