LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 40, ANTELOPE VALLEY, REGIONS 4, LANCASTER, AND 34, DESERT VIEW HIGHLANDS, WATER SYSTEM

2016 PUBLIC HEALTH GOALS REPORT

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I. Background

Section 116470 (b) of the California Health and Safety Code specifies that public water systems serving more than 10,000 service connections are required to prepare a triennial report if their water quality measurements exceed any Public Health Goals (PHGs). PHGs, which are non-enforceable goals, are standards for water quality constituents established by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA). Current law requires that where OEHHA has not adopted a PHG for a constituent, the water suppliers are to use the Maximum Contaminant Level Goals (MCLGs) adopted by the United States Environmental Protection Agency (USEPA). Only constituents that have a California primary drinking water standard and for which either a PHG or MCLG has been set are to be addressed.

This report provides information required by law for water quality constituents that were detected in the Los Angeles County Waterworks District No. 40, Antelope Valley, Regions 4 and 34 (District) at a level exceeding an applicable PHG or MCLG. Included in the report is information on the numerical public health risk associated with the Maximum Contaminant Level (MCL) and the PHG or MCLG, the category or type of health risk typically associated with each constituent, the best treatment technology available to reduce the constituent level, and an estimate of the cost of installing that treatment if it is appropriate and feasible.

II. Definition of PHGs and MCLGs

PHGs are standards that are established by OEHHA and are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the USEPA or State Water Resource Control Board Division of Drinking Water (SWRCB DDW) in setting drinking water standards (MCLs) are considered when setting PHGs. These factors include analytical detection capabilities, available treatment technologies, benefits, and costs. MCLGs are the Federal equivalent of the State PHGs.

III. Best Available Treatment Technology

Both the USEPA and the SWRCB DDW adopt what are known as Best Available Technologies (BATs) which are the best-known methods for reducing regulated contaminant levels to the MCL. Costs can be estimated for such technologies. However, since many PHGs and MCLGs are set lower than the MCLs, it is not always possible or feasible to determine what treatment is needed to further reduce a constituent to or near a PHG or MCLG, many which are set at zero.

Estimating the costs to reduce a constituent to zero is difficult, if not impossible, because it is not possible to verify by analytical means that the level has been lowered to zero. In some cases, installing treatment to try and further reduce very low levels of one constituent may have adverse effects on other aspects of water quality.

IV. Definitions

The terms defined below will be used to describe health effects from detected constituents in the following section.

acute toxicity – adverse health effects that develop after a short-term exposure to a chemical (minutes to days).
chronic toxicity – adverse effects that usually develop gradually from low levels of chemical exposure over a long period of time (months to years).
carcinogenic – capable of producing cancer.
mutagenic – capable of inducing or increasing rate of mutation.
teratogenic – capable of interfering with normal embryonic development.

IV. Constituents Detected That Exceed a PHG or MCLG

The following is a discussion of water quality constituents that were detected in the System above the PHG or if no PHG is available, above the MCLG.

A. Arsenic

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 PHG for arsenic is 0.004 micrograms per liter (µg/L). The MCL or State drinking water standard for arsenic is 10 µg/L. The MCL was lowered in 2006 due to increasing evidence of potential detrimental health effects even at low levels. California's Detection Limit for Purposes of Reporting (DLR) is 2 µg/L. Any data below the State's DLR of 2 µg/L is considered "non-detect" (ND).

Source water sampling is conducted on a triennial basis, unless results exceed the MCL. The District also blends water from wells with high arsenic concentration with nearby wells with low arsenic concentration and/or purchased surface water. The blended water is tested for arsenic on a weekly basis. The arsenic concentration in the system water ranged from ND to 12 µg/L, with an average of 4.2 µg/L.

The health risk category associated with arsenic is carcinogenicity. At the PHG, the theoretical cancer risk is one excess cancer case per million people exposed to the PHG level for a lifetime of 70 years. At the federal and state MCL of 10 µg/L, the theoretical cancer risk is 2.5 excess cancer cases per one thousand people exposed to the MCL for a lifetime of 70 years.

USEPA final rule identified the following as Best Available Technologies (BATs) for achieving compliance with this regulatory level: Ion Exchange (IX), Activated Alumina (AA), Oxidation/Filtration, Reverse Osmosis (RO), Electrodialysis Reversal, Enhanced Coagulation/Filtration, Enhanced Lime Softening.

