City of
Santa Monica®

CITY OF SANTA MONICA
REPORT ON WATER QUALITY
RELATIVE TO PUBLIC HEALTH GOALS

June 2016

BACKGROUND

The California legislature has established the concept of a Public Health Goal (PHG). PHGs are established by the California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA). A 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 State Water Resource Control Board (SWRCB)/Division of Drinking Water (DDW), formerly the California Department of Public Health, uses PHGs in the evaluation of health-related drinking water standards, known as Maximum Contaminant Levels (MCLs). DDW uses PHGs to identify MCLs that are to be reviewed for possible revision or when setting new MCLs for unregulated chemicals.

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, 2016 if their water quality measurements have 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 Goal (MCLG) adopted by the United States Environmental Protection Agency (USEPA). MCLGs are the federal equivalent to PHGs, but are not identical. 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 in this report. 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 2013, 2014, and 2015 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.

WHAT ARE 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 of the water quality data collected for Santa Monica's water system between 2013 and 2015 for purposes of determining compliance with drinking water standards were considered. This information was summarized in tables included in the Annual Water Quality Reports made available to all Santa Monica customers, residents, and businesses in June 2014, June 2015 and June 2016 (Exhibit D).

Most of the constituents tested in the water were reported as Not Detected (ND) and are not generally listed in the Annual Water Quality Reports. When a constituent is reported as ND, it generally means that the laboratory did not detect the compound, but it could also mean 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 the 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. 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 what treatment is needed to further reduce a constituent down to or near 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. For some constituents such as Total Coliform Bacteria and Trichloroethylene, no detections above the MCLG or PHG occurred during the period covered by this report, but have appeared in previous PHG reports and are discussed again for comparison purposes. Santa Monica consistently delivers safe water at the lowest possible cost to its customers using multiple treatment methods approved by DDW. 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. No more than 5% of all samples collected in a month can be positive for total coliforms. This defines the MCL. Although there is no PHG for total coliform bacteria, the MCLG is zero positive samples. 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. Because total coliform analysis is only a surrogate indicator of the potential presence of pathogens, it is not possible to state a specific numerical health risk. While USEPA normally sets MCLGs "at a level where no known or anticipated adverse effects on persons would occur", EPA 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, about 80 of the sites where samples are taken for total coliform bacteria are taps, typically hose bibbs, on private residences or businesses. 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 test positive on rare occasion.

During the period covered by this report, the City collected between 119 and 142 samples each month for total coliform analysis. No samples were found to be positive for total coliform bacteria for calendar years 2013 - 2015.

In an effort to reduce the potential for positive results due to taps exposed to the open environment, the Water Resources Division (Division) has a program to prioritize the sites and install more dedicated sampling stations. The dedicated samplers are enclosed in a lockable box and are protected from the environment. Two new boxes were installed during the period covered by this report with plans to complete more in the future in conjunction with the Division's main line replacement program.

The Division 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 Division has already taken all of the steps described by the DDW as Best Available Technology (BAT) for Coliform Bacteria in Section 6447, 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 the distribution sampling sites, staff recommends no change to the existing treatment.

- **<u>Trichloroethylene (TCE)</u>**

The PHG for trichloroethylene (TCE) is 0.0017 milligrams per liter (mg/l). The MCL for TCE is 0.005 mg/l. The level of TCE in the City's groundwater and supplemental supplies was below the MCL and PHG at all times during the period of this report.

Trichloroethylene is a volatile organic compound (VOC). It is a manmade solvent used since the 40's and 50's as a degreaser, parts cleaner, and in other industries. In the last several decades, TCE has shown up increasingly in groundwater supplies in Southern California and elsewhere. TCE was discovered at low levels in several of the City's wells located along or near Olympic Boulevard in 1980. Initially the TCE from the Olympic Wells was diluted in the mixture with other, uncontaminated wells. As the TCE levels increased over time, several wells had to be turned off until treatment to remove the TCE could be installed. In 1992, the Division completed an expansion and upgrade to the Arcadia Treatment Plant that included mechanical aeration to remove TCE in the combined well flow to a level below the MCL of 0.005 mg/l. The contaminated Olympic Wells were placed back in service and were blended and treated in this way until December 2010 when the City's new Reverse Osmosis (RO) softening plant was commissioned. The new plant includes a decarbonator unit that now provides additional removal of TCE.

