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

2022 TRIENNIAL REPORT ON WATER QUALITY RELATIVE TO PUBLIC HEALTH GOALS

BACKGROUND

The California Health and Safety Code (HSC §116470(b)) specifies water utilities with greater than 10,000 service connections prepare a special Public Health Goal Report (Report) every three years if water quality measurements have exceeded any Public Health Goal (PHG). Attachment 1 includes Section 116470 (b). The report must be completed by July 1 of the year in which it is due and new reports are required every three years. Past reports were prepared by City of Vacaville in 2010, 2013, 2016, 2019.

PHG reports must present information on (1) contaminants that have been detected above a PHG, (2) health risk information for the detected contaminants, (3) an estimate of the cost to install Best Available Technology (BAT) to reduce the level of a given contaminant, and (4) what action, if any, the local water purveyor intends to take to reduce the concentration of the contaminants(s) and the basis for that decision.

PHGs are non-enforcement goals established by the California Environmental Protection Agency's (Cal- EPA) Office of Environmental Health Hazard Assessment (OEHAA). The regulation also requires that where OEHHA has not adopted a PHG for a constituent, the water suppliers are to use the Maximum Contaminant Level Goal (MCLG) adopted by the United States Environmental Protection Agency (USEPA). The State Water Resources Control Board Division of Drinking Water (DDW) sets Maximum Contaminant Levels (MCLs) as close as feasible to the PHG taking treatment cost and available analytical and treatment technology into consideration. MCLs are enforceable limits that water purveyors must meet to protect public health. Only constituents having a MCL and either a PHG or MCLG are required to be addressed in the Report. Attachments 2 and 3 provides a complete list of all regulated constituents with the MCLs and PHGs or MCLGs.

The Report addresses any constituent detected in the City's water supply between 2019 and 2021 at a level exceeding any applicable PHG or MCLG, as required by the regulation. The Report includes 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. This report uses the most recent health risk information published by OEHHA.

WHAT ARE PUBLIC HEALTH GOALS?

PHGs are set by OEHHA and are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the USEPA or State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) in setting MCL drinking water standards 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 and likewise are non-enforceable.

WHAT WATER QUALITY DATA WAS REVIEWED TO PREPARE THIS REPORT?

All of the water quality data collected in the City of Vacaville Public Water System between 2019 and 2021 was considered for purposes of determining compliance with drinking water standards. This data was previously summarized in our 2019, 2020, and 2021 Annual Water Quality (AWQ) Reports, which are available on the City's website and included in Attachment 4 of this report.

WHAT GUIDELINES WERE FOLLOWED IN PREPARING THIS REPORT?

A workgroup formed by Association of California Water Agencies (ACWA) prepared guidelines for water utilities, which were used in the preparation of this PHG Report. The most recent guidelines (ACWA "2022 PHG Guidance") were used to prepare this report. No guidance was available from state regulatory agencies. OEHHA publishes a document with health risk information for regulated constituents. The OEHHA publication (OEHHA, "Health Risk Information for PHG Exceedance Report", February 2022) was used to prepare this report (See Attachment 3).

WHAT IS BEST AVAILABLE TECHNOLOGY AND THE ASSOCIATED ESTIMATED COST?

Both the USEPA and DDW adopt what are known as Best Available Technologies (BATs), 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 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.

WHAT ARE DETECTION LIMITS FOR PURPOSE OF REPORTING (DLRs)?

When DDW establishes a drinking water regulation, the agency evaluates available analytical methods and sets a DLR for the constituent. DLRs are the lowest concentration of the constituent that laboratories report for determining compliance. A constituent is considered by DDW to be "detected" when measured concentrations are above the DLR.

WHAT CONSTITUENTS WERE DETECTED ABOVE A PHG (OR MCLG)?

Two constituents were detected at levels above the MCLG in the distribution system. There is no PHG for total coliform; the MCL was not exceeded.

ARSENIC

Arsenic has been detected at levels up to 8.4 micrograms per liter (ug/L) in the water supplied to the City of Vacaville Public Water System. The MCL is 10 ug/L and the PHG is 4 nanograms per liter (ng/L). Our water system is in full compliance with the drinking water standard for arsenic, but the arsenic level in the system at times exceeds the PHG.

The DDW and USEPA have determined that arsenic is a health concern at certain levels of exposure. The category of health risk associated with arsenic, and the reason that a drinking water standard was adopted for it, is that some people who drink water containing arsenic above the MCL over many years may experience skin damage and circulatory system problems and are at a higher risk of getting cancer. The numerical health risk for the PHG of 4 ng/L is one excess cancer case per million people. The numerical health risk for the MCL of 10 ug/L is 2.5 excess cancer cases per thousand people.

The DDW lists the Best Available Technologies (BATs) for removing arsenic to below the MCL as activated alumina, ion exchange, lime softening, coagulation/filtration and reverse osmosis (RO). For the purpose of cost estimation, RO was selected as the treatment method to consistently remove arsenic below the PHG in the City's system.

GROSS ALPHA PARTICLE ACTIVITY

Certain minerals are radioactive and may emit a form of radiation known as alpha radiation, or gross alpha particle activity. Gross alpha particle activity has been detected at levels up to 3.88 pico-Curies per liter (pCi/L) in the water supplied to the City System. There is no PHG for gross alpha particle activity. However, the USEPA has established a MCLG level at 0 pCi/L. The MCL for gross alpha particle activity is 15 pCi/L based on an annual average of four quarterly samples. Our water system is in full compliance with the drinking water standard for gross alpha particle activity, but the level in the system at times exceeds the MCLG.

The DDW and USEPA have determined that gross alpha particle activity is a health concern at certain levels of exposure. This radiological constituent is a naturally occurring contaminant in some groundwater and surface water supplies. The category of health risk associated with gross alpha particle activity, and the reason that a drinking water standard was adopted for it, is that some people who drink water containing alpha emitters in excess of the MCL over many years may have an increased risk of getting cancer. The numerical health risk for the MCLG of 0 pCi/L is zero excess cancer cases. The numerical health risk for the MCL of 15 pCi/L is one excess cancer case per thousand people.

The DDW lists the BAT for removing gross alpha particle activity as reverse osmosis (RO). For the purpose of cost estimation, RO was selected as the treatment method to consistently remove gross alpha particle activity below the MCLG in the City system.

WHAT IS THE COST OF TREATMENT?

The cost of treatment can depend upon a number of factors. They include the type of treatment, the number of separate treatment facilities required, and if there are multiple contaminants, whether they can all be removed with one treatment technology or require multiple technologies. Both contaminants detected in the City system can be removed with RO technology, however, all water entering our system would need to be treated due to the low level of the MCLG set for Gross Alpha Particles.

Between 2019-2021, the City produced an average of 5.7 billion gallons of water. Treatment cost estimates, to install and operate arsenic and gross alpha particle removal systems for six ground water wells and the water treatment plant, would range from approximately $11,514,000 - $45,828,000 per year, which includes the annualized cost of construction plus annual operation and maintenance costs for reverse osmosis ($2.02 - $8.04 per 1,000 gallons). 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. With 29,170 service connections in 2021, this translates into an estimated additional annual cost of $395 to $1,571 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 FURTHER ACTION

The drinking water quality of the City's Public Water System meets all DDW, and USEPA drinking water standards set to protect public health. Any additional effort by the City to further reduce the levels of arsenic or gross alpha particles that are already below the health-based MCLs established to provide "safe drinking water" would require additional costly treatment processes. The effectiveness of any new treatment process(es) to provide significant reductions in arsenic or gross alpha particle levels at these already low values is uncertain. In addition, the health protection benefits of these further hypothetical reductions are not at all clear and may not be quantifiable. Therefore, no action is proposed.

REFERENCES:
1 - Excerpt from California Health & Safety Code: Section 116470 (b)
2 - City of Vacaville 2019, 2020 and 2021 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 - dated April 2022

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.

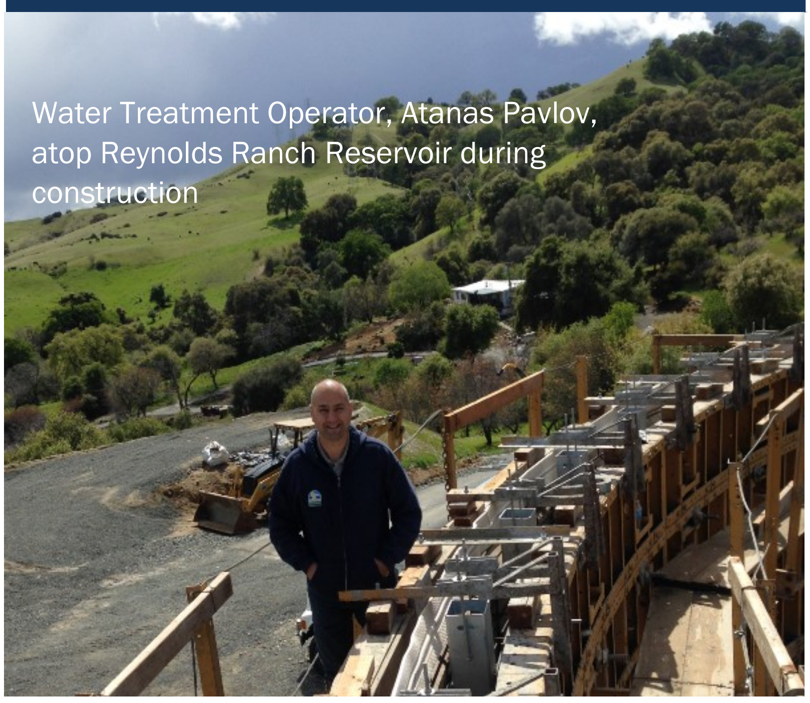
(f) Pending adoption of a public health goal by the Office of Environmental Health Hazard Assessment pursuant to subdivision (c) of Section 116365, and in lieu thereof, public water systems shall use the national maximum contaminant level goal adopted by the United States Environmental Protection Agency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

2019

CITY OF VACAVILLE

WATER QUALITY REPORT TO CONSUMERS



Water Treatment Operator, Atanas Pavlov, atop Reynolds Ranch Reservoir during construction

Este informe contiene información muy importante sobre su agua para beber. Favor de comunicarse City of Vacaville Water Quality Laboratory at (707) 469-6400 para asistirlo en español.

