City of
Santa Monica®

CITY OF SANTA MONICA

REPORT ON WATER QUALITY
RELATIVE TO
PUBLIC HEALTH GOALS (PHGs)

June 2019

BACKGROUND

A Public Health Goal (PHG) is a health risk assessment, not a proposed drinking water standard. It is the level of a contaminant in drinking water, which is considered not to pose a significant risk to health if consumed for a lifetime. This determination is made without regard to cost or treatability.

The California legislature created the concept of PHGs, and the California Environmental Protection Agency's (Cal-EPA) Office of Environmental Health Hazard Assessment (OEHHA) researches and establishes PHGs. The State Water Resource Control Board (SWRCB) - Division of Drinking Water (DDW), formerly the California Department of Public Health, then uses PHGs to evaluate health-related drinking water standard Maximum Contaminant Levels (MCLs). PHGs, as well as cost and technical feasibility estimates, provide the basis for revising and setting new contaminant MCLs.

Provisions of the California Health and Safety Code Section 116470(b) (Exhibit A) require that large water utilities (>10,000 service connections) prepare a special report by July 1, 2019 if their water quality measurements exceeded any PHGs in the three previous calendar years. The law also requires that where OEHHA has not adopted a PHG for a contaminant, the water suppliers are to use the Maximum Contaminant Level Goals (MCLGs) adopted by the United States Environmental Protection Agency (USEPA). MCLGs are the federal equivalent to PHGs, but they are not identical. This report includes only constituents that have both a California primary drinking water standard, or MCL, and either a set PHG or MCLG. Exhibit B is a list of all regulated constituents with 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 have yet been adopted by OEHHA or USEPA. These include total trihalomethanes (TTHMs) among others.

This report provides the following information as specified in the Health and Safety Code (Exhibit A) for each constituent detected in the City of Santa Monica's (City) water supply in 2016, 2017, and 2018 at a level exceeding an applicable PHG or MCLG:

- Numerical public health risk associated with the MCL and the PHG or MCLG (Exhibit C).
- Category or type of risk to health that could be associated with each constituent.
- Best Available Treatment Technology that could be used to reduce the constituent level.
- Estimate of the cost to install that treatment if it is appropriate and feasible.

APPLICATION OF PHGs

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

WATER QUALITY DATA CONSIDERED

All the water quality data collected for Santa Monica's water system between 2016 and 2018 for purposes of determining compliance with drinking water standards was considered. This information was summarized in our Annual Water Quality Reports made available to all Santa Monica customers, residents, and businesses in June 2017, June 2018 and June 2019 (Exhibit D).

Most of the constituents tested in our water were reported as Not Detected (ND) and are not generally listed in the Annual Water Quality Reports. A constituent reported as ND generally means that the laboratory did not detect the compound, or that it was detected at a level less than California's Detection Level for purposes of Reporting (DLR).

GUIDELINES FOLLOWED

The Association of California Water Agencies (ACWA) formed a workgroup, which prepared guidelines for water utilities to use in preparing PHG reports. These guidelines were used in the preparation of this report. No general guidelines are available from the state regulatory agencies. ACWA's workgroup also prepared guidelines for water utilities to use in estimating the costs to reduce a constituent to the MCL. Exhibit E provides cost estimates for the best treatment technologies that are available today.

BEST AVAILABLE TREATMENT TECHNOLOGY AND COST ESTIMATES

Both the USEPA and DDW have adopted what are known as Best Available Technologies (BATs), which are the best-known methods of reducing contaminant levels to achieve compliance with MCLs. Capital construction and operation and maintenance (O&M) costs can be estimated for such technologies. However, since many PHGs and MCLGs are set much lower than the MCL, it is not always possible or feasible to determine the treatment needed to meet the PHG or MCLG. For example, USEPA sets the MCLG for potential cancer-causing chemicals at zero. Estimating the costs to reduce a constituent to zero is difficult, if not impossible, because it is not possible to verify by analytical means that the level has been lowered to zero. In some cases, installing treatment to try and further reduce very low levels of one constituent may have adverse effects on other aspects of water quality.

CONSTITUENTS DETECTED THAT EXCEED A PHG OR A MCLG

The following is a discussion of constituents that were detected in one or more of the City's drinking water sources at levels exceeding the PHG or, if no PHG exists, above the MCLG. Constituents that were detected in one or more drinking water sources at levels above the MCLs are reduced to acceptable levels. The health risk information for regulated constituents with MCLs, PHGs or MCLGs is provided in Exhibit C.

- **Total Coliform Bacteria**

Total coliform bacteria are measured at approximately 100 sites around the City. The MCL requires that no more than 5% of all samples collected in a month can be positive for total coliforms, and the MCLG requires zero positive samples per month. There is no PHG for total coliform bacteria, thus the MCLG is followed. The reason for the total coliform drinking water standard is to minimize the possibility of the water containing pathogens, which are organisms that cause waterborne disease. Total coliform analysis serves as a surrogate indicator of the potential presence of pathogens, it is not possible to state a specific numerical health risk. While USEPA normally sets MCLGs "at a level where no known or anticipated adverse effects on persons would occur", USEPA indicates that it cannot do so with total coliforms. Nevertheless, without the ability to determine a specific numerical risk, the MCLG has been set at zero for total coliform bacteria.

Coliform bacteria are a group of indicator organisms that are ubiquitous in nature and are not generally considered harmful. They are used because of the ease in monitoring and analysis. If a positive sample is found, it indicates a potential problem that needs to be investigated with follow-up sampling. It is not at all unusual for a system to have an occasional positive sample. In Santa Monica, approximately 80 of the total coliform bacteria sample sites are taken from resident or business taps, such as hose bibbs. Many of these taps are exposed to the environment and while they provide a satisfactory sample point most of the time, occasionally the tap itself may become exposed to bacteria from the environment, e.g. overgrown plants, pets and humans. When samples are drawn from these exposed taps, they may test positive on rare occasion.

During the 2016 – 2018 period, the City collected between 119 and 142 samples each month for total coliform analysis. No samples were confirmed positive for Total Coliform Bacteria from 2016 - 2018. The Annual Water Quality Reports, also known as CCRs, state that the highest percent of monthly samples positive was 1.35% and 0.82% in 2017 and 2018 respectively. This percent includes sample locations that initially tested positive, however, they were resampled and confirmed having no presence of Coliform Bacteria.

In order to reduce the potential for positive results due to taps exposed to the open environment, the Water Resources Division (WRD) has a program to prioritize the sites and install more dedicated sampling stations in conjunction with the WRD's main line replacement program. The dedicated sampling stations are enclosed in a lockable box and are protected from the environment.

The WRD already maintains an effective cross connection control program, a disinfectant residual throughout the system, an effective monitoring and surveillance program, and positive pressure in all parts of the distribution system. The WRD has already taken all steps described by the DDW as Best Available Technology (BAT) for Coliform Bacteria in Section 64447, Title 22, CCR. Since it is unlikely that any change to the treatment process at the Arcadia Water Treatment Plant would prevent the occasional positive test result at distribution sampling sites, staff recommends no change to the existing treatment.