The level of TCE in the water produced by the Arcadia Treatment Plant ranged from ND to 0.0007 mg/l for the period covered in this report. The annual average TCE produced at the treatment plant was 0.0005 mg/l in 2015 and ND for 2013 and 2014.

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 for many years could experience an increased risk of getting cancer. DDW says that "Drinking water which meets this standard (the MCL) is associated with little to none of this risk and should be considered safe with respect to TCE." This language is taken from the California Code of Regulations (CCR), Title 22, Section 64468.2. The numerical health risk of ingesting drinking water with TCE above the PHG is $1X10^{-6}$, or one additional theoretical cancer case in one million people drinking two liters of water a day for 70 years. The health risk of ingesting water with TCE above the MCL is six additional theoretical cancer cases in one million people.

The Best Available Technology (BAT) for TCE to lower the concentration below the MCL is either adsorption using liquid phase Granular Activated Carbon (GAC) or Packed Tower Aeration (PTA). However, because the new RO softening plant includes a decarbonator system that is very similar to PTA, the level of TCE is now consistently and reliably below the PHG for TCE. Therefore, no recommendation for further action is advised.

- **Lead and Copper**

There are no MCLs for lead or copper. Lead and copper are not present in our water sources, but 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 and the PHG for copper is 0.3 mg/l.

The last round of testing for lead and copper was conducted by the Water Resources Division in 2013 (next round is summer 2016). The 90th percentile reading for lead in the last round was 0.0028 mg/l and was 0.13 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.

There are two 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.

As stated previously, the City’s water supply is considered to have “optimized corrosion control”. In general, optimizing corrosion control is considered to be BAT to address corrosion issues and any lead and copper findings. The Division will continue to monitor water quality parameters that relate to corrosivity such as pH, hardness, alkalinity and total dissolved solids and will take action, 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. 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 or problems with circulatory systems, and may cause cancer.

Arsenic was below the MCL in all of the City’s water sources at all times during the period covered in this report, however several sources exceeded the PHG during 2014 and 2015. Arsenic readings for all sources for the period covered by this report ranged from ND (Reporting Limit was 0.002 mg/l) to a high of 0.0033 mg/l in the water purchased from the Metropolitan Water District’s (MWD) Jensen Treatment Plant. The annual average for the Jensen supply ranged from ND to 0.0033 mg/l for the period covered by this report and ND to 0.0021 mg/l for the Weymouth supply.

Local groundwater supplies had annual averages for this period that ranged from ND (Reporting Limit was 0.0005 mg/l) to 0.001 mg/l for Santa Monica Well #1. No detection of arsenic was found in water coming from the Arcadia Treatment Plant and the annual average for arsenic in water produced by the treatment plant was ND for calendar years 2013 - 2015.

The category of health risk associated with arsenic is that people who drink water containing arsenic above the MCL for many years could experience an increased cancer risk. 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.

There are two BATs designated for arsenic removal, Ion Exchange and Reverse Osmosis (RO). As previously stated, the City's RO softening plant was commissioned in December 2010 and as expected, is achieving reduction of arsenic to below the level it can be measured. Please note that BATs are designed for treatment to achieve compliance with the corresponding MCL only, and not PHGs. It is unlikely that arsenic will be removed to a level lower than the very low PHG for arsenic. In any case, that level is lower than laboratory tests can detect, so it would be impossible to confirm whether water coming from the Arcadia Treatment Plant, or any given water supply, actually has arsenic lower than the PHG level because it cannot be measured at that 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, so no such determination will be attempted here 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 was below the MCL for all water sources at all times during the period covered in this report, however all sources exceeded the PHG at least once during this period. Uranium readings for the period covered by this report ranged from 1.5 pCi/l to a high of 2.7 pCi/l in the water coming from the Arcadia Treatment Plant. Annual averages for the water coming from the plant ranged from 1.7 to 1.9 pCi/l for calendar years 2013 - 2015. Annual averages for the water coming from MWD's Weymouth and Jensen supplies ranged from ND (Reporting Limit was 1 pCi/l) to 3 pCi/l for the period covered by this report.