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 2019 the City distributed over 5.3 billion gallons of high quality 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 8,000 analyses were performed on drinking water samples in 2019.

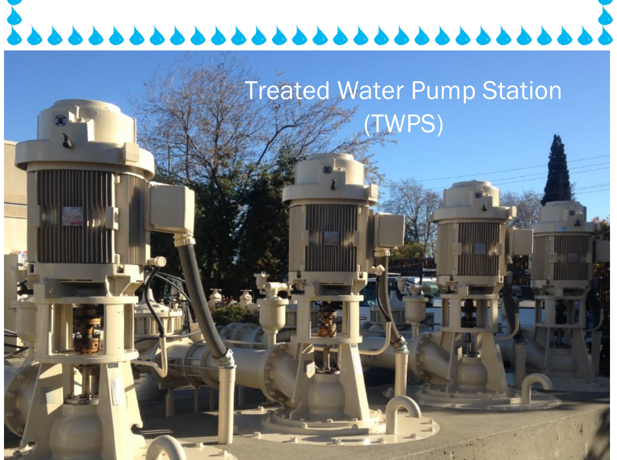
Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants doesn't necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline at (800) 426-4791. If you have further questions, please contact the Water Quality Laboratory Supervisor, Michael Torres, by phone at (707) 469-6439 or by email at Michael.Torres@cityofvacaville.com. You may also attend City Council Meetings to voice your opinions—please check the City website for meeting notices to see if any water related topics are on the agenda.

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 for infections. These people should seek advice about drinking water from their health care providers. USEPA and Centers for Disease Control and Prevention (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 at (800) 426-4791.

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 U.S. Environmental Protection Agency 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.



Treated Water Pump Station (TWPS)

SOURCES OF WATER AND CONTAMINANTS:

The sources of drinking water (both tap and bottled) includes 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 42% of the City's total consumption of water in 2019, and Sacramento Delta surface water, from the North Bay Aqueduct (NBA), provided an additional 27%. Groundwater from the 11 deep wells made up the balance (31%) 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 stormwater 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 stormwater 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 stormwater 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 SWRCB prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. SWRCB regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

The following tables list all of the drinking water contaminants that were detected during the most recent sampling for 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	0.9%	0	5% (1381 samples collected in 2019)	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 IN DISTRIBUTION SYSTEM

Constituent (reporting units)	No of samples (collected in 2017)	90th Percentile Detected	No. Sites exceeding AL	AL	PHG	Contaminant Sources
Lead (ppb) [(a)]	36	0	0	15	0.2	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm)[(a)]	36	0.17	0	1.3	0.3	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives

In 2018 The City of Vacaville had 18 school samplings for the Lead in Schools Program. Sample locations within those schools did not exceed action levels or require additional action by the school.

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

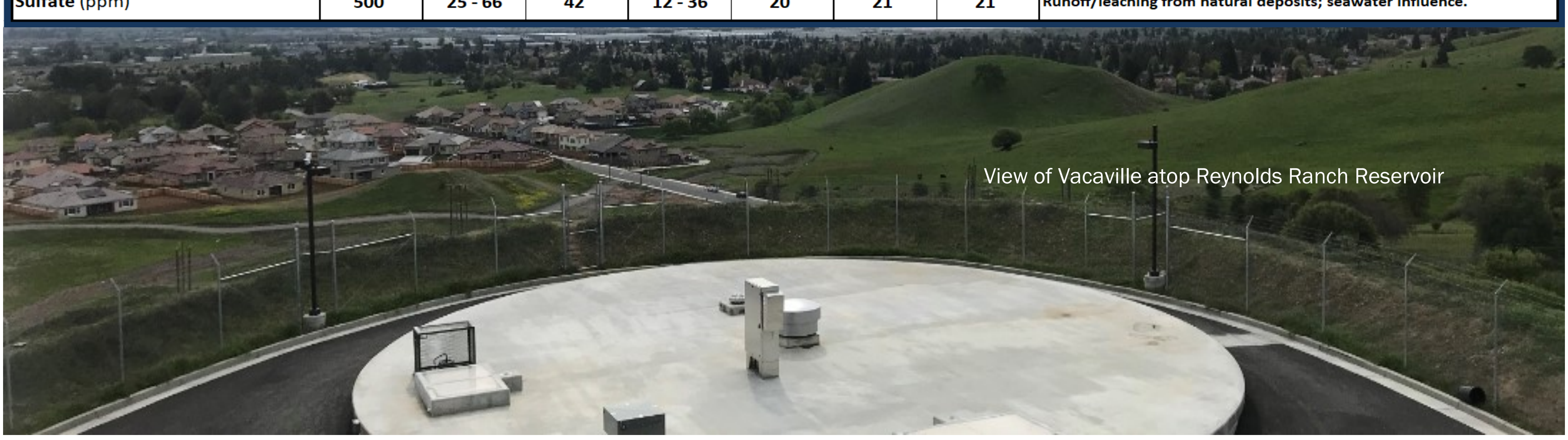
Constituent (reporting units)	2017 GROUNDWATER		2019 TREATED SURFACE WATER from NBR		2019 TREATED SURFACE WATER from VWTP		
	Range	Average	Range	Average	Range	Average	
Hardness (ppm)	81-320	183	85-160	137	150	150	Sum of polyvalent cations present in the water, generally magnesium and calcium, and are usually naturally occurring.
Sodium (ppm)	42-84	58	8.9-31	17	17	17	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)	Jan-Aug 2017 GROUNDWATER		Jan-Oct 2019 TREATED SURFACE WATER from NBR		Jan-Oct 2019 TREATED SURFACE WATER from VWTP		Contaminant Sources
			Range	Average	Range	Average	Range	Average	
Aluminum (ppm)	1	0.6	nd	nd	nd - 0.09	0.06	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Arsenic (ppb)	10	0.004	nd - 8.1	1.9	nd	nd	nd	nd	Erosion of natural deposits; runoff from orchards; glass and electronics production wastes.
Barium (ppm)	1	2	nd - 0.14	0.06	nd	nd	nd	nd	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits.
Chromium (ppb)	50	10	nd - 25	9.6	nd	nd	nd	nd	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits.
Fluoride (ppm)[(d)]	2.0	1	System-wide annual average = 0.74, minimum = 0.41, maximum = 0.92						Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories.
Nitrate as N (ppm)	10	10	0.31 - 3.2	1.5	nd	nd	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[(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	Jan-Aug 2017 GROUNDWATER		Jan-Oct 2019 TREATED SURFACE WATER from NBR		Jan-Oct 2019 TREATED SURFACE WATER from VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Aluminum (ppb)	200	nd	nd	nd - 91	59	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes.
Odor- Threshold (units)	3	nd - 1	nd	1.4	1.4	2.5	2.5	Naturally-occurring organic materials.
Turbidity (units)[(f)]	5	nd - 0.21	0.05	0.03 - 0.06	0.05	0.17	0.17	Soil runoff.
Total Dissolved Solids (ppm)	1000	280 - 530	372	174 - 206	187	210	210	Runoff/leaching from natural deposits.
Specific Conductance (µS/cm)	1600	440 - 790	572	304 - 346	324	360	360	Substances that form ions when in water; seawater influence.
Chloride (ppm)	500	8.2 - 34	17	11 - 15	12	15	15	Runoff/leaching from natural deposits; seawater influence.
Sulfate (ppm)	500	25 - 66	42	12 - 36	20	21	21	Runoff/leaching from natural deposits; seawater influence.



View of Vacaville atop Reynolds Ranch Reservoir

Table 6 - DETECTION OF UNREGULATED CONTAMINANTS (Hexavalent Chromium and UCMR4)

Constituent (reporting units)	Sampling Date	Source Water Range	Source Water Average	Distribution System Range	Distribution System Average	PHG (MCLG)	
Hexavalent Chromium (ppb)	Jan - Aug 2017	nd - 25	4.3	na	na	0.02 [h]	Some People who drink water containing hexavalent Chromium in excess of the MCL over many years may have an increased risk of getting cancer. [h]
Bromide (ppb)	Feb-Oct 2019	nd - 55.0	16.7	na	na	na	Unregulated contaminant monitoring helps the USEPA and the Cal EPA determine where certain contaminants occur and whether the contaminants need to be regulated. The City of Vacaville will began the UCMR4 program data collection in February 2019.
Total Organic Carbon (ppm)		2.6 - 8.9	3.7	na	na	na	
Manganese (ppb)		nd - 5.0	0.6	na	na	na	**Haloacetic acids (HAAs) are a type of chlorination disinfection by-product (CDBP) that are formed when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter in water.
HAA5 (ppb) **		na	na	0.4 - 35	8.8	60	HAAs are a collection of several different compounds. The sum of Bromodichloroacetic Acid (BrCl2AA), Dibromochloroacetic Acid (Br2ClAA), and Tribromoacetic Acid (Br3AA) concentrations is known as HAA3. The sum of Monochloroacetic Acid (ClAA),
HAA6 Br (ppb) **		na	na	nd - 10.5	5.1	na	Monobromoacetic Acid (BrAA), Dichloroacetic Acid (Cl2AA), Trichloroacetic Acid (Cl3AA), and Dibromoacetic Acid (Br2AA) concentrations are known as HAA5. HAA6 refers to the
HAA9 (ppb) **		na	na	0.4 - 40	13	na	sum of HAA5 and Bromochloroacetic Acid (BrClAA) concentrations. HAA6 and HAA3 together make up HAA9

Table 7 - DETECTION OF DISINFECTION BYPRODUCTS

Constituent (reporting units)	MCL	PHG (MCLG)	Range	Average	Violations	Contaminant Sources
Total Trihalomethanes (ppb)	80	na	3.0 - 62	30	0	By-product of drinking water disinfection.
Halo-Acetic Acids (ppb)	60	na	nd - 35	8.3	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	-	2.4	1.8	2.7	Various natural and man-made sources.
Chlorine (ppm)	4	4	0.79	nd	1.54	Drinking water disinfectant added for treatment

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 MCL 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 U.S. Environmental Protection Agency.