- **Lead and Copper**

There are no MCLs for lead or copper. Lead and copper are not present in our water sources, but they can leach into drinking water through the resident's plumbing systems and faucets. Instead of MCLs, every three years a set of special samples is collected, and the results evaluated to determine whether the City's water system has achieved "optimized corrosion control". The samples collected are first-draw at the tap of thirty or more homes identified as high-risk (new plumbing installed with lead solder before it was banned). To meet drinking water standards, the 90th percentile reading (meaning 90% of the samples were lower) of all samples collected by the City from these household taps cannot exceed an Action Level (AL) of 0.015 mg/L for lead and 1.3 mg/L for copper. The PHG for lead is 0.0002 mg/L (0.2 ppb) and the PHG for copper is 0.3 mg/L.

There are three categories of health risk associated with lead - chronic toxicity (neurobehavioral effects in children, hypertension in adults) and cancer. The numerical health risk of ingesting drinking water with lead above the PHG is $2X10^{-6}$, or two additional theoretical cancer cases in one million people drinking two liters of water a day for 70 years.

The last round of testing for lead and copper was conducted by the Water Resources WRD in 2017 (next round is summer 2019). The 90^{th} percentile reading for lead in the last round was 0.00316 mg/L and was 0.20 mg/L for copper. These are below the Action Levels, which means the City continued to meet water quality standards for lead and copper and was again considered to have "optimized corrosion control". The value for copper was lower than the PHG, but the level for lead was higher than its corresponding PHG.

In general, optimizing corrosion control is considered the Best Available Technology to address corrosion issues and any lead and copper findings. The WRD will continue to monitor water quality parameters that relate to corrosivity, such as pH, hardness, alkalinity, and total dissolved solids, and will act, if necessary, to maintain our system in an "optimized corrosion control" condition.

Since the City's water supply continues to meet the "optimized corrosion control" requirements, it is not prudent to initiate additional corrosion control treatment until such time as changing conditions might warrant further action. Therefore, no estimate of cost has been included in this report and no recommendations for further action are advised.

- **Arsenic**

The PHG for Arsenic is 0.000004 mg/L (4.0 ppt). The MCL for Arsenic is 0.01 mg/L. Arsenic is a naturally occurring metallic element found in water generally at low levels throughout California and elsewhere due to the erosion of mineral deposits. It can also enter water supplies from runoff from agricultural and industrial sites. The MCL was lowered in 2006 due to increasing evidence of potential detrimental health effects even at low levels. The concern is that long-term exposure to Arsenic in drinking water may cause skin damage, problems with circulatory systems, and may cause cancer.

Arsenic was below the MCL in all the City's water sources during 2016 – 2018; however, several sources exceeded the PHG during this period. Arsenic readings for all sources during this report period ranged from ND (Reporting Limit was 0.0005 mg/L) to a high of 0.0031 mg/L, which occurred in water purchased from the Metropolitan Water District's (MWD) Jensen Treatment Plant. The annual average for the Jensen supply ranged from ND to 0.0031 mg/L and stayed at ND for the Weymouth supply for 2016 – 2018.

The City's single well not treated by the Arcadia Treatment Plant is Santa Monica Well #1. Santa Monica Well #1 had annual averages that ranged from 0.0006 mg/L to 0.0012 mg/L during 2016 – 2018. No detection (Reporting Limit was 0.0005 mg/L) of Arsenic was found in water from the Arcadia Treatment Plant for years 2016 - 2018.

An increased risk of cancer the health risk category for long-term exposure to drinking water containing Arsenic above the MCL. The numerical health risk of ingesting drinking water with Arsenic above the PHG is $1X10^{-6}$, or one additional theoretical cancer cases in one million people drinking two liters of water a day for 70 years.

The following BATs are designated for Arsenic removal: Ion Exchange, Wells Blending, Granular Ferric Oxide Resin Adsorption; Coagulation Filtration, and Reverse Osmosis (RO). The City's RO softening plant, commissioned in December 2010, is achieving reduction of Arsenic to below the level it can be analytically measured (Reporting Limit).

BATs are designed for treatment to achieve compliance with the corresponding MCLs, and not necessarily the PHGs. It is unlikely that Arsenic will be removed to a level lower than the very low Arsenic PHG. The PHG is also lower than laboratory tests can detect, so it would be impossible to confirm whether water out of the Arcadia Treatment Plant, or any given water supply, contains Arsenic lower than the PHG level.

It is not practical or feasible to estimate costs for the reduction of Arsenic from the supplemental water the City purchases from MWD or Santa Monica Well #1. Therefore, no estimate of cost has been included in this report and no recommendations for further action are advised.

- **Uranium**

The PHG for Uranium is 0.43 picoCuries per liter (pCi/L) and the MCL is 20 pCi/L. Uranium is a naturally occurring metallic element which is weakly radioactive and is ubiquitous in the earth's crust. Uranium is found in ground and surface waters due to its natural occurrence in geological formations. The average Uranium concentrations in surface and ground water are 1 and 2 pCi/L respectively. The Uranium intake from water is about equal to the total from other dietary components.

Uranium levels always tested below the MCL for all water sources from 2016 – 2018; however, all sources exceeded the PHG at least once during this period.

Uranium readings in water out of the Arcadia Treatment Plant ranged from 2.0 pCi/L to 3.4 pCi/L; the annual averages from the plant ranged from 2.3 to 2.5 pCi/L for 2016 – 2018. Annual averages of water from MWD's Weymouth and Jensen plants ranged from ND (Reporting Limit was 0.7 pCi/L) to 3 pCi/L for years 2016 – 2018.

An increased risk of developing cancer is the health risk category associated with drinking water containing Uranium above the MCL for many years. OEHHA has determined that the numerical cancer risk for Uranium above the PHG level is $1x10^{-6}$, or one additional theoretical cancer case in one million people drinking two liters of water a day for 70 years.

There are several BATs designated to lower Uranium to below the MCL including RO. The City's RO softening plant, commissioned in December 2010, is achieving some reduction of Uranium from most of the City's groundwater supplies. However, BATs are designed for treatment to achieve compliance with the corresponding MCL only, and not PHGs; thus, RO treatment did not achieve reduction of Uranium to below the PHG. Further treatment to reduce Uranium at the Arcadia Treatment Plant is neither practical, nor feasible.

The City's single well not treated by the Arcadia Treatment Plant is Santa Monica Well #1. The water for this well had a Uranium level that ranged from 0.7pCi/L (Reporting Limit is 0.7 pCi/L) to 0.8 pCi/l for 2016 – 2018, thus it must be evaluated for treatment for removal of Uranium to below the PHG. Of the designated BATs for Uranium, the most effective and economical approach would be to use RO treatment at the well site. Based on 2018 flow rates and estimated costs, this would be approximately $472,345 per year not including the cost for waste (brine) disposal (cost from Exhibit E, Table 3, No. 12). However, this well is located in the center median of San Vicente Blvd in a residential neighborhood where it would not be feasible to construct even a small treatment plant at the well site. Again, it is also unclear whether treatment to below the PHG for Uranium could be achieved using RO, as BATs are designed to achieve compliance only to the corresponding MCL. Also, this cost estimate may be imprecise as treatment and operational costs can vary widely depending on variables of the situation.

