2019 Report on Water Quality Relative to Public Health Goals

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Contents

Figures

Tables

List of Acronyms and Abbreviations

DLR	detection limit for purposes of reporting
EGWD	Elk Grove Water District
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
OEHHA	California Office of Environmental Health Hazard Assessment
PHG	Public Health Goal
pCi/L	picocuries per liter
SCWA	Sacramento County Water Agency
USEPA	United States Environmental Protection Agency
µg/L	micrograms per liter

Background

The California Health and Safety Code Section 116470(b) specifies that public water systems serving more than 10,000 service connections prepare a brief written report every three years that documents detections of any constituents in drinking water that exceed a Public Health Goal (PHG). PHGs are non-enforceable goals established by the California Office of Environmental Health Hazard Assessment (OEHHA). The law also requires that where OEHHA has not adopted a PHG for a constituent, public water systems are to use the Maximum Contaminant Level Goal (MCLG) adopted by the United States Environmental Protection Agency (USEPA). Only constituents that have both a California primary drinking water Maximum Contaminant Level (MCL) and a PHG (or MCLG if no PHG exists) are to be addressed in this report.

This report addresses constituents detected in Elk Grove Water District's (EGWD) drinking water supply during calendar years 2016 through 2018 at a level exceeding an applicable PHG or MCLG and provides the required information for each constituent. The required information includes: the category or type of risk to health that could be associated with each constituent; the numerical public health risk associated with the primary MCL and the PHG or MCLG; the Best Available Technology that could be used to reduce the constituent level; and an estimate of the cost to install that Best Available Technology treatment process.

What are PHGs?

PHGs are set by OEHHA and are non-enforceable goals based solely on public health risk considerations. The practical risk-management factors considered by the USEPA or California's State Water Resources Control Board, Division of Drinking Water in setting drinking water MCLs are not addressed in setting the PHGs. These practical risk-management factors include: analytical detection capability, treatment technology available, benefit and costs. The PHGs are not enforceable and are not required to be met by any public water system. MCLGs are the federal equivalent to PHGs.

Water Quality Data Considered

Water for the EGWD system is supplied by two water providers, EGWD and Sacramento County Water Agency (SCWA) as follows:

- Service Area 1 – local groundwater from EGWD
- Service Area 2 – local groundwater from SCWA, with periodic surface water from SCWA

Service Area 1 has approximately 8,000 customers and Service Area 2 has approximately 4,300 customers. A map of the service areas is provided below in Figure 1.

The water quality data that was collected from EGWD and SCWA's water system for purposes of determining compliance with drinking water standards during calendar years 2016 through 2018 was utilized to prepare this report. Water quality data are summarized annually in Consumer Confidence Reports, which are available on the District's website (http://www.egwd.org/waterquality.html) and mailed to all EGWD customers.