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 California Environmental Protection Agency.

PDWS (Primary Drinking Water Standard): MCLs, MRDLs and treatment techniques (TTs) for contaminants that affect health, along with their monitoring and reporting requirements.

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): Standard unit for turbidity.

pCi/L Picocuries per Liter.

µS/cm Microsiemens Per Centimeter. Unit of measure for conductance.

ppm Parts Per Million or Milligrams Per Liter (mg/L). Equivalent to 1 second in 11.5 days.

ppb Parts Per Billion or Micrograms Per Liter (µg/L). Equivalent to 1 second in 32 years.

FOOTNOTES

(a) This is the state action level for samples collected inside schools and 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 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) Not possible to differentiate water source in distribution system. Reported minimum and maximum numbers are individual source samples analyzed and Annual Average is based on a weighted average of sources used.

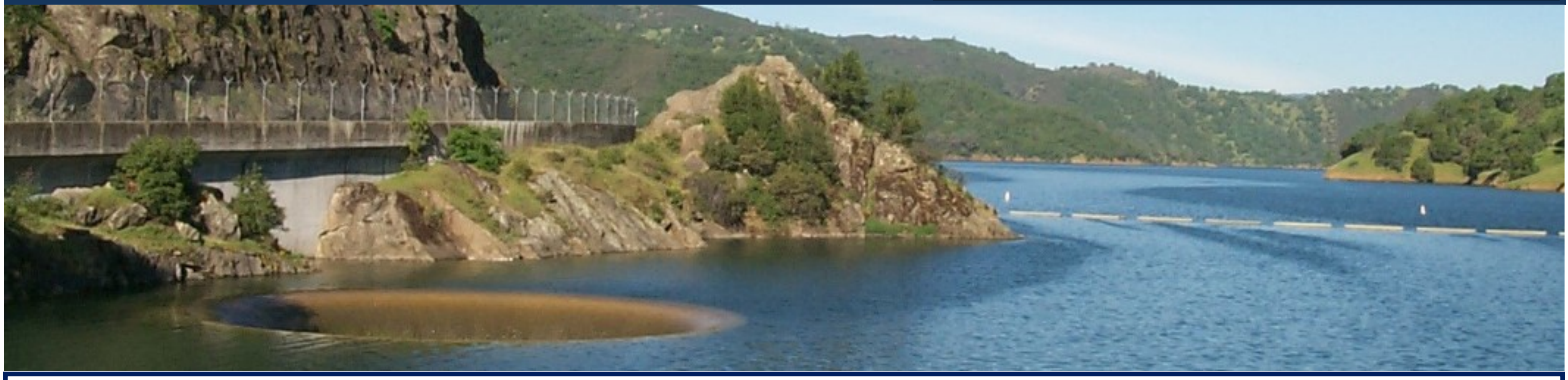
(d) Not possible to differentiate water source. The City of Vacaville treats the water by adding fluoride to the naturally occurring level to help prevent dental caries in consumers. The fluoride levels in the treated water are maintained within the range of 0.7 - 1.3 ppm, as required by the California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

(g) The State allows us to monitor for some contaminants less than once per year because the concentrations of these contaminants do not change frequently. Some of our data, though representative, are more than one year old. Results from last samples collected in 2011. Will be analyzed again in 2020.

(h) There is currently no MCL for hexavalent chromium. The previous MCL of 0.010 mg/L was withdrawn on September 11, 2017.



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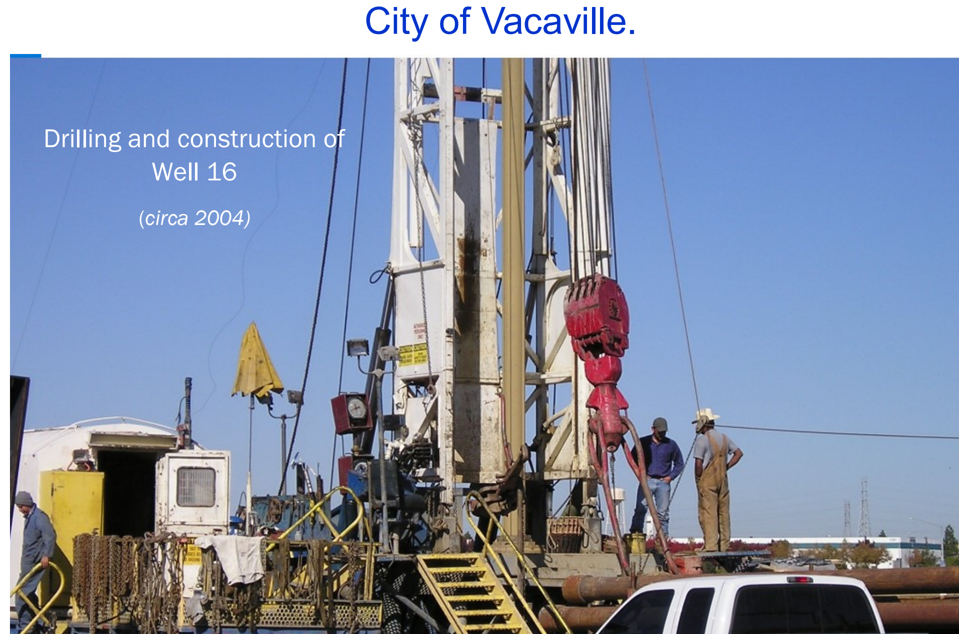
HEXAVALENT CHROMIUM IN VACAVILLE'S DRINKING WATER

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 (Cr6+). Chromium+3 is found naturally in foods at low levels and is an essential human dietary nutrient that is often medically prescribed to maintain healthy insulin metabolism. Chromium+6 is the toxic form of chromium that has been found to cause cancer in humans when inhaled and is suspected to cause cancer when ingested. Conservatively, the California State Water Board lowered the acceptable level of Cr+6 in drinking water from 50 ppb to 10 ppb in July 2014, whereas the USEPA limit continued to be 100 ppb.

Five of the City's eleven source water wells have Cr+6 above the new MCL of 10 ppb. The City began working with the State Division of Drinking Water (DDW) in 2014 to implement the City's approved Cr+6 Compliance Plan 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. The State of California withdrew the 10 ppb MCL in September 2017, so all of Vacaville's wells are within compliance levels at this time. The City will continue to monitor regulations and treatment options so we will be ready to meet new regulations should they be implemented at a later date.

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



Drilling and construction of Well 16

(circa 2004)

2020

CITY OF VACAVILLE

WATER QUALITY REPORT TO CONSUMERS

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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 2020, the City distributed over 5.96 billion gallons of high quality 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 8,000 analyses were performed on drinking water samples in 2020.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not 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, Michael Torres, by phone at (707) 469-6439 or by email at Michael.Torres@cityofvacaville.com. You may also attend City Council Meetings to voice your opinions. Please check the City website for meeting notices to see if any water related topics are on the agenda.

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ARSENIC IN DRINKING WATER
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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 U.S. Environmental Protection Agency 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:

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 50% of the City's total consumption of water in 2020, and Sacramento Delta surface water, from the North Bay Aqueduct (NBA), provided an additional 23%. Groundwater from the 8 deep wells currently in operation made up the balance (27%) 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.

The sources of drinking water (both tap and bottled water) includes 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.

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 stormwater 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 stormwater 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 stormwater 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 SWRCB prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. SWRCB regulations also establish limits for contaminants in bottled water that provide the same protection for public health.

The following tables list all of the drinking water contaminants that were detected during the most recent sampling for constituents. To read the tables, start with the far left column titled *Constituent* or *Contaminant* 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	0.9%	0	5% (1351 samples collected in 2020)	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 IN DISTRIBUTION SYSTEM

Constituent (reporting units)	No of samples (collected in 2020)	90th Percentile Detected	No. Sites exceeding AL	AL	PHG	Contaminant Sources
Lead (ppb) [(a)]	33	<0.005	0	15	0.2	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm)[(a)]	33	0.16	0	1.3	0.3	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives

In 2018 The City of Vacaville had 18 school samplings for the Lead in Schools Program. Sample locations within those schools did not exceed action levels or require additional action by the school.