The District is currently utilizing a non-treatment option: blending the water from wells that exceed the MCL with wells that do not exceed the MCL. We are currently using several blending sites where water from different wells is blended into forebay tanks before it is pumped to the distribution system. Additional blending plans are being considered to mitigate the effects of high arsenic concentrations in other areas of the District. This has proven to be the most cost-effective method of reducing arsenic concentrations to meet the MCL.

A second method that has been used by the District is the partial abandonment of wells that have high arsenic concentrations. Zone testing of new wells and information gathered by the U.S. Geological Survey showed that the high levels of arsenic in the Antelope Valley were originating from a deep aquifer. Partial abandonment of existing wells utilizes a procedure where the deep portion of the well is filled with concrete and sealed off so that water from the deep aquifer cannot enter the well. The District has utilized this approach on several wells and successfully lowered the arsenic concentration in each well to below 10 µg/L. Additional partial abandonment projects are currently in the design phase.

Between 2013 – 2015, most of the District's wells had arsenic levels above the PHG. Since the PHG is set much lower than the MCL, it is not always possible or feasible to determine what treatment is needed to meet the PHG. Sometimes it is impossible to verify by analytical means of the level below detection limit or zero. In some cases, using treatment to lower one constituent may have adverse effects on other aspects of water quality.

The most cost-effective treatment method is ion exchange. Based on an estimate from a 2012 survey (indexed to 2015) published in the Association of California Water Agencies (ACWA) suggested guidelines for PHG reports (March 2016), ion exchange treatment costs $1.99 per 1,000 gallons per year. With a total annual production of approximately 4.07 billion gallons (12,495 acre-feet), it would cost to District approximately $8.1 million per year to treat all well water to meet the PHG. The cost per customer would be approximately $160 per year.

B. <u>Copper</u>

The PHG for copper is 0.3 milligrams per liter (mg/L). The Action Level (AL) for copper is 1.3 mg/L. Water quality testing was conducted on source water wells in the District and copper was not detected in any of the District's wells.

Copper is also sampled at household taps once every three years as part of the Lead and Copper Rule which is intended to determine the corrosivity of the water on the plumbing in homes with copper pipes and lead solder. To meet the Lead and Copper Rule requirements, the 90th percentile value of the samples collected from household taps cannot exceed 1.3 mg/L. The latest round of copper testing from household taps in the District was completed in 2013. The 90th percentile value of the collected samples was 0.43 mg/L, which is slightly higher than the PHG, but still well within the lead and Copper Rule requirements. The next round of sampling will be completed by August 2016.

The health risk category for copper is acute toxicity in the form of gastrointestinal irritation in children. Persons with Wilson's disease may be at a higher risk of health effects due to copper than the general public. A numerical health risk is not calculated for copper because the chemical is considered a noncarcinogen. For noncarcinogens, an exact numerical public health risk cannot be calculated. The PHG for noncarcinogens is set at a level which is believed to be without any significant public health risk to individuals exposed to that chemical over a lifetime.

All of the District's source water samples for lead and copper in 2013, 2014, and 2015 were ND. The District is in full compliance with the Federal and State Lead and Copper Rule. Based on extensive sampling, it was determined that the District meets the action level for lead and copper according to State regulatory requirements and is therefore considered by the SWRCB DDW to have optimized corrosion control for our system.

In general, optimizing corrosion control is considered to be the BAT to deal with corrosion issues. The District continues to monitor water quality parameters that relate to corrosivity, such as pH, hardness, alkalinity, total dissolved solids, and will take action as necessary to maintain the system in an optimized, corrosion-controlled condition. In addition, the District's surface water wholesaler, the Antelope Valley-East Kern Water Agency (AVEK), adds zinc orthophosphate (a corrosion inhibitor) to the finished water processed at their treatment plant.

Since the District meets the optimized corrosion control requirements, it is not prudent to initiate additional corrosion control treatment as it involves additional equipment or other chemicals that could cause different water quality issues. Therefore, no cost estimate has been included.