It is not practical or feasible to estimate costs for the reduction of Uranium from the supplemental water the City purchases from MWD. Therefore, no estimate of cost has been included in this report and no recommendations for further action are advised.

- **Other Radionuclides**

There are several radionuclides for which OEHHA has not set PHGs, but for which an MCLG has been designated by USEPA. The standards include the following radionuclides: alpha emitters, beta/photon emitters, combined radium as well as the standard for Uranium described above. In addition to these standards, USEPA has designated an MCLG of zero for each. The groundwater and supplemental water supplies for Santa Monica always tested below the MCLs for these constituents during 2016 – 2018; however, the MCLGs of zero for some of these radionuclides were exceeded at some sources at various times during this period.

Radionuclides are radioactive elements that are found in nature or are man-made. They are unstable and emit particles or waves of high energy from the nucleus or other parts of the atom. There are three basic kinds of high-energy radiation: alpha, beta, and gamma (included in a broader group called photons). Many radionuclides emit more than one kind of radiation, but they are classified by their most important kind. The MCL for alpha emitters limits the level of “gross alpha” radiation other than what is contributed by Uranium and radon. The MCL for beta/photon emitters limits the level of radiation from a group of 179 man-made radioactive materials. The MCL for combined radium limits the radiation on two kinds (or “isotopes”) of radium: radium-226 and radium-228. These MCLs were adopted to address concern with the health effects from radiation inside the body after consuming the radionuclides because evidence suggests that long-term exposure to radionuclides in drinking water may cause cancer.

The level of alpha emitters in the City’s groundwater and supplemental supplies always tested below the MCL of 15 pCi/L during 2016 – 2018; however, alpha emitters did exceed the MCLG of zero in some monitoring data. Gross alpha readings for this period ranged from ND (Reporting Limit was 3 pCi/L) for all supplies to a high of 5 pCi/L, which came from MWD’s Jensen Plant water in 2016. Annual averages from all the supplies ranged from ND to 3 pCi/L, the high came from the Jensen Plant in 2016.

The standard for beta/photon emitters does not apply to the City's groundwater and as such, is not covered by this report. The standard for beta/photon emitters does apply to supplemental water that the City received from MWD. The MWD water always tested below the beta/photon emitters MCL of 50 pCi/L, but it was verified to exceed the MCLG of zero data during 2016. Beta/photon emitter readings for both MWD supplies for this period ranged from ND (Detection Limit for Purposes of Reporting or DLR was 4 pCi/L) to a high of 6 pCi/L in the water coming from MWD's Weymouth Treatment Plant during 2016. The annual averages ranged from ND to 5 pCi/L for the Jensen and Weymouth supplies respectively, for the period covered by this report.

The level of combined radium in the City's groundwater and supplemental supplies always tested below the MCL of 5 pCi/L during 2016 – 2018. No detections of combined radium were reported for the City's supplies or MWD imported water from Weymouth and Jensen plant.

The BATs for these radionuclides are similar to those for Uranium, which includes RO. The City's RO softening plant, commissioned in December 2010, is achieving some reduction of these radionuclides from the City's groundwater supply. BATs are designed for treatment to achieve compliance with the corresponding MCL only, and not PHGs, so the addition of RO softening, considered a BAT for these other radionuclides, did not achieve reduction to below the MCLGs in all cases. Further treatment to reduce other radionuclides at the Arcadia Treatment Plant is neither practical, nor feasible. Thus, the analysis for treatment of Santa Monica Well #1 and the MWD supplies is the same as for Uranium and no recommendations for further action are advised.

- **<u>Bromate</u>**

Bromate is a disinfection byproduct (DBP) formed when water containing naturally occurring bromide ion is ozonated. Long-term exposure to bromate in drinking water may cause cancer; thus, the Bromate MCL was adopted in 2002 to address the potential health effect. The standard applies only to water treatment plants that apply ozone for disinfection and does not apply to the City's groundwater or treatment system.

The standard does apply to supplemental water the City receives from MWD's Jensen and Weymouth Treatment Plants. After more than two decades of planning and construction, MWD has retrofitted all five of its water treatment plants to use ozone, rather than chlorine, as the primary disinfectant. The upgrade has driven DBP levels in MWD's system to historically low levels and complies with stringent regulations that limit the level of DBPs in drinking water. Ozonation also improves drinking water aesthetics, offers protection from pathogens, and reduces other potential contaminants such as cyanotoxins. MWD controls Bromate by adjusting pH, or by adding chloramine (a combination of ammonia and chlorine) prior to the water reaching the ozone contactors.

The PHG for bromate is 0.0001 mg/L. The MCL for bromate is 0.010 mg/L. The MCL for bromate does not apply to single readings but is instead compared to a Running Annual Average (RAA). For 2016 – 2018, the highest RAAs from MWD's Jensen Plant

(0.0074 mg/L in 2016 and 2017) and Weymouth Plant (0.0050 mg/L in 2018) stayed below the RAA MCL for bromate, but they exceeded the PHG during 2016 – 2018.

An increased risk of developing cancer is the category for health risk associated with drinking water containing bromate above the MCL for many years. OEHHA has determined that the numerical cancer risk for bromate above the PHG level is $1x10^{-6}$, or one additional theoretical cancer case in one million people drinking two liters of water a day for 70 years.

The BAT to reduce bromate is control of the ozone treatment process. As such, this is a process that is under the control and jurisdiction of MWD, that is already being conducted, and that will not be addressed in this report.

RECOMMENDATIONS FOR FURTHER ACTION

The drinking water quality of the City of Santa Monica meets all SWRCB/Division of Drinking Water and USEPA drinking water standards set to protect public health. The City's RO softening plant commissioned in December 2010 is achieving further reduction of many of the constituents identified in this report from the City's groundwater supply. To further reduce the levels of these constituents that are already significantly below the established health-based Maximum Contaminant Levels (MCL) would typically require that additional costly treatment processes be constructed. 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 clear and may not be quantifiable. Therefore, no action is proposed at this time.

EXHIBITS:

A. California Health and Safety Code Section 116470(b)
B. List of Regulated Constituents with MCLs, PHGs or MCLGs
C. Numerical Health Risk Information
D. Tables excerpted from Annual Water Quality Reports for 2016 - 2018
E. Cost Estimates for Treatment Technologies
F. Acronyms

Exhibit A

Health and Safety Code
Section 116470 (b)

(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 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.C. Section 300g-3(c).