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

Constituent (reporting units)	2020 GROUNDWATER		2020 TREATED SURFACE WATER from NBR		2020 TREATED SURFACE WATER from VWTP		
	Range	Average	Range	Average	Range	Average	
Hardness (ppm)	81-310	183	85-160	124	na	150	Sum of polyvalent cations present in the water, generally magnesium and calcium, and are usually naturally occurring.
Sodium (ppm)	40-77	55	25.0-31.5	28.4	na	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)	Jan-Oct 2020 GROUNDWATER		Jan-Oct 2020 TREATED SURFACE WATER from NBR		Jan-Oct 2020 TREATED SURFACE WATER from VWTP		Contaminant Sources
			Range	Average	Range	Average	Range	Average	
Arsenic (ppb)	10	0.004	nd - 7.25	2.38	na	nd	na	nd	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
Barium (ppm)	1	2	nd - 0.14	0.08	na	nd	na	nd	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits
Chromium, total (ppb)	50	(100)	nd - 22	7.4	na	nd	na	nd	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits.
Fluoride (ppm)[(c)]	2.0	1	System-wide annual average = 0.72, minimum = 0.61, maximum = 0.86						Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories.
Nitrate as N (ppm)	10	10	nd - 3.3	1.6	na	nd	na	nd	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
Gross Alpha Activity (pCi/L)	15	0	1.9 - 4.1	3.0	na	nd	na	2.8	Erosion of natural deposits

Table 5 - DETECTION OF CONTAMINANTS WITH A SECONDARY DRINKING WATER STANDARD [(d)]

Constituent (reporting units)	MCL	Jan-Oct 2020 GROUNDWATER		Jan-Oct 2020 TREATED SURFACE WATER from NBR		Jan-Oct 2020 TREATED SURFACE WATER from VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Turbidity (units)[(e)]	TT=5.0 NTU TT=95% of samples ≤0.5 NTU	nd - 0.14	0.08	0.04 - 0.07	0.05	na	0.32	Soil runoff.
Odor- Threshold (units)	3	nd - 5.3	1.1	na	1.4	na	2.5	Naturally-occurring organic materials.
Chloride (ppm)	500	7.8 - 35	17	12 - 26	19	na	15	Runoff/leaching from natural deposits; seawater influence.
Sulfate (ppm)	500	20 - 69	42	24 - 42	32	na	20	Runoff/leaching from natural deposits; seawater influence.
Total Dissolved Solids (ppm)	1000	290 - 530	383	193 - 241	217	na	210	Runoff/leaching from natural deposits.
Specific Conductance (µS/cm)	1600	440 - 790	570	325 - 417	371	na	350	Substances that form ions when in water; seawater influence.

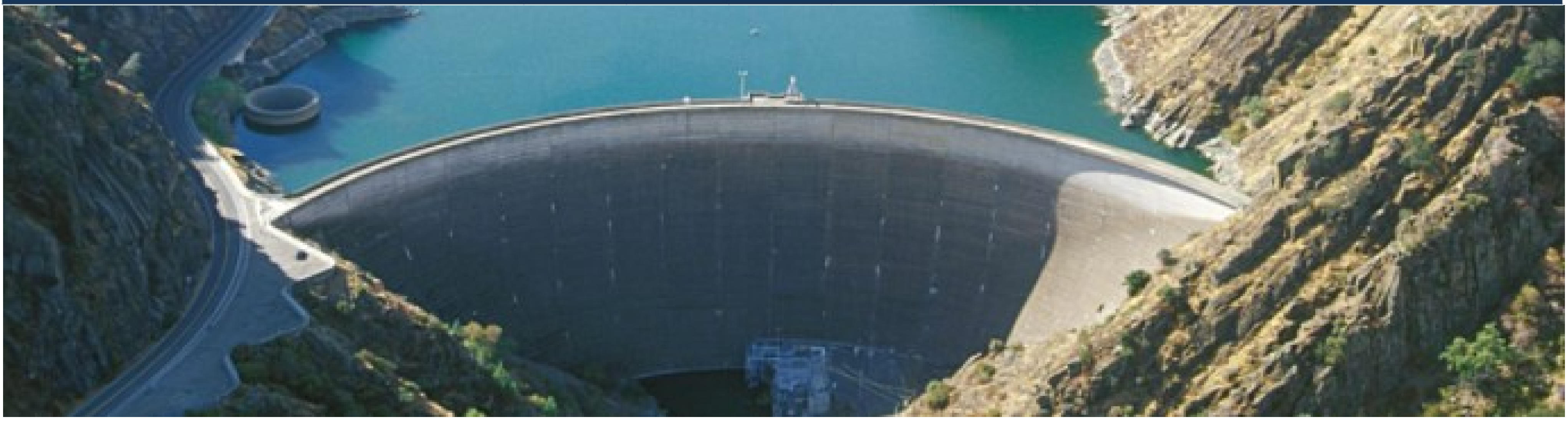

Table 6 - DETECTION OF UNREGULATED CONTAMINANTS (Hexavalent Chromium and UCMR4)

Constituent (reporting units)	Sampling Date	Source Water Range	Source Water Average	Distribution System Range	Distribution System Average	PHG (MCLG)	
Hexavalent Chromium (ppb)	Jan - Oct 2020	1.6 - 22	10.8	nd - 2.0	1.4	0.020	Some people who use water containing chromium in excess of the MCL over many years may experience allergic dermatitis. [f]
Bromide (ppb)	Feb-Oct 2019	nd - 55.0	16.7	na	na	na	Unregulated contaminant monitoring helps the USEPA and the Cal EPA determine where certain contaminants occur and whether the contaminants need to be regulated. The City of Vacaville completed the UCMR4 program data collection in 2019. **Haloacetic acids (HAAs) are a type of chlorination disinfection by-product (CDBP) that are formed when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter in water. HAAs are a collection of several different compounds. The sum of Bromodichloroacetic Acid (BrCl2AA), Dibromochloroacetic Acid (Br2ClAA), and Tribromoacetic Acid (Br3AA) concentrations is known as HAA3. The sum of Monochloroacetic Acid (ClAA), Monobromoacetic Acid (BrAA), Dichloroacetic Acid (Cl2AA), Trichloroacetic Acid (Cl3AA), and Dibromoacetic Acid (Br2AA) concentrations are known as HAA5. HAA6 refers to the sum of HAA5 and Bromochloroacetic Acid (BrClAA) concentrations. HAA6 and HAA3 together make up HAA9
Total Organic Carbon (ppm)		2.6 - 8.9	3.7	na	na	na	
Manganese (ppb)		nd - 5.0	0.6	na	na	na	
HAA5 (ppb) **		na	na	0.4 - 35	8.8	60	
HAA6 Br (ppb) **		na	na	nd - 10.5	5.1	na	
HAA9 (ppb) **		na	na	0.4 - 40	13	na	

Table 7 - DETECTION OF DISINFECTION BYPRODUCTS

Constituent (reporting units)	MCL	PHG (MCLG)	Range	Average	Violations	Contaminant Sources
Total Trihalomethanes (ppb)	80	na	4.2 - 65	37	0	By-product of drinking water disinfection.
Halo-Acetic Acids (ppb)	60	na	nd - 28	13	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	-	2.1	1.4	2.6	Various natural and man-made sources.
Chlorine (ppm)	4	4	0.78	nd	1.46	Drinking water disinfectant added for treatment

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 MCL: 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 U.S. Environmental Protection Agency.
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 California Environmental Protection Agency.
PDWS (Primary Drinking Water Standard): MCLs, MRDLs and treatment techniques (TTs) for contaminants that affect health, along with their monitoring and reporting requirements.
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): Standard unit for turbidity.
pCi/L: Picocuries per Liter.
µS/cm: Microsiemens Per Centimeter. Unit of measure for conductance.
ppm: Parts Per Million or Milligrams Per Liter (mg/L). Equivalent to 1 second in 11.5 days.

FOOTNOTES

(a) This is the state action level for samples collected inside schools and 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-September 2020.

(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 17.1.

(c) Not possible to differentiate water source. The City of Vacaville treats the water by adding fluoride to the naturally occurring 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.

(d) Secondary MCLs do not have PHGs or MCLGs because secondary MCLs are set to protect the aesthetics (odor, tastes, and appearance) of drinking water, and PHGs and MCLGs are based on health concerns.

(e) Turbidity is a measure of the cloudiness of the water and is a good indicator of water quality. High turbidity can hinder the effectiveness of disinfectants.

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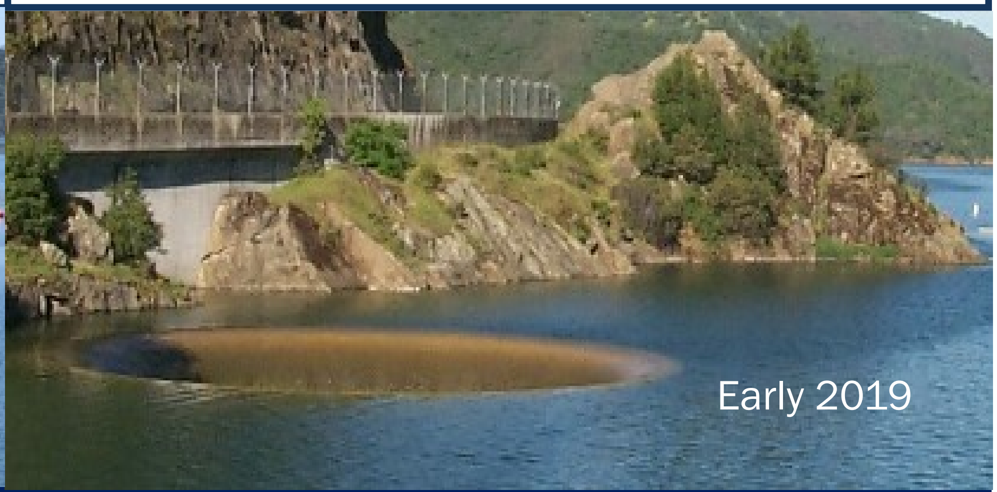

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In 2014 the Maximum Contaminant Level (MCL) set by the California State Water Resources Control Board (SWRCB) for Total Chromium (combined Cr+3 & Cr+6) was 50 ppb, and an MCL specifically for Cr+6 was set at 10 ppb. In September 2017, State of California withdrew the Cr+6 10 ppb MCL and returned solely to the current Total Chromium MCL of 50 ppb whereas the USEPA limit continued to be 100 ppb. However, in 2020, the SWRCB set forth to conduct an economic feasibility analysis in consideration of a Cr+6 MCL. SWRCB's goal is to set the level as low as technologically and economically feasible with the emphasis placed primarily on the protection of public health.