The category for health risk associated with uranium is that people who drink water containing uranium above the MCL for many years could experience an increased cancer risk. OEHHA has determined that the numerical cancer risk for uranium above the PHG level is $1x10^{-6}$, or one additional theoretical cancer cases 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. As previously stated, the City's RO softening plant was commissioned in December 2010 and as expected, is achieving some reduction of uranium from the City's groundwater supply. However, BATs are designed for treatment to achieve compliance with the corresponding MCL only, and not PHGs, so this addition of a BAT for uranium 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 ND (Reporting Limit is 0.7 pCi/l) to 0.8 pCi/l for the period covered by this report and so 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 2015 flow rates and estimated costs, this would be in the range of $332,000 per year not including the cost for waste (brine) disposal. 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. It should also be noted that this cost estimate may be imprecise as treatment costs can vary widely depending on the particulars 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, so no such determination will be attempted here 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 are for radionuclides including: 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 are below the MCLs for these constituents at all times during the period covered by this report, but 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 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 as 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 was below the MCL of 15 pCi/l at all times during the period covered by this report, but exceeded the MCLG of zero in some monitoring data. Gross alpha readings for the period covered by this report ranged from ND (Reporting Limit was 2 pCi/l) for all supplies at various times to a high of 5 pCi/l in the water coming from MWD's Jensen Plant in 2014. Annual averages ranged from ND for some of the supplies to 3 pCi/l for water coming from Jensen.

The standard for beta/photon emitters does not apply to the City's groundwater and as such, is not covered by this report. However, the supplemental water the City receives from MWD met the MCL of 50 pCi/l for beta/photon emitters at all times, but exceeded the MCLG of zero in some monitoring data. Readings for beta/photon emitters for both MWD supplies for the period covered by this report ranged from ND (Reporting Limit was 4 pCi/l) to a high of 6 pCi/l in the water coming from MWD's Weymouth Treatment Plant reported for 2014. 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 was below the MCL of 5 pCi/l at all times during the period covered by this report. 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 the same as for uranium. As previously stated, the City's RO softening plant was commissioned in December 2010 and as expected, is achieving some reduction of these other radionuclides from the City's groundwater supply. As explained previously, BATs are designed for treatment to achieve compliance with the corresponding MCL only, and not PHGs, so this 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. Likewise, 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.

- **Bromate**

The PHG for bromate is 0.0001 mg/l. The MCL for bromate is 0.010 mg/l. Bromate is a disinfection byproduct (DBP) formed when water containing naturally occurring bromide ion is ozonated. The MCL for bromate does not apply to single readings but is instead compared to a Running Annual Average (RAA).

The MCL was adopted in 2002 to address concern with potential health effects as evidence suggests that long-term exposure to bromate in drinking water may cause cancer. The standard applies only to water treatment plants that apply ozone for disinfection or other purposes, and so does not apply to the City's groundwater. However, the supplemental water the City receives from MWD's Jensen Treatment Plant is ozonated and met the RAA MCL for bromate of 0.010 mg/l at all times, but exceeded the PHG for the period covered by this report.

The Jensen Treatment Plant was retrofitted with ozone in 2005 as part of MWD's plan to implement ozonation at all six of their treatment plants. The purpose of the retrofit is to insure compliance with new requirements for disinfection of surface waters and new DBP regulations, as well as an improvement in the plants' ability to handle taste and odor episodes resulting from periodic algal blooms in MWD's source reservoirs. As expected, the switch to ozone at the Jensen Treatment Plant resulted in reductions of total trihalomethanes and haloacetic acids, which are classes of DBPs that are also regulated. However, bromate itself is a DBP and the formation of which is a consequence of the switch in disinfectant. Bromate readings for the Jensen Treatment Plant for the period covered by this report ranged from ND (Reporting Level is 0.001 mg/l) to 0.013 mg/l. The highest RAA was 0.008 mg/l for 2015 and demonstrated compliance with the MCL as did all other RAAs for 2013 and 2014.