Exhibit B

ATTACHMENT NO. 1
2019 PHG Triennial Report: Calendar Years 2016-2017-2018

MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants

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

Last Update: December 26, 2018

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	0.0000017	1999
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.07	0.01	0.02	2009
Di(2-ethylhexyl)adipate	0.4	0.005	0.2	2003
Di(2-ethylhexyl)phthalate (DEHP)	0.004	0.003	0.012	1997
Dinoseb	0.007	0.002	0.014	1997 (rev2010)
Diquat	0.02	0.004	0.006	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	2018 draft

Bromoform	--	0.0010	0.0005	2018 draft
Chloroform	--	0.0010	0.0004	2018 draft
Dibromochloromethane	--	0.0010	0.0001	2018 draft
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.				

<u>Exhibit C</u>

This document is available at the following site:
oehha.ca.gov/media/downloads/proposition-65/public-health-goal-report/phgexceedancereport020719.pdf

Health Risk Information for Public Health Goal Exceedance Reports

Prepared by

Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

February 2019

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 Public Health Goals (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 for each 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.

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

The Act requires that OEHHA publish PHGs based on health risk assessments using the most current scientific methods. As defined in statute, PHGs for non-carcinogenic

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

chemicals in drinking water are set at a concentration “at which no known or anticipated adverse health effects will occur, with an adequate margin of safety.” For carcinogens, PHGs are set at a concentration that “does not pose any significant risk to health.” PHGs provide one basis for revising MCLs, along with cost and technological feasibility. OEHHA has been publishing PHGs since 1997 and the entire list published to date is shown in Table 1.

Table 2 presents health risk information for contaminants that do not have PHGs but have state or federal regulatory standards. The Act requires that, for chemical contaminants with California MCLs that do not yet have PHGs, water utilities use the federal Maximum Contaminant Level Goal (MCLG) for the purpose of complying with the requirement of public notification. MCLGs, like PHGs, are strictly health based and include a margin of safety. One difference, however, is that the MCLGs for carcinogens are set at zero because the US Environmental Protection Agency (US EPA) assumes there is no absolutely safe level of exposure to such chemicals. PHGs, on the other hand, are set at a level considered to pose no *significant* risk of cancer; this is usually 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 chemical with a PHG are summarized in a PHG technical support document. These documents are available on the OEHHA website (http://www.oehha.ca.gov). Also, technical fact sheets on most of the chemicals having federal MCLs can be found at http://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants.

Office of Environmental Health Hazard Assessment
Water Toxicology Section
February 2019

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	digestive system toxicity (causes vomiting)	0.02	NA	0.006	NA
Arsenic	carcinogenicity (causes cancer)	0.000004 (4×10^{-6})	1×10^{-6} (one per million)	0.01	2.5×10^{-3} (2.5 per thousand)
Asbestos	carcinogenicity (causes cancer)	7 MFL[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: http://oehha.ca.gov/multimedia/green/pdf/GC_Regtext011912.pdf).
[2] mg/L = milligrams per liter of water or parts per million (ppm)
[3] Cancer Risk = Upper 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
Diethylhexyl-phthalate (DEHP)	carcinogenicity (causes cancer)	0.012	1×10^{-6}	0.004	3×10^{-7} (three per ten million)

[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
1,2-Dibromo-3-chloropropane (DBCP)	carcinogenicity (causes cancer)	0.0000017 (1.7×10^{-6})	1×10^{-6}	0.0002	1×10^{-4} (one per ten thousand)
1,2-Dichloro-benzene (*o*-DCB)	hepatotoxicity (harms the liver)	0.6	NA	0.6	NA
1,4-Dichloro-benzene (*p*-DCB)	carcinogenicity (causes cancer)	0.006	1×10^{-6}	0.005	8×10^{-7} (eight per ten million)
1,1-Dichloro-ethane (1,1-DCA)	carcinogenicity (causes cancer)	0.003	1×10^{-6}	0.005	2×10^{-6} (two per million)
1,2-Dichloro-ethane (1,2-DCA)	carcinogenicity (causes cancer)	0.0004	1×10^{-6}	0.0005	1×10^{-6} (one per million)
1,1-Dichloro-ethylene (1,1-DCE)	hepatotoxicity (harms the liver)	0.01	NA	0.006	NA
1,2-Dichloro-ethylene, cis	nephrotoxicity (harms the kidney)	0.013	NA	0.006	NA
1,2-Dichloro-ethylene, trans	immunotoxicity (harms the immune system)	0.05	NA	0.01	NA
Dichloromethane (methylene chloride)	carcinogenicity (causes cancer)	0.004	1×10^{-6}	0.005	1×10^{-6} (one 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
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
Ethylene dibromide (1,2-Dibromoethane)	carcinogenicity (causes cancer)	0.00001	1×10^{-6}	0.00005	5×10^{-6} (five 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
Fluoride	musculoskeletal toxicity (causes tooth mottling)	1	NA	2	NA
Glyphosate	nephrotoxicity (harms the kidney)	0.9	NA	0.7	NA
Heptachlor	carcinogenicity (causes cancer)	0.000008 (8×10^{-6})	1×10^{-6}	0.00001	1×10^{-6} (one per million)
Heptachlor epoxide	carcinogenicity (causes cancer)	0.000006 (6×10^{-6})	1×10^{-6}	0.00001	2×10^{-6} (two per million)
Hexachloroben-zene	carcinogenicity (causes cancer)	0.00003	1×10^{-6}	0.001	3×10^{-5} (three per hundred thousand)
Hexachloro-cyclopentadiene (HCCPD)	digestive system toxicity (causes stomach lesions)	0.002	NA	0.05	NA
Lead	developmental neurotoxicity (causes neurobehavioral effects in children) cardiovascular toxicity (causes high blood pressure) carcinogenicity (causes cancer)	0.0002	$<1 \times 10^{-6}$ (PHG is not based on this effect)	0.015 (AL[8])	2×10^{-6} (two per million)
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

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
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
Nitrate and Nitrite	hematotoxicity (causes methemoglobinemia)	10 as nitrogen[10]	NA	10 as nitrogen	NA

[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
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)
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

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
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)
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

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
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
1,1,2-Trichloro-ethane	carcinogenicity (causes cancer)	0.0003	$1 x 10^{-6}$	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)

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
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
Tritium	carcinogenicity (causes cancer)	400 pCi/L	1×10^{-6}	20,000 pCi/L	5×10^{-5} (five per hundred thousand)
Uranium	carcinogenicity (causes cancer)	0.43 pCi/L	1×10^{-6}	20 pCi/L	5×10^{-5} (five per hundred thousand)
Vinyl chloride	carcinogenicity (causes cancer)	0.00005	1×10^{-6}	0.0005	1×10^{-5} (one per hundred thousand)
Xylene	neurotoxicity (affects the senses, mood, and motor control)	1.8 (single isomer or sum of isomers)	NA	1.75 (single isomer or sum of isomers)	NA