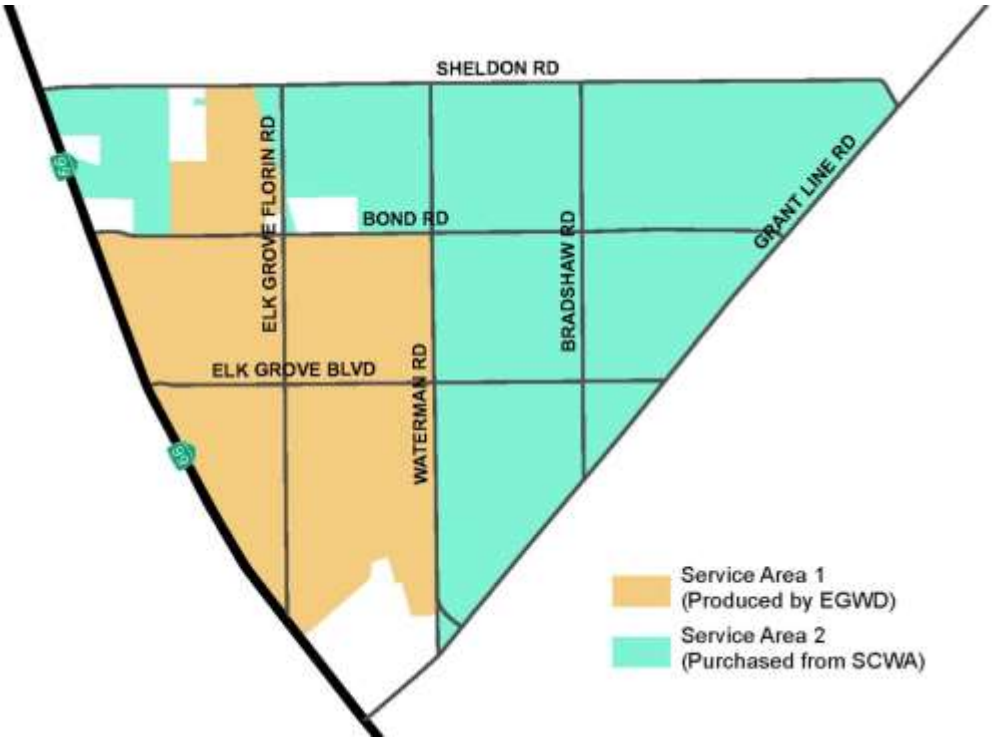

Figure 1. Elk Grove Water District Service Area Boundaries.

Guidelines Followed

The Association of California Water Agencies 2019 guidelines[1] were utilized in the preparation of this report. No formal guidance for preparing these reports is available from state regulatory agencies.

Best Available Treatment Technology and Cost Estimates

Both the USEPA and California have adopted what are known as Best Available Technologies, which are the best known methods of reducing contaminant levels to the MCL. Costs can be estimated for such technologies. However, since many PHGs and all MCLGs are set much lower than the MCL, it is not always possible or feasible to determine what treatment is needed to further reduce a constituent concentration downward to or near the PHG or MCLG, many of which are set at zero. Estimating the costs to reduce a constituent level to zero is difficult, because it is not possible to verify by analytical means that the constituent level has been lowered to zero. In some cases, installing treatment to further reduce very low levels of one constituent may have adverse effects on other aspects of water quality. Costs presented herein are based on costs compiled in the Association of California Water Agencies' 2019 guidelines.

[1] Association of California Water Agencies. 2019 (April). *Suggested Guidelines for Preparation of Required Reports on PUBLIC HEALTH GOALS (PHGs) to satisfy requirements of California Health and Safety Code Section 116470(b)*.

Constituents Detected that Exceed a PHG or MCLG

Table 1 presents the constituents that were detected in EGWD's drinking water system at levels above its PHG, or if no PHG, above the MCLG. These constituents are further discussed in the sections following Table 1.

Table 1. Constituents Detected Above a PHG or MCLG

Constituent (Units)	PHG (MCLG) [a]	MCL	DLR
Arsenic (µg/L)	0.004	10	2
Gross Alpha (pCi/L)	(0)	15	3
Radium-226 (pCi/L)	0.05	5 [b]	1
Radium-228 (pCi/L)	0.019	5 [b]	1
Uranium (pCi/L)	0.43	20	1
Total Coliform Bacteria	0% Positive Samples Per Month	≤5% Positive Samples Per Month	Not applicable

Notes:
DLR = detection limit for purposes of reporting
MCL = drinking water maximum contaminant level
PHG = public health goal
pCi/L = picocuries per liter of water
µg/L = micrograms per liter of water
[a] MCLG provided in parentheses for constituents with no adopted PHG.
[b] MCL is for combined radium-226 and radium-228.