The category for health risk associated with bromate is that people who drink water containing bromate above the MCL for many years could experience an increased risk of getting cancer. OEHHA has determined that the numerical cancer risk for bromate above the PHG level is $1x10^{-6}$, or one additional theoretical cancer cases 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 to reduce production of this DBP. As such, this is a process that is under the control and jurisdiction of MWD, is already being conducted and will not be addressed further in this report.

- **Hexavalent Chromium (Chromium VI)**

A PHG for chromium VI was set at 0.00002 mg/L in July 2011. The MCL for chromium VI was set at 0.01 mg/l in July 2014. The total chromium MCL of 0.05mg/l was established in 1977 to address the non-cancer toxic effect of chromium VI.

Chromium is an odorless and tasteless metallic element. It is found naturally in rocks, plants and can also be produced by industrial processes. The most common types of chromium found in natural waters in the environment are chromium III and chromium VI. Total chromium is the sum of chromium III and chromium VI. Chromium III and chromium VI are covered together under the total chromium MCL because these forms of chromium can convert back and forth in water depending on environmental conditions.

Chromium III is an essential human dietary element and naturally occurs in many vegetables, fruits, grains and yeast. Chromium VI also occurs naturally in the environment from the erosion of natural chromium deposits from rocks and can also be released in the environment from industrial processes via storage leaks, discharges and improper disposal practices.

Total chromium and chromium VI were below the MCL in all of the City's groundwater sources at all times, but exceeded the PHG for chromium VI at least once during the period covered in this report.   Supplemental water from the Jensen and Weymouth Treatment Plants had no detection of chromium or chromium VI during this reporting period.

Water coming from the Arcadia Water Treatment Plant had chromium VI levels that ranged from ND (Reporting Limit is 0.00002 mg/l) to 0.0002 mg/l for the Arcadia Treatment Plant.

The City's single well not treated by the Arcadia Treatment Plant is Santa Monica Well #1, which had levels for this period ranging from 0.0015 to 0.0016mg/l.

Chromium VI is known to be a potent carcinogen when inhaled. It was found to also cause cancer in laboratory mice and rats when exposed through drinking water. OEHHA has determined that the numerical cancer risk for chromium VI above the PHG level is $1x10^{-6}$, or one additional theoretical cancer cases in one million people drinking two liters of water a day for 70 years.

The recommended technologies for Chromium VI removal are weak base anion exchange resin or reduction-coagulation-filtration technology. Weak base anion exchange is considered the more cost-effective of these two technologies.   However, neither is capable of reducing chromium VI to below 0.001 mg/l. The City's new RO softening plant is already achieving a greater reduction of chromium VI than these alternate technologies.

It is unlikely that any technology will be developed that can reduce chromium VI to below the very low PHG. In any case, that level is lower than laboratory tests can detect, so it would be impossible to confirm whether water coming from the Arcadia Treatment Plant, or any given water supply, actually has chromium VI lower than the PHG level because it cannot be measured at that level. Further treatment for the removal of chromium VI is neither practical, nor feasible, so no recommendations for further action are advised.

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.

ADDITIONAL INFORMATION

1,4-Dioxane

No MCL, MCLG, or PHG exists for 1,4-Dioxane, and as such, is not a requirement for this report. However, DDW has a Notification Level (NL) for 1,4-Dioxane, which was lowered to 0.001 mg/l in 2010. As reported to City Council in 2002, the City's Olympic Wells (Santa Monica Wells 3&4) were found to have 1,4-Dioxane above the NL. The City was advised by DDW in 2002 that it was acceptable to continue the use of these wells as long as the level remained less than 100 times the NL. However, plans for the construction of a new treatment plant targeting 1,4-Dioxane and other contaminants in the Olympic Wells are underway with an anticipated completion date by 2020.