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

Chemical	Health Risk Category[1]	US EPA MCLG[2] (mg/L)	Cancer Risk[3] @ MCLG	California MCL[4] (mg/L)	Cancer Risk @ California MCL
Disinfection byproducts (DBPs)					
Chloramines	acute toxicity (causes irritation) digestive system toxicity (harms the stomach) hematotoxicity (causes anemia)	4[5,6]	NA[7]	none	NA
Chlorine	acute toxicity (causes irritation) digestive system toxicity (harms the stomach)	4[5,6]	NA	none	NA
Chlorine dioxide	hematotoxicity (causes anemia) neurotoxicity (harms the nervous system)	0.8[5,6]	NA	none	NA
Disinfection byproducts: haloacetic acids (HAA5)					
Monochloroacetic acid (MCA)	general toxicity (causes body and organ weight changes[8])	0.07	NA	none	NA
Dichloroacetic acid (DCA)	carcinogenicity (causes cancer)	0	0	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] @ MCLG	California MCL[4] (mg/L)	Cancer Risk @ California MCL
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
Disinfection byproducts: trihalomethanes (THMs)					
Bromodichloro-methane (BDCM)	carcinogenicity (causes cancer)	0	0	none	NA
Bromoform	carcinogenicity (causes cancer)	0	0	none	NA
Chloroform	hepatotoxicity and nephrotoxicity (harms the liver and kidney)	0.07	NA	none	NA
Dibromo-chloromethane (DBCM)	hepatotoxicity, nephrotoxicity, and neurotoxicity (harms the liver, kidney, and nervous system)	0.06	NA	none	NA

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] @ MCLG	California MCL[4] (mg/L)	Cancer Risk @ California MCL
Total trihalomethanes (sum of BDCM, bromoform, chloroform and DBCM)	carcinogenicity (causes cancer), hepatotoxicity, nephrotoxicity, and neurotoxicity (harms the liver, kidney, and nervous system)	none	NA	0.08	NA
Radionuclides					
Gross alpha particles[9]	carcinogenicity (causes cancer)	0 (^{210}Po included)	0	15 pCi/L[10] (includes ^{226}Ra but not radon and uranium)	up to 1×10^{-3} (for ^{210}Po, the most potent alpha emitter
Beta particles and photon emitters[9]	carcinogenicity (causes cancer)	0 (^{210}Pb included)	0	50 pCi/L (judged equiv. to 4 mrem/yr)	up to 2×10^{-3} (for ^{210}Pb, the most potent beta-emitter)

[9] MCLs for gross alpha and beta particles are screening standards for a group of radionuclides. Corresponding PHGs were not developed for gross alpha and beta particles. See the OEHHA memoranda discussing the cancer risks at these MCLs at http://www.oehha.ca.gov/water/reports/grossab.html.
[10] pCi/L = picocuries per liter of water.

Exhibit D

CITY OF SANTA MONICA PUBLIC WORKS/WATER RESOURCES DIVISION

Summary of Results for Primary Drinking Water Standards for 2016

Parameter	PHG/ [MCLG]/ {MRDLG}	State MCL/ {MRDL}	LOCAL WELL WATER Arcadia Plant Average	LOCAL WELL WATER Arcadia Plant Range	SM WELL #1(a) Average	SM WELL #1(a) Range	IMPORTED SURFACE WATER Weymouth Plant Average	IMPORTED SURFACE WATER Weymouth Plant Range	IMPORTED SURFACE WATER Jensen Plant Average	IMPORTED SURFACE WATER Jensen Plant Range	Dates Sampled if other than 2016(b)	Meets Std	MAJOR SOURCES IN DRINKING WATER
PRIMARY DRINKING WATER STANDARDS (MANDATORY HEALTH-RELATED STANDARDS)													
Clarity													
Maximum Turbidity (NTU)	NS	95% < 0.3	N/A	N/A	N/A	N/A	0.03	100% ≤ 0.3	0.05	100% ≤ 0.3		Y	Soil runoff
Microbiological													
Total Coliform Bacteria (% positive samples/month)	[0]	5%	City-wide Maximum: 0 Positive Samples									Y	Naturally present in the environment
Fecal Coliform/E. Coli	[0]	(c)	City-wide Maximum: 0 Positive Samples									Y	Human and animal fecal waste
Organic Chemical													
Methyl tert-Butyl Ether (MTBE) (ppb)	13	13(5*)	ND	ND	ND	ND	ND	ND	ND	ND		Y	Leaking underground storage tanks
Trichloroethylene (ppb)	1.7	5	0.4	ND - 0.7	ND	ND	ND	ND	ND	ND		Y	Discharge from metal degreasing sites
Disinfection Byproducts & Residuals													
Total Trihalomethanes (ppb)	NS	80	City-wide LRAA: 28.6 Range: 3.2 - 39.9									Y	By-product of drinking water chlorination
Haloacetic Acids (ppb)	NS	60	City-wide LRAA: 7 Range: ND - 14.3									Y	By-product of drinking water chlorination
Total Chlorine/Chloramines (ppm)	{4}	{4}	City-wide Average: 1.1 Range: ND - 2.5									Y	Drinking water disinfectant added for treatment
Bromate (ppb)	0.1	10	N/A	N/A	N/A	N/A	N/A	N/A	7.4	4.4 - 13		Y	By-product of drinking water ozonation
Inorganic Chemicals													
Aluminum (ppm)	0.6	1 (0.2*)	ND	ND	ND	ND	0.16	0.08 - 0.22	0.10	ND - 0.13	2015	Y	Erosion of natural deposits; used in water treatment process
Arsenic (ppb)	0.004	10	ND	ND	1.0	1.0	ND	ND	3.1	3.1	2015	Y	Erosion of natural deposits
Barium (ppm)	2	1	0.02	0.02	0.05	0.05	0.14	0.14	ND	ND	2015	Y	Discharge from oil and metal industries; Erosion of natural deposits
Chromium (ppb)	[100]	50	0.3	0.3 - 0.4	1.7	1.6 - 1.7	ND	ND	ND	ND	2015	Y	Discharge from steel and pulp mills; natural deposits erosion
Chromium 6 (ppb)	0.02	10	0.2	0.2	1.6	1.6	ND	ND	ND	ND	2015	Y	Naturally occuring; industrial waste discharge
Copper (d) (ppm)	0.3	AL=1.3 (1.0*)	City-wide, 90th percentile: 0.20 0 sites out of 32 exceeded the AL									Y	Corrosion of household plumbing systems
Fluoride After Treatment (ppm)	1	2	Control Range: 0.6 - 1.2 Citywide Range: 0.3 - 1.0									Y	Water additive for dental health
Lead (d) (ppb)	0.2	AL=15	City-wide, 90th percentile: 3.0 0 sites out of 32 exceeded the AL									Y	Corrosion of household plumbing systems
Nitrate (as N) (ppm)	10	10	1.0	0.9 - 1.1	3.8	3.4 - 4.4	ND	ND	0.8	0.6 - 0.9		Y	Runoff from fertilizer use; leaching from sewage;
Perchlorate (ppb)	1	6	ND	ND	ND	ND	ND	ND	ND	ND		Y	Industrial waste discharge
Radionuclides													
Alpha emitters (pCi/l)	[0]	15	ND	ND	ND	ND	ND	ND - 4	3	ND - 5	2014	Y	Erosion of natural deposits
Beta/photon emitters (pCi/l)	[0]	50	N/A	N/A	N/A	N/A	5	4 - 6	ND	ND - 5	2014	Y	Decay of natural and man-made deposits
Combined Radium (pCi/l)	[0]	5	ND	ND	ND	ND	ND	ND	ND	ND		Y	Erosion of natural deposits
Uranium (pCi/l)	0.43	20	2.5	2.3 -2.9	0.7	0.7	3	2 - 3	2	2 - 3		Y	Erosion of natural deposits

KEY TO ABBREVIATIONS

Primary Drinking Water Standards = MCLs and MRDLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.
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.
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.
MCL = Maximum Contaminant Level, The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. Secondary MCLs are set to protect the odor, taste, and appearance of drinking water.
MRDLG = Maximum Residual Disinfectant Level Goal, 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.
MRDL = Maximum Residual Disinfectant Level, 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.