Arsenic

Table 2 summarizes the range and average arsenic concentrations in the EGWD drinking water for Service Areas 1 and 2. The PHG for arsenic is 0.004 micrograms per liter (µg/L). The MCL for arsenic is 10 µg/L. The health risk category associated with arsenic is carcinogenicity. At the PHG for arsenic, the theoretical cancer risk is 1×10^{-6}. This means the 70-year lifetime cancer risk for consuming drinking water with an arsenic concentration at the PHG is 1 excess case of cancer per 1,000,000 people exposed (or 0.0001 percent). At the MCL of 10 µg/L, the theoretical cancer risk is 2.5×10^{-3}. This means the 70-year lifetime cancer risk for consuming drinking water with an arsenic concentration at the MCL is 2.5 excess cases per 1,000 people exposed (or 0.25 percent). The concentrations presented in Table 2 demonstrate that maximum concentrations of arsenic were less than the MCL of 10 µg/L.

Table 2. Water Quality Data Summary for Arsenic

Constituent	EGWD Service Area 1 (Groundwater)	EGWD Service Area 2 (SCWA Groundwater)	EGWD Service Area 2 (SCWA Surface Water)
Range (µg/L)	ND – 8.7	ND – 6.2	ND
Average (µg/L)	2.6	ND	ND
ND = not detected			

The following are identified in California Code of Regulations, Title 22 Section 64447.2 as Best Available Technologies for reducing arsenic levels in drinking water.

- Activated alumina
- Coagulation/filtration
- Ion Exchange
- Lime softening
- Reverse Osmosis
- Electrodialysis
- Oxidation/filtration

Further engineering feasibility and review would be necessary to make a determination regarding which treatment method would be most appropriate to implement. For the purposes of this report, the cost evaluation was conducted for implementation of an ion exchange treatment process.

Within EGWD Service Area 1, five drinking water supply wells that are owned and operated by the EGWD had detected concentrations of arsenic above the PHG in at least one sample in calendar years 2016 through 2018, and it is assumed that these wells would have ion exchange as the treatment method. The annualized capital and operations and maintenance cost for ion exchange at the five wells in Service Area 1 is estimated to be $1.8 million per year, which would be an increased cost for each customer in Service Area 1 of approximately $230 per year. This cost is based on the maximum annual production of each well during 2016–2018, which totaled 841 million gallons, and a unit cost for ion exchange of $2.19 per one thousand gallons requiring treatment.

The SCWA water purchased for EGWD Service Area 2 also had detections of arsenic above the PHG. The estimated cost per customer for SCWA to implement a Best Available Technology would be similar to that described above for Service Area 1.

Radionuclides

Radionuclides detected in the EGWD water system include gross alpha, radium-226, radium-228, and uranium. **Table 3** summarizes the range and average radionuclide levels in the EGWD drinking water for Service Areas 1 and 2. The health risk and costs for treatment to reduce levels of these radionuclides are addressed separately for each constituent below.

Table 3. Water Quality Data Summary for Radionuclides			
Constituent	EGWD Service Area 1 (Groundwater)	EGWD Service Area 2 (SCWA Groundwater)	EGWD Service Area 2 (SCWA Surface Water)
Gross Alpha			
Range (pCi/L)	ND – 6.3	ND – 8.1	ND
Average (pCi/L)	ND	ND	ND
Radium-226			
Range (pCi/L)	ND – 1.1	--	--
Average (pCi/L)	ND	--	--
Radium-228			
Range (pCi/L)	1.3 – 2.9	--	--
Average (pCi/L)	2.4	--	--
Uranium			
Range (pCi/L)	ND – 2.2	ND – 2.7	ND
Average (pCi/L)	1.0	ND	ND
ND = not detected "--" = no data			

Gross Alpha

Gross alpha is a measurement of the overall radioactivity of naturally occurring substances present in water due to radioactive elements breaking down. These can include radium-226, radium-228, and uranium. OEHHA has not established a PHG for gross alpha; the federal MCLG is 0 picocuries per liter of water (pCi/L) due to classification of gross alpha particles as carcinogens. The cancer risk at 0 pCi/L of gross alpha is zero. At the MCL of 15 pCi/L of gross alpha, the theoretical cancer risk is 1×10^{-3}, which means the 70-year lifetime cancer risk for consuming drinking water with a gross alpha concentration at the MCL is 1 excess case of cancer per 1,000 people exposed (0.1 percent). The concentrations presented in Table 3 demonstrate that maximum levels of gross alpha were less than the MCL of 15 pCi/L.