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 2013 - 2015
E Cost Estimates for Treatment Technologies
F Acronyms

EXHIBIT A

Health & Safety Code

Section 116470 (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

2016 PHG Triennial Report: Calendar Years 2013-2014-2015				
MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants **(Units are in milligrams per liter (mg/L), unless otherwise noted.)** **Last Update: December 29, 2015** (Reference last update 9/23/2015: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.shtml)				
This table includes: • DDW's maximum contaminant levels (MCLs) • DDW's detection limits for purposes of reporting (DLRs) • Public health goals (PHGs) from the Office of Environmental Health Hazard Assessment (OEHHA) • PHGs for NDMA and 1,2,3-Trichloropropane (both are unregulated) are at the bottom of this table • The federal MCLG for chemicals without a PHG, microbial contaminants, and the DLR for 1,2,3-TCP				
Constituent	**MCL**	**DLR**	**PHG or (MCLG)**	**Date of PHG**
Chemicals with MCLs in 22 CCR §64431—Inorganic Chemicals				
Aluminum	1	0.05	0.6	2001
Antimony	0.006	0.006	0.02	1997
Antimony	--	--	0.0007	2009 draft
Arsenic	0.010	0.002	0.000004	2004
Asbestos (MFL = million fibers per liter; for fibers >10 microns long)	7 MFL	0.2 MFL	7 MFL	2003
Barium	1	0.1	2	2003
Beryllium	0.004	0.001	0.001	2003
Cadmium	0.005	0.001	0.00004	2006
Chromium, Total - OEHHA withdrew the 1999 0.0025 mg/L PHG in Nov 2001	0.05	0.01	(0.100)	
Chromium, Hexavalent (Chromium-6)	0.01	0.001	0.00002	2011
Cyanide	0.15	0.1	0.15	1997
Fluoride	2	0.1	1	1997
Mercury (inorganic)	0.002	0.001	0.0012	1999 (rev2005)*
Nickel	0.1	0.01	0.012	2001
Nitrate (as N)	10 as N	0.4	45 as NO3 (=10 as N)	1997
Nitrite (as N)	1 as N	0.4	1 as N	1997
Nitrate + Nitrite (as N)	10 as N	0.4	10 as N	1997
Perchlorate	0.006	0.004	0.001	2015
Selenium	0.05	0.005	0.03	2010
Thallium	0.002	0.001	0.0001	1999 (rev2004)
Copper and Lead, 22 CCR §64672.3				
Values referred to as MCLs for lead and copper are not actually MCLs; instead, they are called "Action Levels" under the lead and copper rule				
Copper	1.3	0.05	0.3	2008
Lead	0.015	0.005	0.0002	2009

Exhibit B

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

Exhibit B

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

Exhibit B

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

Notes:

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

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

** Surface water treatment = TT

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

Health Risk Information for Public Health Goal Exceedance Reports

Prepared by

Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

February 2016

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Chemical	Health Risk Category[1]	U.S. EPA MCLG[2] (mg/L)	Cancer Risk[3] @ MCLG	California MCL[4] (mg/L)	Cancer Risk @ California MCL
Radionuclides					
Gross alpha particles[9]	carcinogenicity (causes cancer)	0 (^{210}Po included)	0	15 pCi/L[10] (includes ^{226}Ra but not radon and uranium)	up to 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://oehha.studio-weeren.com/media/downloads/water/chemicals/phg/grossalphahealth.pdf.