LRAA = Locational Running Annual Average. The running annual average is based on monitoring location.
AL = Action Level, or the concentration of a contaminant which, when exceeded, triggers treatment or other requirements which a water system must follow.
N/A = Not Applicable
NS = No Standard
ND = Monitored for but Not Detected
NTU = Nephelometric Turbidity Units - used to measure cloudiness of drinking water.
RAL = Regulatory Action 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.
Variances and Exemptions: State Board permission to exceed an MCL or not comply with a treatment technique under certain conditions.
ppb = parts per billion, or micrograms per liter (μg/l)
ppm = parts per million, or milligrams per liter (mg/l)
pCi/l = picocuries per liter

***** = secondary standard
(a) = SM Well#1 is pumped into a transmission line, is blended with Imported Surface Water and enters the system at 19th St. & Idaho Ave.
(b) = The City is not required to test for every parameter each year. If indicated, data is from a previous year.
(c) = Two consecutive Total Coliform-positive samples, one of which contains Fecal Coliform/E. Coli constitutes an acute MCL violation. No violations occurred for 2015.
(d) = The MCL has been replaced with a treatment technique requiring agencies to optimize corrosion control. Results given are from first draw, at-the-tap monitoring performed every three years.

FOR ADDITIONAL WATER QUALITY QUESTIONS, CONTACT JACK MIYAMOTO, LEAD CHEMIST AT 310-434-2672

CITY OF SANTA MONICA WATER RESOURCES DIVISION

Summary of Results for Primary Drinking Water Standards for 2017

Parameter	PHG/ [MCLG]/ {MRDLG}	State MCL/ {MRDL}	LOCAL WELL WATER Arcadia Plant Average	Range	SM WELL #1(a) Average	Range	IMPORTED SURFACE WATER Weymouth Plant Average	Range	IMPORTED SURFACE WATER Jensen Plant Average	Range	Dates Sampled if other than 2017(b)	Meets Std	MAJOR SOURCES IN DRINKING WATER
PRIMARY DRINKING WATER STANDARDS (MANDATORY HEALTH-RELATED STANDARDS)													
Clarity													
Maximum Turbidity (NTU)	NS	95% < 0.3	N/A	N/A	N/A	N/A	0.04	100% ≤ 0.3	0.06	100% ≤ 0.3		Y	Soil runoff
Microbiological													
Total Coliform Bacteria (% positive samples/month)	[0]	5%	Highest percent of monthly samples positive was 1.35%									Y	Naturally present in the environment
Fecal Coliform/E. Coli	[0]	(c)	City-wide Maximum: 0 Positive Samples									Y	Human and animal fecal waste
Organic Chemical													
Methyl tert-Butyl Ether (MTBE) (ppb)	13	13(5*)	ND	ND	ND	ND	ND	ND	ND	ND		Y	Leaking underground storage tanks
Trichloroethylene (ppb)	1.7	5	0.4	ND - 0.7	ND	ND	ND	ND	ND	ND		Y	Discharge from metal degreasing sites
Disinfection Byproducts & Residuals													
Total Trihalomethanes (ppb)	NS	80	City-wide LRAA: 16.9 Range: 4.1 - 50.4									Y	By-product of drinking water chlorination
Haloacetic Acids (ppb)	NS	60	City-wide LRAA: 1.1 Range: ND - 6.6									Y	By-product of drinking water chlorination
Total Chlorine/Chloramines (ppm)	{4}	{4}	City-wide Average: 1.5 Range: ND - 2.6									Y	Drinking water disinfectant added for treatment
Bromate (ppb)	0.1	10	N/A	N/A	N/A	N/A	N/A	2.6 - 5.0	7.4	3.3 - 8.9		Y	By-product of drinking water ozonation
Total Organic Carbon	N/A	TT	N/A	N/A	N/A	N/A	2.5	2.0 - 2.9	2.5	2.3 - 3.1			
Inorganic Chemicals													
Aluminum (ppm)	0.6	1 (0.2*)	ND	ND	0.03	0.03	0.17	ND - 0.21	0.09	ND - 0.12		Y	Erosion of natural deposits; used in water treatment process
Arsenic (ppb)	0.004	10	ND	ND	1.2	1.2	ND	ND	ND	ND - 2.4		Y	Erosion of natural deposits
Barium (ppm)	2	1	0.02	0.01 - 0.02	0.04	0.04	ND	ND	ND	ND		Y	Discharge from oil and metal industries; Erosion of natural deposits
Chromium (ppb)	[100]	50	ND	ND	ND	ND	ND	ND	ND	ND		Y	Discharge from steel and pulp mills; natural deposits erosion
Chromium 6 (ppb)	0.02	NS	0.2	0.2	1.6	1.6	ND	ND	ND	ND		Y	Naturally occuring; industrial waste discharge
Copper (d) (ppm)	0.3	AL=1.3 (1.0*)	City-wide, 90th percentile: 0.20 0 sites out of 32 exceeded the AL								2016	Y	Corrosion of household plumbing systems
Fluoride After Treatment (ppm)	1	2	Control Range: 0.6 - 1.2 Citywide Range: 0.3 - 1.0									Y	Water additive for dental health
Lead (d) (ppb)	0.2	AL=15	City-wide, 90th percentile: 3.16 0 sites out of 46 exceeded the AL									Y	Corrosion of household plumbing systems
Nitrate (as N) (ppm)	10	10	0.9	0.8 - 1.1	3.3	3.0 - 3.5	ND	ND	0.6	0.6		Y	Runoff from fertilizer use; leaching from sewage; erosion of natural deposits
Perchlorate (ppb)	1	6	ND	ND	ND	ND	ND	ND	ND	ND		Y	Industrial waste discharge
Radionuclides													
Alpha emitters (pCi/l)	[0]	15	ND	ND	ND	ND	ND	ND	ND	ND - 3		Y	Erosion of natural deposits
Beta/photon emitters (pCi/l)	[0]	50	N/A	N/A	N/A	N/A	ND	ND	ND	ND		Y	Decay of natural and man-made deposits
Combined Radium (pCi/l)	[0]	5	ND	ND	ND	ND	ND	ND	ND	ND		Y	Erosion of natural deposits
Uranium (pCi/l)	0.43	20	2.4	2.0 -3.4	0.8	0.8	ND	ND	ND	ND - 1		Y	Erosion of natural deposits

KEY TO ABBREVIATIONS

FOR ADDITIONAL WATER QUALITY QUESTIONS, CONTACT JACK MIYAMOTO, LEAD CHEMIST AT (310) 434-2672

Primary Drinking Water Standards = MCLs and MRDLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.
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***** = secondary standard
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(c) = Two consecutive Total Coliform-positive samples, one of which contains Fecal Coliform/E. Coli constitutes an acute MCL violation. No violations occurred for 2017.
(d) = The MCL has been replaced with a treatment technique requiring agencies to optimize corrosion control. Results given are from first draw, at-the-tap monitoring performed every three years.
(e) = 13 public Schools and 1 private school have requested lead sampling in 2017.