The California Code of Regulations, Title 22 Section 64447.3 identifies reverse osmosis as the Best Available Technology for reducing gross alpha particle levels in drinking water. The wells in which gross alpha particles were detected are EGWD wells serving Service Area 1 and SCWA wells serving Service Area 2. The annualized capital and operations and maintenance cost for reverse osmosis at the two wells in Service Area 1 with gross alpha particles greater than the MCLG is estimated to be $1.1 million per year, which would be an increased cost for each customer in Service Area 1 of approximately $140 per year. This cost is based on treating 324 million gallons annually and a unit cost for reverse osmosis of $3.55 per one thousand gallons requiring treatment. The estimated cost per customer in Service Area 2 for SCWA to implement a Best Available Technology for gross alpha would be similar to that described above for Service Area 1.

Radium-226 and Radium-228

Radium is formed when uranium and thorium, which are naturally occurring elements, undergo radioactive decay. Radium-226 and radiuim-228 are the two main radium isotopes found in the

environment. The PHG is 0.05 pCi/L for radium-226 and 0.019 pCi/L for radium-228. The MCL is 5 pCi/L for radium-226 and radium-228 combined. The health risk category associated with radium-226 and radium-228 is carcinogenicity. The theoretical cancer risk at the PHGs for radium-226 and radium-228 is 1×10^{-6}, which means the 70-year lifetime cancer risk for consuming drinking water with radium-226 or radium-228 at the respective PHG is 1 excess case of cancer per 1,000,000 people exposed (or 0.001 percent). At the MCL of 5 pCi/L, the theoretical cancer risk for radium-226 is 1×10^{-4}, which means the 70-year lifetime cancer risk for consuming drinking water with a radium-226 concentration at the MCL is 1 excess case per 10,000 people exposed (or 0.01 percent). At the MCL of 5 pCi/L, the theoretical cancer risk for radium-228 is 3×10^{-4}, which means the 70-year lifetime cancer risk for consuming drinking water with a radium-228 concentration at the MCL is 3 excess cases per 10,000 people exposed (or 0.03 percent). The concentrations presented in Table 3 demonstrate that maximum concentrations of radium-226 and radium-228 were less than the MCL of 5 pCi/L.

The following are identified in California Code of Regulations, Title 22 Section 64447.3 as Best Available Technologies for reducing radium-226 and radium-228 levels in drinking water.

- Ion Exchange
- Lime softening
- Reverse Osmosis

Further engineering feasibility and review would be necessary to make a determination regarding which would be most appropriate to implement. One EGWD well in Service Area 1 had a detected concentration of radium-226 above its PHG and all wells in Service Area 1 had detected concentrations of radium-228 above its PHG. For purposes of developing annualized costs, ion exchange is selected as the treatment method, because this is also the method for addressing arsenic detected in EGWD wells in Service Area 1. The annualized capital and operations and maintenance cost for ion exchange at all wells in Service Area 1 is estimated to be $3.6 million per year, which would be an increased cost for each customer in Service Area 1 of approximately $450 per year. This cost is based on the maximum annual production of each well during 2016–2018, which totaled 1,637 million gallons, and a unit cost for ion exchange of $2.19 per one thousand gallons requiring treatment.

Uranium

Uranium is a naturally occurring element present in varying amounts in water, soil, and rock. The PHG for uranium is 0.43 pCi/L. The MCL for uranium is 20 pCi/L. The health risk category associated with uranium is carcinogenicity. At the PHG, the theoretical cancer risk is 1×10^{-6}, which means the 70-year lifetime cancer risk for consuming drinking water with a uranium concentration at the PHG is 1 excess case of cancer per 1,000,000 people exposed (or 0.0001 percent). At the MCL of 20 pCi/L, the theoretical cancer risk is 5×10^{-5}, which means the 70-year lifetime cancer risk for consuming drinking water with a uranium concentration at the MCL is 5 excess cases per 100,000 people exposed (or 0.005 percent). The concentrations presented in Table 3 demonstrate that maximum concentrations of uranium were less than the MCL of 20 pCi/L.