In 2020, the City of Vacaville's eleven wells were all in compliance within the 50 ppb limit. The City will continue to monitor regulations and treatment options so as to be ready to meet new regulations should they be implemented at a later date.

2021

CITY OF VACAVILLE

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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% (1345 samples collected in 2021)	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 IN DISTRIBUTION SYSTEM

Constituent (reporting units)	No of samples (collected in 2020)	90th Percentile Detected	No. Sites exceeding AL	AL	PHG	Contaminant Sources
Lead (ppb) [(a)]	33	<0.005	0	15	0.2	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits.
Copper (ppm)[(a)]	33	0.16	0	1.3	0.3	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives

In 2018 The City of Vacaville had 18 school samplings for the Lead in Schools Program. Sample locations within those schools did not exceed action levels or require additional action by the school.

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

Constituent (reporting units)	2020-2021 GROUNDWATER		2021 TREATED SURFACE WATER from NBR		from VWTP		
	Range	Average	Range	Average	Range	Average	
Hardness (ppm)	81-310	181	120-189	163	na	160	Sum of polyvalent cations present in the water, generally magnesium and calcium, and are usually naturally occurring.
Sodium (ppm)	40-77	54	13.0-26.0	18.5	na	15	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)	2020-2021 GROUNDWATER		2020-2021 TREATED SURFACE WATER from NBR		from VWTP		Contaminant Sources
			Range	Average	Range	Average	Range	Average	
Aluminum (ppm)	1	0.6	nd	nd	nd - 0.09	<0.05	nd	nd	Erosion of natural deposits; residue from some surface water treatment processes
Arsenic (ppb)	10	0.004	nd - 7.25	2.42	na	nd	na	nd	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
Barium (ppm)	1	2	nd - 0.14	0.08	na	nd	na	nd	Discharges of oil drilling wastes and from metal refineries; erosion of natural deposits
Chromium, total (ppb)	50	(100)	nd - 22	7.8	na	nd	na	nd	Discharge from steel and pulp mills and chrome plating; erosion of natural deposits.
Fluoride (ppm)[(c)]	2.0	1	System-wide annual average = 0.73, minimum = 0.60, maximum = 0.88						Erosion of natural deposits; water additive that promotes strong teeth; discharge from fertilizer and aluminum factories.
Nitrate as N (ppm)	10	10	nd - 3.3	1.5	na	nd	na	nd	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
Gross Alpha Activity (pCi/L)	15	0	1.9 - 4.1	3.1	na	nd	na	2.8	Erosion of natural deposits

Table 5 - DETECTION OF CONTAMINANTS WITH A SECONDARY DRINKING WATER STANDARD [(d)]

Constituent (reporting units)	MCL	2020-2021 GROUNDWATER		2020-2021 TREATED SURFACE WATER from NBR		from VWTP		Contaminant Sources
		Range	Average	Range	Average	Range	Average	
Turbidity (units)[(e)]	TT=5.0 NTU TT=95% of samples ≤0.5 NTU	nd - 0.14	0.08	0.04 - 0.07	0.06	na	0.29	Soil runoff.
Odor- Threshold (units)	3	nd - 5.3	1.2	na	1.4	na	1.5	Naturally-occurring organic materials.
Chloride (ppm)	500	7.8 - 35	17	10 - 15	12	na	14	Runoff/leaching from natural deposits; seawater influence.
Sulfate (ppm)	500	20 - 69	42	22 - 39	31	na	22	Runoff/leaching from natural deposits; seawater influence.
Total Dissolved Solids (ppm)	1000	290 - 530	377	162 - 262	204	na	210	Runoff/leaching from natural deposits.
Specific Conductance (µS/cm)	1600	440 - 790	567	328 - 385	366	na	390	Substances that form ions when in water; seawater influence.

Table 6 - DETECTION OF UNREGULATED CONTAMINANTS (Hexavalent Chromium and UCMR4)

Constituent (reporting units)	Sampling Date	Source Water Range	Source Water Average	Distribution System Range	Distribution System Average	PHG (MCLG)	
Hexavalent Chromium (ppb)	2020-2021	1.6 - 22	11	nd - 2.0	1.4	0.020	Some people who use water containing chromium in excess of the MCL over many years may experience allergic dermatitis. [f]
Bromide (ppb)	Feb-Oct 2019	nd - 55.0	16.7	na	na	na	Unregulated contaminant monitoring helps the USEPA and the Cal EPA determine where certain contaminants occur and whether the contaminants need to be regulated. The City of Vacaville completed the UCMR4 program data collection in 2019. **Haloacetic acids (HAAs) are a type of chlorination disinfection by-product (CDBP) that are formed when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter in water. HAAs are a collection of several different compounds. The sum of Bromodichloroacetic Acid (BrCl2AA), Dibromochloroacetic Acid (Br2ClAA), and Tribromoacetic Acid (Br3AA) concentrations is known as HAA3. The sum of Monochloroacetic Acid (ClAA), Monobromoacetic Acid (BrAA), Dichloroacetic Acid (Cl2AA), Trichloroacetic Acid (Cl3AA), and Dibromoacetic Acid (Br2AA) concentrations are known as HAA5. HAA6 refers to the sum of HAA5 and Bromochloroacetic Acid (BrClAA) concentrations. HAA6 and HAA3 together make up HAA9
Total Organic Carbon (ppm)		2.6 - 8.9	3.7	na	na	na	
Manganese (ppb)		nd - 5.0	0.6	na	na	na	
HAA5 (ppb) **		na	na	0.4 - 35	8.8	60	
HAA6 Br (ppb) **		na	na	nd - 10.5	5.1	na	
HAA9 (ppb) **		na	na	0.4 - 40	13	na	

Table 7 - DETECTION OF DISINFECTION BYPRODUCTS

Constituent (reporting units)	MCL	PHG (MCLG)	Range	Average	Violations	Contaminant Sources
Total Trihalomethanes (ppb)	80	na	6.1 - 70	47	0	By-product of drinking water disinfection.
Halo-Acetic Acids (ppb)	60	na	2.3 - 26	11	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	-	2.3	1.4	3.1	Various natural and man-made sources.
Chlorine (ppm)	4	4	0.78	nd	1.53	Drinking water disinfectant added for treatment

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 MCL: 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 U.S. Environmental Protection Agency.
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 California Environmental Protection Agency.
PDWS (Primary Drinking Water Standard): MCLs, MRDLs and treatment techniques (TTs) for contaminants that affect health, along with their monitoring and reporting requirements.
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): Standard unit for turbidity.
pCi/L: Picocuries per Liter.
µS/cm: Microsiemens Per Centimeter. Unit of measure for conductance.
ppm: Parts Per Million or Milligrams Per Liter (mg/L). Equivalent to 1 second in 11.5 days.

FOOTNOTES

(a) This is the state action level for samples collected inside schools and 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-September 2020.

(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 17.1.

(c) Not possible to differentiate water source. The City of Vacaville treats the water by adding fluoride to the naturally occurring 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.

(d) Secondary MCLs do not have PHGs or MCLGs because secondary MCLs are set to protect the aesthetics (odor, tastes, and appearance) of drinking water, and PHGs and MCLGs are based on health concerns.

(e) Turbidity is a measure of the cloudiness of the water and is a good indicator of water quality. High turbidity can hinder the effectiveness of disinfectants.

(f) There is currently no MCL for hexavalent chromium.

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/lead .

POLICY ON NONDISCRIMINATION ON THE BASIS OF DISABILITY

In accordance with the requirements of Title II of the Americans with Disabilities Act of 1990, the City of Vacaville (City) does not discriminate against qualified individuals with disabilities on the basis of disability in the City's services, programs, activities, or employment. Information, comments, requests for accommodations or barrier removal, and/or complaints concerning the accessibility of City programs, services or activities to persons with disabilities should be directed to the City's ADA Coordinator, 650 Merchant Street, (707) 449-5409 or (707) 449-5162 (TTY).

WATERSHED SANITARY SURVEYS AND VULNERABILITY SUMMARIES

A Watershed Sanitary Survey evaluates the quality of water that is used in a community drinking water supply in order to identify factors and constituents having the capacity to compromise drinking water quality. The *California State Water Project 2016 Watershed Sanitary Survey Update* (completed in June, 2017) is latest summary report for the Sacramento Delta which includes the North Bay Aqueduct (NBA). 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 Watershed Sanitary Survey (*Solano Project Below Monticello Dam 2017 Watershed Sanitary Survey*) for Putah South Canal (PSC) was completed in 2018. 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 potential contributing activities.