CITY OF SANTA MONICA WATER RESOURCES DIVISION

SUMMARY OF RESULTS FOR PRIMARY DRINKING WATER STANDARDS FOR 2018

Parameter	PHG/ [MCLG]/ {MRDLG}	State MCL/ {MRDL}	LOCAL WELL WATER Arcadia Plant Average	LOCAL WELL WATER Arcadia Plant Range	SM WELL #1(a) Average	SM WELL #1(a) Range	IMPORTED SURFACE WATER Weymouth Plant Average	IMPORTED SURFACE WATER Weymouth Plant Range	IMPORTED SURFACE WATER Jensen Plant Average	IMPORTED SURFACE WATER Jensen Plant Range	Dates Sampled if other than 2018(b)	Meets Std	MAJOR SOURCES IN DRINKING WATER
PRIMARY DRINKING WATER STANDARDS (MANDATORY HEALTH-RELATED STANDARDS)													
Clarity													
Maximum Turbidity (NTU)	NS	95% < 0.3	N/A	N/A	N/A	N/A	0.04	100% ≤ 0.3	0.06	100% ≤ 0.3		Y	Soil runoff
Microbiological													
Total Coliform Bacteria (% positive samples/month)	[0]	5%	Highest percent of monthly samples positive was 0.82% Range: ND - 0.82%									Y	Naturally present in the environment
Fecal Coliform/E. Coli	[0]	(c)	City-wide Maximum: 0 Positive Samples									Y	Human and animal fecal waste
Organic Chemical													
Methyl tert-Butyl Ether (MTBE) (ppb)	13	13(5*)	ND	ND	ND	ND	ND	ND	ND	ND		Y	Leaking underground storage tanks
Trichloroethylene (ppb)	1.7	5	0.5	ND - 0.7	ND	ND	ND	ND	ND	ND		Y	Discharge from metal degreasing sites
Disinfection Byproducts & Residuals													
Total Trihalomethanes (ppb)	NS	80	City-wide LRAA: 16.9 Range: 4.5 - 40.2									Y	By-product of drinking water chlorination
Haloacetic Acids (ppb)	NS	60	City-wide LRAA: 1.7 Range: ND - 7.5									Y	By-product of drinking water chlorination
Total Chlorine/Chloramines (ppm)	{4}	{4}	City-wide Average: 1.39 Range: ND - 2.8									Y	Drinking water disinfectant added for treatment
Bromate (ppb)	0.1	10	N/A	N/A	N/A	N/A	5.2	ND - 6.4	5	ND - 10		Y	By-product of drinking water ozonation
Total Organic Carbon	N/A	TT	N/A	N/A	N/A	N/A	2.6	2.0 - 2.6	2.4	2.1 - 2.8			
Inorganic Chemicals													
Aluminum (ppm)	0.6	1 (0.2*)	ND	ND	ND	ND	ND	ND - 0.075	0.11	ND - 0.22		Y	Erosion of natural deposits; used in water treatment process
Arsenic (ppb)	0.004	10	ND	ND	0.6	0.6	ND	ND	ND	ND		Y	Erosion of natural deposits
Barium (ppm)	2	1	0.02	0.02	0.06	0.06	ND	ND	0.12	0.12		Y	Discharge from oil and metal industries; Erosion of natural deposits
Chromium (ppb)	[100]	50	ND	ND	ND	ND	ND	ND	ND	ND		Y	Discharge from steel and pulp mills; natural deposits erosion
Chromium 6 (ppb)	0.02	NS	0.2	0.2	1.7	1.7	ND	ND	ND	ND		Y	Naturally occuring; industrial waste discharge
Copper (d) (ppm)	0.3	AL=1.3 (1.0*)	City-wide, 90th percentile: 0.20 0 sites out of 32 exceeded the AL								2016	Y	Corrosion of household plumbing systems
Fluoride After Treatment (ppm)	1	2	Control Range: 0.6 - 1.2 Citywide Range: 0.3 - 1.0									Y	Water additive for dental health
Lead (d) (ppb)	0.2	AL=15	City-wide, 90th percentile: 3.16 0 sites out of 46 exceeded the AL (e)								2017	Y	Corrosion of household plumbing systems
Nitrate (as N) (ppm)	10	10	0.7	0.6 - 0.9	2.4	1.9 - 3.3	0.5	0.5	ND	ND		Y	Runoff from fertilizer use; leaching from sewage; erosion of natural deposits
Perchlorate (ppb)	1	6	ND	ND	ND	ND	ND	ND	ND	ND		Y	Industrial waste discharge
Radionuclides													
Alpha emitters (pCi/l)	[0]	15	ND	ND	ND	ND	ND	ND - 3	ND	ND		Y	Erosion of natural deposits
Beta/photon emitters (pCi/l)	[0]	50	N/A	N/A	N/A	N/A	ND	ND	ND	ND		Y	Decay of natural and man-made deposits
Combined Radium (pCi/l)	[0]	5	ND	ND	ND	ND	ND	ND	ND	ND		Y	Erosion of natural deposits
Uranium (pCi/l)	0.43	20	2.3	2.0 -2.7	0.8	0.8	ND	ND -1	ND	ND		Y	Erosion of natural deposits

KEY TO ABBREVIATIONS

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ppb = parts per billion, or micrograms per liter (µg/l)

ppm = parts per million, or milligrams per liter (mg/l)

pCi/l = picocuries per liter

***** = secondary standard

(a) = SM Well#1 is pumped into a transmission line, is blended with Imported Surface Water and enters the system at 19th St. & Idaho Ave.

(b) = 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 a year old.

(c) = Two consecutive Total Coliform-positive samples, one of which contains Fecal Coliform/E. Coli constitutes an acute MCL violation. No violations occurred for 2018.

(d) = The MCL has been replaced with a treatment technique requiring agencies to optimize corrosion control. Results given are from first draw, at-the-tap monitoring performed every three years.

(e) = 13 public Schools and 1 private school have requested lead sampling in 2018.