The following are identified in California Code of Regulations, Title 22 Section 64447.3 as Best Available Technologies for reducing uranium levels in drinking water.

- Coagulation/filtration
- Ion Exchange
- Lime softening
- Reverse Osmosis

The wells in which uranium was detected are EGWD wells serving Service Area 1 and SCWA wells serving EGWD Service Area 2. For purposes of developing annualized costs, ion exchange is selected as the treatment method for EGWD wells, because this is also the method for addressing arsenic, radium-226 and radium-228 detected in EGWD wells. Within EGWD Service Area 1, three EGWD wells had detected concentrations of uranium above the PHG and it is assumed that these wells would have ion exchange as the treatment method. The annualized capital and operations and maintenance cost for ion exchange at the three wells with uranium above the PHG is estimated to be $1.1 million per year, which would be an increased cost for each customer in Service Area 1 of approximately $140 per year. This cost is based on the maximum annual production of each well during 2016–2018, which totaled 493 million gallons, and a unit cost for ion exchange of $2.19 per one thousand gallons requiring treatment.

The SCWA water purchased for EGWD Service Area 2 also had detections of uranium above the PHG. The estimated cost per customer for SCWA to implement a Best Available Technology would be similar to that described above for Service Area 1.

Total Coliform Bacteria

The MCL for total coliform bacteria is 5% positive samples of all samples per month. There is no PHG for total coliform bacteria; the MCLG is 0% positive samples per month. Coliform bacteria are an indicator organism that are ubiquitous in nature and are not generally considered harmful; they are used because of the ease in monitoring and analysis. The reason for the total coliform bacteria drinking water MCL is to minimize the possibility of the water containing potentially harmful pathogens that cause waterborne disease. If a positive sample is found, it indicates a potential problem that needs to be investigated and follow-up sampling performed. It is not unusual for a system to have an occasional positive sample, and it is difficult, if not impossible, to assure that a system will never get a positive sample. Because coliform is only a surrogate indicator of the potential presence of pathogens, it is not possible to state a specific numerical health risk.

In 2017 and 2018, one distribution system sample tested positive for total coliform bacteria in a single month. EGWD immediately resampled in accordance with drinking water regulations. All resamples were negative for total coliform bacteria.

California Code of Regulations, Title 22, Section 64447 lists the following Best Available Technologies for achieving compliance with the total coliform MCLs:

- Protection of wells from coliform contamination by appropriate placement and construction;

- Maintenance of a disinfectant residual throughout the distribution system;
- Proper maintenance of the distribution system; and
- Filtration and/or disinfection of approved surface water, in compliance with Section 64650, or disinfection of groundwater.

The EGWD implements the above Best Available Technologies for total coliform bacteria. EGWD adds chlorine at its water 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 levels of disinfection byproducts, which are regulated in drinking water. This careful balance of treatment processes is essential to continue supplying EGWD customers with safe drinking water. Other equally important measures that the EGWD has implemented include: an effective cross-connection control program, maintenance of a disinfectant residual throughout the water distribution system, an effective monitoring and surveillance program, and maintaining positive pressures in the distribution system. Surface water from SCWA is treated using conventional filtration and disinfection. Because Best Available Technology measures are fully implemented by EGWD, no estimated cost for further treatment is provided.

Recommendations for Further Action

The drinking water quality of the EGWD meets all California 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 MCLs established to provide “safe drinking water,” additional costly treatment processes would be required. The effectiveness of the treatment processes to provide any significant reductions in constituent levels at these already low values is uncertain. The health protection benefits of these further hypothetical reductions are not at all clear and may not be quantifiable. Therefore, no action is proposed at this time.