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

EXHIBIT D

Summary of Results for Primary Drinking Water Standards for 2013

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 2013(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	0.05	100% <0.3	0.1	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	ND	ND	ND	ND	ND	ND	ND	ND		Y	Discharge from metal degreasing sites
Toluene (ppb) (e)	150	150	ND	ND - 1.8	ND	ND	ND	ND	ND	ND		Y	Discharge from petroleum based products
Disinfection Byproducts & Residuals													
Total Trihalomethanes (ppb)	NS	80	City-wide LRAA: 16 Range: 1 - 52									Y	By-product of drinking water chlorination
Haloacetic Acids (ppb)	NS	60	City-wide LRAA: 5 Range: ND - 18									Y	By-product of drinking water chlorination
Total Chlorine/Chloramines (ppm)	{4}	{4}	City-wide Average: 1.4 Range: 0.2 - 2.4									Y	Drinking water disinfectant added for treatment
Bromate (ppb)	0.1	10	N/A	N/A	N/A	N/A	N/A	N/A	7.6	3.9 - 13		Y	By-product of drinking water ozonation
Inorganic Chemicals													
Aluminum (ppm)	0.6	1 (0.2*)	ND	ND	ND	ND	0.14	0.1 - 0.22	0.10	0.07 - 0.11		Y	Erosion of natural deposits; used in water treatment process
Arsenic (ppb)	0.004	10	ND	ND	ND	ND	ND	ND	ND	ND		Y	Erosion of natural deposits
Barium (ppm)	2	1	0.02	0.02	0.09	0.09	ND	ND	ND	ND		Y	Discharge from oil and metal industries; Erosion of natural deposits
Copper (d) (ppm)	0.3	AL=1.3 (1.0*)	City-wide 90th percentile: 0.13 0 sites out of 33 exceeded the AL									Y	Corrosion of household plumbing systems
Fluoride After Treatment (ppm)	1	2	Control Range 0.7 - 1.3 City-wide Range 0.6 - 1.0									Y	Water additive for dental health
Lead (d) (ppb)	0.2	AL=15	City-wide 90th percentile: 2.8 0 site out of 34 exceeded the AL									Y	Corrosion of household plumbing systems
Nitrate (as N) (ppm)	10	10	0.8	0.5 - 1.1	3.7	3.6 - 3.8	0.5	0.5	.05	0.5		Y	Runoff from fertilizer use; Leaching from sewage; Erosion of natural deposits
Perchlorate (ppb)	6	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	2011	Y	Erosion of natural deposits
Beta/photon emitters (pCi/l)	[0]	50	N/A	N/A	N/A	N/A	4	ND - 6	ND	ND	2011	Y	Decay of natural and man-made deposits
Combined Radium (pCi/l)	[0]	5	ND	ND	ND	ND	ND	ND	ND	ND	2011	Y	Erosion of natural deposits
Uranium (pCi/l)	0.43	20	1.8	1.5 - 2.0	ND	ND	2	1 - 2	1	ND - 2	2011	Y	Erosion of natural deposits

KEY TO ABBREVIATIONS

Primary Drinking Water Standards = MCLs, MRDLs and treatment techniques for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.

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MRDL = Maximum Residual Disinfectant Level, or 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.

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.

NS = No Standard

ND = Monitored for but Not Detected

NTU = Nephelometric Turbidity Units - used to measure cloudiness of drinking water.

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) = We are 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 2013.

(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) = Toluene is monitored weekly at the Arcadia Plant. In 2013, very low levels of toluene were detected two times after the completion of reservoir roof repairs in June 2013. The detections were traced to a glue used in the repair process.

FOR ADDITIONAL WATER QUALITY QUESTIONS, CONTACT M. CARDENAS, ASSISTANT MANAGER FOR WATER PRODUCTION AND TREATMENT AT 310-826-6712

CITY OF SANTA MONICA PUBLIC WORKS/WATER RESOURCES DIVISION

Summary of Results for Primary Drinking Water Standards for 2014

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 2014(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	0.06	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	ND	ND - 0.6	ND	ND	ND	ND	ND	ND		Y	Discharge from metal degreasing sites
Disinfection Byproducts & Residuals													
Total Trihalomethanes (ppb)	NS	80				City-wide LRAA: 16	Range: 4 - 55					Y	By-product of drinking water chlorination
Haloacetic Acids (ppb)	NS	60				City-wide LRAA: 2	Range: ND - 9					Y	By-product of drinking water chlorination
Total Chlorine/Chloramines (ppm)	{4}	{4}				City-wide Average: 1.2	Range: 0.2 - 2.4					Y	Drinking water disinfectant added for treatment
Bromate (ppb)	0.1	10	N/A	N/A	N/A	N/A	N/A	N/A	7.8	4.4 - 13		Y	By-product of drinking water ozonation
Inorganic Chemicals													
Aluminum (ppm)	0.6	1 (0.2*)	ND	ND	ND	ND	0.14	0.07 - 0.23	0.08	ND - 0.11		Y	Erosion of natural deposits; used in water treatment process
Arsenic (ppb)	0.004	10	ND	ND	1.0	1.0	ND	ND	2.2	2.2		Y	Erosion of natural deposits
Barium (ppm)	2	1	0.02	0.02	0.05	0.05	0.11	0.11	ND	ND		Y	Discharge from oil and metal industries; Erosion of natural deposits
Chromium 6 (ppb)	0.02	10	ND	ND	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: 0.13	0 sites out of 34 exceeded the AL				2013	Y	Corrosion of household plumbing systems
Fluoride After Treatment (ppm)	1	2				Control Range: 0.7 - 1.3	Citywide Range: 0.6 - 1.0					Y	Water additive for dental health
Lead (d) (ppb)	0.2	AL=15				City-wide, 90th percentile: 2.8	0 sites out of 34 exceeded the AL				2013	Y	Corrosion of household plumbing systems
Nitrate (as N) (ppm)	10	10	0.8	0.7 - 1.2	3.3	3.2 - 3.4	ND	ND	ND	ND		Y	Runoff from fertilizer use; leaching from sewage;
Perchlorate (ppb)	6	6	ND	ND	ND	ND	ND	ND	ND	ND		Y	Industrial waste discharge
Radionuclides													
Alpha emitters (pCi/l)	[0]	15	2	ND - 3	ND	ND	ND	ND - 4	3	ND - 5		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		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	1.7	1.7	0.8	0.8	3	2 - 3	2	2 - 3		Y	Erosion of natural deposits