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 possible contaminating activities (PCAs) due to factors such as the aquifer, deep water table intakes, well construction features and physical barriers. Copies of the Watershed Sanitary Surveys 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 SWRCB, Division of Drinking Water, at (510) 620-3474.

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

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). The combination of both forms is referred to as Total Chromium. Chromium+3 is found naturally in foods at low levels and is an essential human dietary nutrient that is often medically prescribed to maintain healthy insulin metabolism. Chromium+6 is the toxic form of chromium that has been found to cause cancer in humans when inhaled and is suspected to cause cancer when ingested.

In 2014 the Maximum Contaminant Level (MCL) set by the California State Water Resources Control Board (SWRCB) for Total Chromium (combined Cr+3 & Cr+6) was 50 ppb, and an MCL specifically for Cr+6 was set at 10 ppb. In September 2017, State of California withdrew the Cr+6 10 ppb MCL and returned solely to the current Total Chromium MCL of 50 ppb whereas the USEPA limit continued to be 100 ppb. However, in 2020, the SWRCB set forth to conduct an economic feasibility analysis in consideration of a Cr+6 MCL. SWRCB's goal is to set the level as low as technologically and economically feasible with the emphasis placed primarily on the protection of public health.

Analyses in 2020 and 2021 indicate the City of Vacaville's eleven wells were all in compliance within the 50 ppb limit. The City will continue to monitor regulations and treatment options so as to be ready to meet new regulations should they be implemented at a later date.

April 2022

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, 2022 that gives information on the "detection" of any contaminants above the Public Health Goals (PHGs) published by the state's 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 (U.S. EPA) 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 U.S. EPA 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 U.S. EPA, 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 U.S. EPA'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.

The DDW is the primary enforcing agency of all provisions of the Health and Safety (H&S) Code relative to drinking water systems. It 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 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 PHG or MCLG. 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 PHGreport.

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, 2022. 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. 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.

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 forthe 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 (e.g., publication of legal notice in newspaper of general circulation.)

B. 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, 2021**, 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) orwhen it is not feasible or appropriate to set a numerical standard (e.g., the Lead & Copper Rule).

3. It does NOT include contaminants, such as radon, for which U.S. EPA 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, 2021, nor does it include any secondary MCLs(e.g., TDS, SO_4, Na, etc).

B. What data are to be used for the report due by July 1, 2022?

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 2022 report would be based on the analytical data from samples taken in 2019, 2020, and 2021. The data should be the same as that used by the drinking water system 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 Title 22 of the California Code of 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 calculatedand 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 California Code of Regulations Title 22, Sections 64432 & 64445.1 and other DDW guidance on compliance reporting) should be treated as 0 (zero) which is accepted DDW practice. U.S. EPA also recommends treating non-detection (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 E. coli bacteria, the MCLG is 0% samples positive per month which indicates one significant figure. So, if during 2021, 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 0.5ppb 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 comparingto 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. 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 California H&S 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, subdivision (b)(5) requires cost estimates of using the technology described in subdivision (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. Must the report deal with total coliforms?

No. No PHG or MCLG for total coliforms existed during the period covered by the 2022 report. For reports on PHGs prepared in 2019 and prior years, results for total coliforms needed to be evaluated because the U.S. EPA established a MCLG of zero (0) for total coliforms that remained applicable until March 31, 2016. In 2013, U.S. EPA revised the 1989 Total Coliform Rule (TCR) and one of the provisions of the revised Total Coliform Rule (RTCR) eliminated the MCLG for total coliforms effective April 1, 2016.

F. How should the report deal with *E. coli*?

The federal RTCR included a MCL and MCLG for *E. coli* effective April 1, 2016. The MCLG for E. coli is zero (0). DDW adopted a MCL for *E. coli* which became effective July 1, 2021. Even though there is no PHG, *E. coli*. is subject to PHG report requirements because there is a MCLG and a MCL.

1. The *E. coli* MCL is based on either an *E. coli* positive repeat sample following a total coliform (TC) positive routine sample, aTC-positive repeat sample following an *E. coli* -positive routine sample, failure to collect all required repeat samples following a E. coli positive routine sample, or failure to test for E. coli when any repeat sample is TC-positive. The PWS should report the number of *E. coli* detections that occurred during the three-year period (2019, 2020, and 2021 for this report). The MCLG of zero is therefore appropriately interpreted as zero samples positive.

2. If it is determined that the system has exceeded the MCLG of zero for *E. coli*, the following factors are pertinent for deciding what action, if any, is appropriate to consider and for estimating costs:

   a. Exceeding zero *E. coli* bacteria at any one time, in and of itself, would not normally constitute the need for any treatment or action.

   b. There is no action that could be taken with absolute certainty that could ensure that the system would always have zero-percent *E. coli* every single time.

c. The “best available technology” (to meet the MCL, not the MCLG) that is specified for total coliform by DDW in California Code of Regulations Title 22, Section 64447 would also apply to *E. coli* and for the most part is already followed by many systems.

d. The one single action that would most likely decrease the possibility of positive *E. coli* detection would be to significantly increase the disinfectant residual. This would likely result in increased disinfection byproducts (DBPs). While disinfection protects against acute health risks, such as *E. coli* and *Giardia*, DBPs can have potentially adverse chronic health 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 (DBPR).

e. Utilities should point out the positive, proactive steps they take to prevent E. coli contamination in the distribution system, including preventive maintenance, main flushing, special monitoring, residual maintenance and testing, cross-connection control, etc.

G. 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.

H. 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 monitoring lead at the tap, 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 monitoring copper at the tap, 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.

I. 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 U.S. 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, U.S. 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, 2021).

On February 7, 2020, OEHHA published PHGs of 0.4 ppb for chloroform, 0.5 ppb for bromoform, 0.06 ppb for bromodichoromethane, and 0.1 ppb for dibromochloromethane but there are no MCLs for individual trihalomethanes so these constituents do not need to be included in the report.

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

J. 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.)

K. Do utilities have to report detections of hexavalent chromium?

Water systems do NOT have to report anything on hexavalent chromium because there is no MCL. While there is an MCL and an MCLG for TOTAL chromium, systems will not have to report on it either since the MCLG (100 ppb) is much higher than the California MCL (50 ppb).

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 2022, 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 https://oehha.ca.gov/water/public-health-goal-report/health-risk-information-public-health-goal-exceedance-reports-2022.

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 2022 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 2021 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 2021 ENR Cost Index.

Table 3 is treatment cost data from previous ACWA Guidance documents with the costs updated to 2021. This has been revised using the average 2021 ENR Cost Index.

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 granular activated carbon (GAC) and reverse osmosis (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 operations and maintenance (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 U.S. EPA, WRF, AWWA, ASCE, or textbooks, manuals, journals.

The following is a list of 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 AWWA RF and AWWA, 2002,

(2) Implementation of Arsenic Treatment Systems, Part 2: Design Considerations, Operation and Maintenance, AWWA Research Foundation, Published by AWWA RF 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.

U.S. EPA includes cost data in the Federal Register for each regulation when it is proposed or adopted. (NOTE: U.S. EPA 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 a comparable 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 three-year period ending December 31, 2015, as an example. 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 Nick Blair of ACWA at NickB@acwa.com or 916-669-2377.

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants

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

Last Update: September 14, 2021

This table includes:

California's maximum contaminant levels (MCLs)

Detection limits for purposes of reporting (DLRs)

Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA)

Also, the PHG for NDMA (which is not yet regulated) is included at the bottom of this table.

Regulated Contaminant	MCL	DLR	PHG	Date of PHG
Chemicals with MCLs in 22 CCR §64431—Inorganic Chemicals				
Aluminum	1	0.05	0.6	2001
Antimony	0.006	0.006	0.001	2016
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 0.0025-mg/L PHG	0.05	0.01	withdrawn Nov. 2001	1999
Chromium, Hexavalent - 0.01-mg/L MCL & 0.001-mg/L DLR repealed September 2017	--	--	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 nitrogen, N)	10 as N	0.4	45 as NO3 (=10 as N)	2018
Nitrite (as N)	1 as N	0.4	1 as N	2018
Nitrate + Nitrite (as N)	10 as N	--	10 as N	2018
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
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	none	n/a
Gross beta particle activity - OEHHA concluded in 2003 that a PHG was not practical	4 mrem/yr	4	none	n/a
Radium-226	--	1	0.05	2006
Radium-228	--	1	0.019	2006
Radium-226 + Radium-228	5	--	--	--
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	0.013	2018
trans-1,2-Dichloroethylene	0.01	0.0005	0.05	2018
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
(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	0.0007	2016
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	0.000003	2020
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	0.006	2016
Endothal	0.1	0.045	0.094	2014
Endrin	0.002	0.0001	0.0003	2016
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	0.166	2016
Polychlorinated biphenyls (PCBs)	0.0005	0.0005	0.00009	2007
Simazine	0.004	0.001	0.004	2001
Thiobencarb	0.07	0.001	0.042	2016
Toxaphene	0.003	0.001	0.00003	2003
1,2,3-Trichloropropane	0.000005	0.000005	0.0000007	2009
2,3,7,8-TCDD (dioxin)	$3x10^{-8}$	$5x10^{-9}$	$5x10^{-11}$	2010
2,4,5-TP (Silvex)	0.05	0.001	0.003	2014
Chemicals with MCLs in 22 CCR §64533—Disinfection Byproducts				
Total Trihalomethanes	0.080	--	--	--
Bromodichloromethane	--	0.0010	0.00006	2020

Bromoform	--	0.0010	0.0005	2020
Chloroform	--	0.0010	0.0004	2020
Dibromochloromethane	--	0.0010	0.0001	2020
Haloacetic Acids (five) (HAA5)	0.060	--	--	--
Monochloroacetic Acid	--	0.0020	--	--
Dichloroacetic Adic	--	0.0010	--	--
Trichloroacetic Acid	--	0.0010	--	--
Monobromoacetic Acid	--	0.0010	--	--
Dibromoacetic Acid	--	0.0010	--	--
Bromate	0.010	0.0050**	0.0001	2009
Chlorite	1.0	0.020	0.05	2009
Chemicals with PHGs established in response to DDW requests. These are not currently regulated drinking water contaminants.				
N-Nitrosodimethylamine (NDMA)	--	--	0.000003	2006
*OEHHA's review of this chemical during the year indicated (rev20XX) resulted in no change in the PHG.				
**The DLR for Bromate is 0.0010 mg/L for analysis performed using EPA Method 317.0 Revision 2.0, 321.8, or 326.0.				