C. Hexavalent Chromium

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 are trivalent chromium and hexavalent chromium. The PHG for hexavalent chromium was set at 0.02 µg/L in July 2011. The MCL was set at 10 µg/l in July 2014*. The total chromium MCL of 50 µg/l was established in 1977 to address the non-cancer toxic effect of chromium. Total chromium is the sum of trivalent chromium and hexavalent chromium. Trivalent chromium and hexavalent chromium are covered together under the total chromium MCL because these forms of chromium can convert back and forth in water depending on environmental conditions. Trivalent chromium is an essential human dietary element and naturally occurs in many vegetables, fruits, grains and yeast. Hexavalent chromium 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.

In 2014, several of the District's wells exceeded the PHG. In pre-monitoring tests, some wells exceeded the State hexavalent chromium MCL. Those wells were put either on standby or were with blended water from other nearby wells with low hexavalent chromium concentration. The average hexavalent chromium concentrations was 10 µg/l.

The BATs for hexavalent chromium removal are weak base anion exchange resin and reduction-coagulation-filtration technology. Weak base anion exchange is considered the more cost-effective of these two technologies.

It is unlikely that any technology will be developed that can reduce hexavalent chromium to below the very low PHG, which is lower than laboratory tests can detect. Additional treatment for the removal of hexavalent chromium is neither practical, nor feasible, so no recommendations for further action are advised.

*On May 31, 2017, the Superior Court of Sacramento County issued a judgment invalidating the hexavalent chromium maximum contaminant level (MCL) for drinking water. The change became effective on September 11, 2017. Thus, as of September 11, 2017, the maximum contaminant level for hexavalent chromium is no longer in effect.

D. Radiological Contaminants

Radiological Contaminants emit radioactive particles that are measured by an activity unit called a curie (Ci) which represents 3.7×10^{10} nuclear disintegrations per second. Radioactivity in drinking water is measured in picocuries (pCi) which is 10^{-12} curie.

Water quality testing conducted on the source water wells in the District detected four radiological contaminants which exceed the PHG: radium-226, radium-228, gross alpha, and uranium. Specific information regarding each contaminant is detailed below. All forms of radioactivity are considered to be carcinogenic.

Radium-226

Radium-226 is a naturally occurring radioactive isotope formed from the decay of uranium-238. Radium-226 emits radioactive alpha particles. The PHG for radium-226 is 0.05 picocuries per liter (pCi/L). There is no MCL for radium-226 by itself, but an MCL has been issued by the EPA for radium-226 and radium-228 combined at 5.0 pCi/L. Water quality testing conducted on the source water wells in the District detected radium-226 levels ranging from below detectable levels (ND) to 0.23 pCi/L.

The health risk category associated with radium-226 is carcinogenicity. At the PHG, the theoretical cancer risk is one excess cancer case per million people exposed to the PHG level for a lifetime of 70 years. At the federal and state MCL of 5 pCi/L (combined

Ra226+228), the theoretical cancer risk is one excess cancer cases per ten thousand people exposed to the MCL for a lifetime of 70 years.

Radium-228

Radium-228 is a naturally occurring radioactive isotope formed from the decay of thorium-232. Radium-228 decays to become actinium-228 and emits a beta particle in the process. The PHG for radium-228 is 0.019 picocuries per liter (pCi/L). There is no MCL for radium-228 by itself, but an MCL has been issued by the EPA for radium-226 and radium-228 combined at 5.0 pCi/L. Water quality testing conducted on the source water wells in the District detected radium-228 levels ranging from below detectable levels (ND) to 0.33 pCi/L.

The health risk category associated with radium-228 is carcinogenicity. At the PHG, the theoretical cancer risk is one excess cancer case per million people exposed to the PHG level for a lifetime of 70 years. At the federal and state MCL of 5 pCi/L (combined Ra226+228), the theoretical cancer risk is one excess cancer cases per ten thousand people exposed to the MCL for a lifetime of 70 years.

Gross Alpha

Radionuclides such as gross alpha particles in water supplies are predominantly from erosion of natural deposits. The term radionuclide refers to naturally occurring elemental radium, radon, uranium, and thorium with unstable atomic nuclei that spontaneously decay, producing ionizing radiation. Gross alpha is defined as the sum total of these radionuclides. The MCL for gross alpha is 15 picocuries per liter of water (pCi/L) and the MCLG is 0 pCi/L.