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(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 M. CARDENAS, ASSISTANT MANAGER FOR WATER PRODUCTION AND TREATMENT AT 310-434-2672

CITY OF SANTA MONICA PUBLIC WORKS/WATER RESOURCES DIVISION

Summary of Results for Primary Drinking Water Standards for 2015

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 2015(b)	Meets Std	MAJOR SOURCES IN DRINKING WATER
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Clarity													
Maximum Turbidity (NTU)	NS	95% < 0.3	N/A	N/A	N/A	N/A	0.05	100% ≤ 0.3	0.09	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	0.5	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: 41	Range: 11 - 54					Y	By-product of drinking water chlorination
Haloacetic Acids (ppb)	NS	60				City-wide LRAA: 12	Range: ND - 2-16					Y	By-product of drinking water chlorination
Total Chlorine/Chloramines (ppm)	{4}	{4}				City-wide Average: 1.2	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	N/A	8.0	1.1 - 13		Y	By-product of drinking water ozonation
Inorganic Chemicals													
Aluminum (ppm)	0.6	1 (0.2*)	ND	ND	ND	ND	0.16	0.09 - 0.20	ND	ND - 0.08		Y	Erosion of natural deposits; used in water treatment process
Arsenic (ppb)	0.004	10	ND	ND	1.0	1.0	2.1	2.1	3.3	3.3		Y	Erosion of natural deposits
Barium (ppm)	2	1	0.02	0.02	0.05	0.05	0.12	0.12	ND	ND		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		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		Y	Naturally occuring; industrial waste discharge
Copper (d) (ppm)	0.3	AL=1.3 (1.0*)				City-wide, 90th percentile: 0.13	0 sites out of 34 exceeded the AL				2013	Y	Corrosion of household plumbing systems
Fluoride After Treatment (ppm)	1	2				Control Range: 0.7 - 1.3	Citywide Range: 0.3 - 0.9					Y	Water additive for dental health
Lead (d) (ppb)	0.2	AL=15				City-wide, 90th percentile: 2.8	0 sites out of 34 exceeded the AL				2013	Y	Corrosion of household plumbing systems
Nitrate (as N) (ppm)	10	10	1.0	0.7 - 1.2	3.5	3.4 - 3.8	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	2014	Y	Erosion of natural deposits
Uranium (pCi/l)	0.43	20	1.9	1.5 -2.7	0.8	0.8	3	2 - 3	2	2 - 3	2014	Y	Erosion of natural deposits

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Exhibit E
Table 1
Reference: 2012 ACWA PHG Survey

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

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

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

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

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

Exhibit E
Table 2
Reference: Other Agencies

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

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

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

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

Exhibit E
Table 3
Reference: Updated 2012 ACWA Cost of Treatment Table

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

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

COST ESTIMATES FOR TREATMENT TECHNOLOGIES

(INCLUDES ANNUALIZED CAPITAL AND O&M COSTS)

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

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

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

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