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

Public Health Goals

Health Risk Information for Public Health Goal Exceedance Reports

February 2022

Pesticide and Environmental Toxicology Branch
Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

Health Risk Information for Public Health Goal Exceedance Reports

Prepared by

Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

February 2022

NEW for the 2022 Report: New in this document are an updated Public Health Goal(PHG) for 1,2-dibromo-3-chloropropane (DBCP) and newly established PHGs for the trihalomethanes bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

Background: Under the Calderon-Sher Safe Drinking Water Act of 1996 (the Act), public water systems with more than 10,000 service connections are required to prepare a report every three years for contaminants that exceed their respective PHGs.[1]This document contains health risk information on regulated drinking water contaminants to assist public water systems in preparing these reports. A PHG is the concentration of a contaminant in drinking water that poses no significant health risk if consumed for a lifetime. PHGs are developed and published by the Office of Environmental Health Hazard Assessment (OEHHA) using current risk assessment principles, practices and methods.[2]

The water system's report is required to identify the health risk category (e.g., carcinogenicity or neurotoxicity) associated with exposure to each regulated contaminant in drinking water and to include a brief, plainly worded description of these risks. The report is also required to disclose the numerical public health risk, if available,associated with the California Maximum Contaminant Level (MCL) and with the PHG foreach contaminant. This health risk information document is prepared by OEHHA every three years to assist the water systems in providing the required information in their reports.

[1] Health and Safety Code Section 116470(b)
[2] Health and Safety Code Section 116365

Numerical health risks: Table 1 presents health risk categories and cancer risk valuesfor 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 anticipatedadverse 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 carcinogensare 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 no more than a 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 chemicalwith a PHG are summarized in a PHG technical support document. These documentsare available on the OEHHA website (https://oehha.ca.gov/water/public-health-goals- phgs).

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[5,6]	0.002	NA
Aluminum	neurotoxicity and immunotoxicity (harms the nervous and immune systems)	0.6	NA	1	NA
Antimony	hepatotoxicity (harms the liver)	0.001	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[7] (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: https://oehha.ca.gov/media/downloads/risk-assessment//gcregtext011912.pdf).
[2] mg/L = milligrams per liter of water or parts per million (ppm)
[3] Cancer Risk = Upper bound 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. Cancer risk cannot be calculated.
[6] The PHG for alachlor is based on a threshold model of carcinogenesis and is set at a level that is believed to be without any significant cancer risk to individuals exposed to the chemical over a lifetime.
[7] 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[8])	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)	0.0007	NA	0.018	NA

[8] 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}	none	NA
Copper	digestive system toxicity (causes nausea, vomiting, diarrhea)	0.3	NA	1.3 (AL[9])	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
Di(2-ethylhexyl) adipate (DEHA)	developmental toxicity (disrupts development)	0.2	NA	0.4	NA

[9] 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
Di(2-ethylhexyl) phthalate (DEHP)	carcinogenicity (causes cancer)	0.012	1×10^{-6}	0.004	3×10^{-7} (three per ten million)
1,2-Dibromo-3-chloropropane (DBCP)	carcinogenicity (causes cancer)	0.000003 ($3x10^{-6}$)	1×10^{-6}	0.0002	7×10^{-5} (seven per hundred 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)	0.013	NA	0.006	NA
1,2-Dichloro-ethylene, trans	immunotoxicity (harms the immune system)	0.05	NA	0.01	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
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
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)
Dinoseb	reproductive toxicity (harms the uterus and testis)	0.014	NA	0.007	NA
Diquat	ocular toxicity (harms the eye) developmental toxicity (causes malformation)	0.006	NA	0.02	NA
Endothall	digestive system toxicity (harms the stomach or intestine)	0.094	NA	0.1	NA
Endrin	neurotoxicity (causes convulsions) hepatotoxicity (harms the liver)	0.0003	NA	0.002	NA
Ethylbenzene (phenylethane)	hepatotoxicity (harms the liver)	0.3	NA	0.3	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
Ethylene dibromide (1,2-Dibromoethane)	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)
Hexachlorobenzene	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	$<1 \times 10^{-6}$ (PHG is not based on this effect)	0.015 (AL[9])	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)	3 as nitrite	NA	1 as nitrogen (=3 as nitrite)	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[10]	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)	0.166	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)

[10] The joint nitrate/nitrite PHG of 10 mg/L (10 ppm, expressed as nitrogen) does not replace the individual values, and the maximum contribution from nitrite should not exceed 1 mg/L nitrite-nitrogen.

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
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)
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)
2,3,7,8-Tetra-chlorodibenzo-*p*-dioxin (TCDD, or dioxin)	carcinogenicity (causes cancer)	5×10^{-11}	1×10^{-6}	3×10^{-8}	6×10^{-4} (six 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
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)	0.042	NA	0.07	NA
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

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
1,1,2-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
1,2,3-Trichloro-propane (1,2,3-TCP)	carcinogenicity (causes cancer)	0.0000007 (7×10^{-7})	1×10^{-6}	0.000005 (5×10^{-6})	7×10^{-6} (seven per million)
1,1,2-Trichloro-1,2,2-trifluoro-ethane (Freon 113)	hepatotoxicity (harms the liver)	4	NA	1.2	NA
Trihalomethanes: Bromodichloro-methane	carcinogenicity (causes cancer)	0.00006	1×10^{-6}	0.080*	1.3×10^{-3} (1.3 per thousand)[11]
Trihalomethanes: Bromoform	carcinogenicity (causes cancer)	0.0005	1×10^{-6}	0.080*	2×10^{-4} (two per ten thousand)[12]

* For total trihalomethanes (the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane). There are no MCLs for individual trihalomethanes.
[11] Based on 0.080 mg/L bromodichloromethane; the risk will vary with different combinations and ratios of the other trihalomethanes in a particular sample.
[12] Based on 0.080 mg/L bromoform; the risk will vary with different combinations and ratios of the other trihalomethanes in a particular sample.

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
Trihalomethanes: Chloroform	carcinogenicity (causes cancer)	0.0004	1×10^{-6}	0.080*	2×10^{-4} (two per ten thousand)[13]
Trihalomethanes: Dibromochloro-methane	carcinogenicity (causes cancer)	0.0001	1×10^{-6}	0.080*	8×10^{-4} (eight per ten thousand)[14]
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

* For total trihalomethanes (the sum of bromodichloromethane, bromoform, chloroform, and dibromochloromethane). There are no MCLs for individual trihalomethanes.
[13] Based on 0.080 mg/L chloroform; the risk will vary with different combinations and ratios of the other trihalomethanes in a particular sample.
[14] Based on 0.080 mg/L dibromochloromethane; the risk will vary with different combinations and ratios of the other trihalomethanes in a particular sample.

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

Chemical	Health Risk Category[1]	US EPA MCLG[2] (mg/L)	Cancer Risk[3] at the MCLG	California MCL[4] (mg/L)	Cancer Risk at the 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)					
Monochloroacetic acid (MCA)	general toxicity (causes body and organ weight changes[8])	0.07	NA	none	NA

[1] Health risk category based on the US EPA MCLG document or California MCL document unless otherwise specified.
[2] MCLG = maximum contaminant level goal established by US 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]	US EPA MCLG[2] (mg/L)	Cancer Risk[3] at the MCLG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
Dichloroacetic acid (DCA)	Carcinogenicity (causes cancer)	0	0	none	NA
Trichloroacetic acid (TCA)	hepatotoxicity (harms the liver)	0.02	NA	none	NA
Monobromoacetic acid (MBA)	NA	none	NA	none	NA
Dibromoacetic acid (DBA)	NA	none	NA	none	NA
Total haloacetic acids (sum of MCA, DCA, TCA, MBA, and DBA)	general toxicity, hepatotoxicity and carcinogenicity (causes body and organ weight changes, harms the liver and causes cancer)	none	NA	0.06	NA
Radionuclides					
Gross alpha particles[9]	carcinogenicity (causes cancer)	0 (^{210}Po included)	0	15 pCi/L[10] (includes radium but not radon and uranium)	up to $1x10^{-3}$ (for ^{210}Po, the most potent alpha 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://www.oehha.ca.gov/water/reports/grossab.html.
[10] pCi/L = picocuries per liter of water.