Exhibit E

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 2018* ($/1,000 gallons treated)
1	Ion Exchange	Coachella Valley WD, for GW, to reduce Arsenic concentrations. 2011 costs.	2.19
2	Ion Exchange	City of Riverside Public Utilities, for GW, for Perchlorate treatment.	1.06
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.	0.80
4	Granular Activated Carbon	City of Riverside Public Utilities, GW sources, for TCE, DBCP (VOC, SOC) treatment.	0.53
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.	0.38
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.	1.62
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.	0.86
8	Packed Tower Aeration	City of Monrovia, treatment to reduce TCE, PCE concentrations. 2011-12 costs.	0.47
9	Ozonation+ Chemical addition	SCVWD, STWTP treatment plant includes chemical addition + ozone generation costs to reduce THM/HAAs concentrations. 2009-2012 costs.	0.10

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 2018* ($/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.	0.21
11	Coagulation/Filtration	Soquel WD, treatment to reduce manganese concentrations in GW. 2011 costs.	0.80
12	Coagulation/Filtration Optimization	San Diego WA, costs to reduce THM/Bromate, Turbidity concentrations, raw SW a blend of State Water Project water and Colorado River water, treated at Twin Oaks Valley WTP.	0.91
13	Blending (Well)	Rancho California WD, GW blending well, 1150 gpm, to reduce fluoride concentrations.	0.76
14	Blending (Wells)	Rancho California WD, GW blending wells, to reduce arsenic concentrations, 2012 costs.	0.62
15	Blending	Rancho California WD, using MWD water to blend with GW to reduce arsenic concentrations. 2012 costs.	0.74
16	Corrosion Inhibition	Atascadero Mutual WC, corrosion inhibitor addition to control aggressive water. 2011 costs.	0.09

*Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average building costs of 2018 and 2012. The adjustment factor was derived from the ratio of 2018 Index/2012 Index, or 1.188.

For the indexed 2015 costs, please refer to the ACWA PHG Guidance published in March 2016.

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 2018*** ($/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.	1.74 - 10.97
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.	1.79 - 7.47
3	IX	Golden State Water Co., IX w/disposable resin, 1 MGD, Perchlorate removal, built in 2010.	0.55
4	IX	Golden State Water Co., IX w/disposable resin, 1000 gpm, perchlorate removal (Proposed; O&M estimated).	1.19
5	IX	Golden State Water Co., IX with brine regeneration, 500 gpm for Selenium removal, built in 2007.	7.81
6	GFO/Adsorption	Golden State Water Co., Granular Ferric Oxide Resin, Arsenic removal, 600 gpm, 2 facilities, built in 2006.	2.04 - 2.18
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.	2.67
8	IX	Reference: Inland Empire Utilities Agency : Chino Basin Desalter. IX cost to reduce 150 ppm Nitrate (as NO3); approx. 2.6 mgd.	1.49

9	Packed Tower Aeration	Reference: Inland Empire Utilities Agency : Chino Basin Desalter. PTA-VOC air stripping, typical treated flow of approx. 1.6 mgd.	0.45
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.	0.62 - 0.88
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.	0.41
12	FBR	Reference: West Valley WD/Envirogen design data for the O&M + actual capitol costs, 2.88 mgd fluidized bed reactor (FBR) treatment system, Perchlorate and Nitrate removal, followed by multimedia filtration & chlorination, 2012. NOTE: The capitol cost for the treatment facility for the first 2,000 gpm is $23 million annualized over 20 years with ability to expand to 4,000 gpm with minimal costs in the future. $17 million funded through state and federal grants with the remainder funded by WVWD and the City of Rialto.	1.84 - 1.94

*Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average building costs of 2018 and 2012. The adjustment factor was derived from the ratio of 2018 Index/2012 Index, or 1.188.

For the indexed 2015 costs, please refer to the ACWA PHG Guidance published in March 2016.

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 2018* ($/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	0.63 - 1.19
2	Granular Activated Carbon	Reference: Carollo Engineers, estimate for VOC treatment (PCE), 95% removal of PCE, Oct. 1994,1900 gpm design capacity	0.29
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	1.38
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	0.54 - 0.78
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	2.47
6	Granular Activated Carbon	Reference: Southern California Water Co. - actual data for permanent GAC to remove VOCs (TCE), 2.16 mgd plant capacity, 1998	1.60
7	Reverse Osmosis	Reference: Malcolm Pirnie estimate for California Urban Water Agencies, large surface water treatment plants treating water from the State Water Project to meet Stage 2 D/DBP and bromate regulation, 1998	1.85 - 3.55
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	4.38
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	2.70
10	Reverse Osmosis	Reference: Boyle Engineering, RO cost to reduce 1000 ppm TDS in brackish groundwater in So. Calif., 10.0 mgd plant operated at 40% of design flow, high brine line cost, May 1991	2.92

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated 2012 Unit Cost Indexed to 2018* ($/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	2.26
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	7.33
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	4.33
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	3.24
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	2.01
16	Reverse Osmosis	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility with RO to remove nitrate, 1990	2.02 - 3.55
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	1.16
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	0.62
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	0.31
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	0.32
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	0.50 - 0.82

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

No.	Treatment Technology	Source of Information	Estimated 2012 Unit Cost Indexed to 2018* ($/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	0.61
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	0.14 - 0.29
24	Ion Exchange	Reference: CH2M Hill study on San Gabriel Basin, for 135 mgd central treatment facility - ion exchange to remove nitrate, 1990	0.67 - 0.88

*Costs were adjusted from date of original estimates to present, where appropriate, using the Engineering News Record (ENR) annual average building costs of 2018 and 2012. The adjustment factor was derived from the ratio of 2018 Index/2012 Index, or 1.188.
For the indexed 2015 costs, please refer to the ACWA PHG Guidance published in March 2016.

EXHIBIT F

ACRONYMS

ACWA - Association of California Water Agencies

AL - Action Level

BAT - Best Available Technology

Cal/EPA - California Environmental Protection Agency

CCR - California Code of Regulations

DBP - Disinfection Byproduct

DDW – Division of Drinking Water

DLR - Detection Level for purposes of Reporting

GAC - Granular Activated Carbon

MCL - Maximum Contaminant Level

MCLG - Maximum Contaminant Level Goal

mg/l - milligrams per liter

MWD - Metropolitan Water District

ND - Not Detected

NL - Notification Level

OEHHA - Office of Environmental Health Hazard Assessment

pCi/l - picoCuries per liter

PHG – Public Health Goal

PPM – Parts Per Million (1 / 1,000,000)

PPB – Parts Per Billion (1 / 1,000,000,000)

PPT – Parts Per Trillion (1 / 1,000,000,000,000)

PTA - Packed Tower Aeration

RAA - Running Annual Average

RO - Reverse Osmosis

SWRCB – State Water Resource Control Board

TCE –Trichloroethylene

TTHMs - Total Trihalomethanes

USEPA - United States Environmental Protection Agency

VOC - Volatile Organic Compound