Region 4 and 34 analyzed 77 samples for gross alpha particles between 2013-2015, with values that ranged from non-detect (ND) to 6 pCi/L, with an average value of 1.4 pCi/L. All sample results were below the MCL.

Office of Environmental Health Hazard Assessment (OEHHA) has not established a PHG for gross alpha activity because gross alpha does not represent a specific constituent and its results are used as a screening tool for naturally occurring radionuclides. The health risk category for alpha particles is carcinogenicity. The numerical cancer health risk at the MCL of 15 pCi/L could be one excess case of cancer per one thousand people exposed for a lifetime of 70 years.

Uranium

Uranium is a naturally occurring radioactive isotope formed from the decay of uranium-238. Uranium emits ionizing radiation, which is carcinogenic, mutagenic, and teratogenic. Uranium has also been shown to affect kidney and liver functions. The PHG for uranium is 0.43 pCi/L, which is the based on the *de minimis* 10^{-6}, or one-in-a-million, lifetime cancer risk. The State of California MCL for uranium is 20 pCi/L and is based on studies of toxicity in the kidneys of rabbits. Water quality testing conducted on the source water wells in the District detected uranium levels ranging from ND to 7.7 pCi/L.

The health risk category associated with uranium is carcinogenicity. At the PHG, the theoretical cancer risk is one excess cancer case per million people exposed to the PHG level for a lifetime of 70 years. At the federal and state MCL of 20 pCi/L, the theoretical cancer risk is five excess cancer cases per hundred thousand people exposed to the MCL for a lifetime of 70 years.

The BATs for radiological contaminants removal are ion exchange, reverse osmosis, lime softening, and coagulation/filtration.

Between 2013-2015, the District detected radium-226, radium-228, gross alpha, and uranium measurements above the PHG. The most cost-effective treatment method is ion exchange. Based on an estimate from a 2012 survey (indexed to 2015) published in the Association of California Water Agencies (ACWA) suggested guidelines for PHG reports (March 2016), ion exchange treatment costs $1.99 per 1,000 gallons per year. Because the total annual production of the District's wells with radiological contaminants is approximately 3.75 billion gallons (11,513 acre-feet), it would cost approximately $7.46 million per year meet the PHGs. The cost per customer would be approximately $147 per year.

E. <u>Coliform Bacteria</u>

Coliform bacteria are indicator organisms and are not generally considered harmful. They are used because of the ease in monitoring and analysis. If a positive sample is found, it indicates a potential problem that needs to be investigated and follow up sampling is performed. It is not at all unusual for a system to have an occasional positive sample. It is difficult, if not impossible, to assure that a system will never get a positive sample.

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

During 2013, 2014, and 2015 the District collected an average of 171 samples each month for coliform analysis. Of these samples, a maximum of 4.2 percent came out positive for coliform bacteria in a single month but check samples were negative and follow up actions were taken.

Chlorine is added at the District's sources to assure that the water served is microbiologically safe. The chlorine residual levels are carefully controlled to provide the best health protection without causing the water to have undesirable taste and odor or increasing the disinfection byproduct level. This careful balance of treatment processes is essential to continue supplying customers with safe drinking water.

Other equally important measures that we have implemented include: an effective cross-connection control program, maintenance of a disinfectant residual throughout the system, an effective monitoring program and maintaining positive pressure in the District's distribution system. Our system has already taken all of the steps described by SWRCB DDW as "best available technology" for coliform bacteria in Section 64447, Title 22, CCR.

V. Recommendations for Further Action

The drinking water quality of the District meets all SWRCB DDW and USEPA drinking water standards set to protect public health. To further reduce the levels of the constituents identified in this report that are already significantly below the health-based Maximum Contaminant Levels established to provide "safe drinking water," additional costly treatment processes would be required. The effectiveness of the treatment processes to provide any significant reductions in constituent levels at these already low values is uncertain. The health protection benefits of these further hypothetical reductions are not all clear and may not be quantifiable. Therefore, no action is proposed. The funds that would be required for these additional treatment processes might provide greater public health protection benefits if spent on other water system operation, surveillance, and monitoring programs.

References

Suggested Guidelines for Preparation of Required Reports on Public Health Goals (PHGs) to satisfy requirements of California Health and Safety Code Section 116470(b). (2016). Association of California Water Agencies.