Chemical	Health Risk Category[1]	US EPA MCLG[2] (mg/L)	Cancer Risk[3] at the MCLG	California MCL[4] (mg/L)	Cancer Risk at the California MCL
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)

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 2021* ($/1,000 gallons treated)
1	Ion Exchange	Coachella Valley WD, for GW, to reduce Arsenic concentrations. 2011 costs.	2.40
2	Ion Exchange	City of Riverside Public Utilities, for GW, for Perchlorate treatment.	1.16
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.	0.88
4	Granular Activated Carbon	City of Riverside Public Utilities, GW sources, for TCE, DBCP (VOC, SOC) treatment.	0.58
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.	0.42
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.	1.78
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.	0.94
8	Packed Tower Aeration	City of Monrovia, treatment to reduce TCE, PCE concentrations. 2011-12 costs.	0.52
9	Ozonation+ Chemical addition	SCVWD, STWTP treatment plant includes chemical addition + ozone generation costs to reduce THM/HAAs concentrations. 2009-2012 costs.	0.11

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 2021* ($/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.	0.23
11	Coagulation/Filtration	Soquel WD, treatment to reduce manganese concentrations in GW. 2011 costs.	0.88
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.	1.00
13	Blending (Well)	Rancho California WD, GW blending well, 1150 gpm, to reduce fluoride concentrations.	0.83
14	Blending (Wells)	Rancho California WD, GW blending wells, to reduce arsenic concentrations, 2012 costs.	0.68
15	Blending	Rancho California WD, using MWD water to blend with GW to reduce arsenic concentrations. 2012 costs.	0.81
16	Corrosion Inhibition	Atascadero Mutual WC, corrosion inhibitor addition to control aggressive water. 2011 costs.	0.10

*Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average Construction Cost Index of 12,1332021

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 2012 Unit Cost Indexed to 2021*** ($/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.	1.91 - 11.96
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.	1.96 – 8.19
3	IX	Golden State Water Co., IX w/disposable resin, 1 MGD, Perchlorate removal, built in 2010.	0.60
4	IX	Golden State Water Co., IX w/disposable resin, 1000 gpm, perchlorate removal (Proposed; O&M estimated).	1.31
5	IX	Golden State Water Co., IX with brine regeneration, 500 gpm for Selenium removal, built in 2007.	8.57
6	GFO/Adsorption	Golden State Water Co., Granular Ferric Oxide Resin, Arsenic removal, 600 gpm, 2 facilities, built in 2006.	2.24 - 2.39
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.	2.93
8	IX	Reference: Inland Empire Utilities Agency : Chino Basin Desalter. IX cost to reduce 150 ppm Nitrate (as NO3); approx. 2.6 mgd.	1.63

9	Packed Tower Aeration	Reference: Inland Empire Utilities Agency : Chino Basin Desalter. PTA-VOC air stripping, typical treated flow of approx. 1.6 mgd.	0.49
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.	0.68 - 0.97
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.	0.45
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.	2.02 – 2.13

* Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average Construction Cost Index of 12,133 for 2021. .

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 2021* ($/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	0.69 - 1.31
2	Granular Activated Carbon	Reference: Carollo Engineers, estimate for VOC treatment (PCE), 95% removal of PCE, Oct. 1994,1900 gpm design capacity	0.32
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	1.51
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	0.59 - 0.86
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	2.71
6	Granular Activated Carbon	Reference: Southern California Water Co. - actual data for permanent GAC to remove VOCs (TCE), 2.16 mgd plant capacity, 1998	1.75
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	2.036 – 3.89
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	4.80
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	2.96
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	3.20

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated 2012 Unit Cost Indexed to 2021* ($/1,000 gallons treated)
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	2.48
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	8.04
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	4.75
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	3.55
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	2.20
16	Reverse Osmosis	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility with RO to remove nitrate, 1990	2.22 - 3.89
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	1.27
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	0.68
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	0.34
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	0.35
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	0.55 - 0.90

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated 2012 Unit Cost Indexed to 2021* ($/1,000 gallons treated)
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	0.67
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	0.15 - 0.32
24	Ion Exchange	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility - ion exchange to remove nitrate, 1990	0.73 - 0.97

* Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average Construction Cost Index of 12,133 for 2021.

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 GOVERN1NG 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 Environment al 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. I) specify that larger (> I0,000 service connections) water utilities prepare a special report by July I, 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. I)

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 repo11 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 thatthe 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/I. We have detected TCE in 2 of our 20 wells at a level of 0.002 mg/I in Well No. I and at 0.003 mg/I 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 lifetimecould 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 ji-om 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. I 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 $, ear.

E. coli:

In July 2021, the California Revised Total Coliform Rule became effective. The revisions included the new Coliform Treatment Technique requirement replacing the Total Coliform MCL, and a new *E. coli* MCL regulatory limit. The purpose for the revisions was to provide the public with increased protection against microbial pathogens in drinking water served by public water systems. A water system is in violation of the *E. coli* MCL if any of the following trigger levels occur:

1. *E. coli*-positive repeat sample following total coliform-positive routine sample
2. Total coliform-positive repeat sample following an *E. coli* routine sample
3. Failure to collect all required repeat samples following an *E. coli*-positive routine sample
4. Failure to test for *E. coli* when any repeat sample is total coliform-positive

Coliform bacteria are an indicator organism that are ubiquitous in nature and are not generally considered harmful. They are used because of the ease in monitoring and analysis. However, the presence of *E.* coli bacteria indicates that the water may be contaminated with human or animal wastes. These bacteria can make people sick and are a particular concern for those with weakened immune systems.
In the month of October 2021, we collected 120 samples from our distribution system for coliform analysis. One of these samples had tested positive for total coliform bacteria and was absent for *E. coli* bacteria. However, the repeat sample we had conducted tested positive for both total coliform bacteria and *E. coli* bacteria; we had exceeded the *E. coli* MCL. In coordinating with our local regulating agency, we initiated a Tier 1 public notification (Boil Water Order) and conducted a Level 2 assessment to identify the cause of the *E .coli*-positive sample. The cause was determined to be (*insert cause of contamination)* and the following corrective actions were taken…(*insert corrective actions taken).*

Alternative No. 1: "We are working closely with our regional water supplier and have instituted new disinfection procedures to provide for a slightly higher disinfectant residua1. Our disinfectant is chloramines. This increase has been carefully studied before it was implemented. This careful balance of treatment processes used is essential to continue supplying our customers with safe drinking water."

Alternative No. 2: "We add chlorine at our sources 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 disinfection byproduct level. This careful balance of treatment processes is essential to continue supplying our customers withsafe drinking water."

Other equally important measures that we have implemented include: an effective cross-connection control program, maintenance of a disinfectant residua1 throughout our system, an effective monitoring and surveillance program and maintaining positive pressures in our distribution system. Our system has already taken all of the steps described by DDW as "best available technology" for colifom1 bacteria inSection 64447, Title 22, CCR.

(Note: Jf a utility is planning to initiate different treatment or new programs, these should be described and cost estimates could be included.)

Lead and/or Copper:

There is no MCL for Lead or Copper. Instead the 90th percentile value of all samples from house hold taps in the distribution system cannot exceed an Action Level of 0.015 mg/I for lea d and 1.3 mg/I for copper. The PHG for lead is 0.002 mg/I. The PH G for copper is 0.17 mg/I.

The category of health risk for lead is damage to the kidneys or nervous system of humans. The category of health risk for copper is gastrointestinal irritation. Numerical health risk data on lead and copper have not yet been provided by OEHHA, the State agency responsible for providing that information. *(Note: If OEHHA provides this information prior to completion of a utility's report, it should be inserted here.)*

All of our source water samples for lead and copper in 200 were less than the PHG. Based on extensive sampling of our distribution system in 200, our 90th percentile value for lead was 0.006 mg/I and for copper was 0.18 mg/I.

Our water system is in full compliance with the Federal and State Lead and Copper Rule. Based on our extensive sampling, it was determined according to State regulatory requirements that we meet the Action Levels for Lead and Copper. Therefore, we are deemed by DDW to have "optimized corrosion control" for our system.

In general, optimizing corrosion control is considered to be the best available techno logy to deal with corrosion issues and with any lead or copper findings. We continue to monitor our wa ter quality parameters that relate to corrosivity, such as the pH, hardness, alkalinity, total dissolved solids, and will take action if necessary to maintain our sys tem in an "optimized corrosion control" condition.

Alternative No. 1: Since we are meeting the "optimized corrosion control" requirements, it is not prudent to initiate additional corrosion control treatment as it involves the addition of other chemicals and there could be additional water quality issues raised. Therefore, no estimate of cost has been included.

Alternative No. 2: To further reduce the potential that lead (or copper) values at consumer taps would exceed the PHO, corrosion control treatment could be installed at all of our sources at an estimated initial cost of $____ and an ongoing annual O&M cost of $_ _ _ _ _ which would be equivalent to $ per service connection.

RECOMMENDATIONS FOR FURTHER ACTION:

The drinking water quality of the SoftWater Public Water Utility District meets all State of California, DDW and USEPA drinking water standards set to protect public health. To further reduce the levels of the constituents identified in this report that are already significantly below the health-based Maximum Contaminant Levels established to provide "safe drinking water", additional costly treatment processes would be required. The effectiveness of the treatment processes to provide any significant reductions in constituent levels at these already low values is uncertain. The health protection benefits of these further hypothetical reductions are not at all clear and may not be quantifiable .Therefore, no action is proposed.

Optional additional language: "The money that would be required for these additional treatment processes might provide greater public health protection benefits if spent on other water system operation, surveillance, and monitoring programs."

REFERENCES:

No.I Excerpt from Calif Health & Safety Code: Section 116470 (b)No.2
Table of Regulated Constituents with MCLs, PHGs or MCLGs
No.3 SoftWater Public Water Utility District's 2013, 2014 and 2015 Water Quality Reports
No.4 Glossary of terms and abbreviations used in report *(Optional)*