SOQUEL CREEK WATER DISTRICT
REPORT ON DISTRICT'S WATER QUALITY
RELATIVE TO PUBLIC HEALTH GOALS
2013 - 2015

Introduction

In accordance with California Health and Safety Code §116470(b), Soquel Creek Water District (SqCWD) has prepared this Public Health Goal (PHG) report. The Association of California Water Agencies (ACWA) formed a workgroup which produced guidelines for water utilities to use in preparing PHG reports. SqCWD used these ACWA guidelines, updated in 2016, in the preparation of this report. No guidance was available from state regulatory agencies.

The regulation, as interpreted by ACWA, specifies that every 3 years, larger water utilities (>10,000 service connections) prepare a report if their water quality measurements have detected and exceeded any PHG for constituents that also have an established California primary Maximum Contaminant Level (MCL) or action level. PHGs are non-enforceable goals established by the California Environmental Protection Agency's (EPA's) Office of Environmental Health Hazard Assessment (OEHHA). The law also requires that where OEHHA has not adopted a PHG for a particular constituent, the water suppliers are to use the Maximum Contaminant Level Goals (MCLGs) adopted by US EPA.

PHGs are set by OEHHA and are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the US EPA or the California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) in setting drinking water standards (MCLs) are considered in setting the PHGs. These factors include analytical detection capability, treatment technology availability, benefits and costs. The PHGs are not enforceable and are not required to be met by any public water system. MCLGs are the federal equivalent to PHGs.

PHG reports are unique to California. They are required in addition to the extensive public reporting of water quality information that California water utilities have been doing for many years and in addition to the federally and state-mandated annual Consumer Confidence Reports/Water Quality Reports. Hence, it should be kept in mind that in addition to this report, SqCWD will continue to report annually in greater depth on water quality in the system.

The purpose of the legislative requirement is to give water system customers access to information on levels of constituents even below the enforceable mandatory MCLs. Included is the numerical public health risk associated with the MCL and the PHG or MCLG, the category or type of risk to health that could be associated

with each constituent, the best treatment technology available that could be used to reduce the constituent level, and an estimate of the cost to install that treatment if it is appropriate and feasible.

There are a few constituents that are routinely detected in water systems at levels usually well below the drinking water standards for which no PHG nor MCLG has yet been adopted by OEHHA or US EPA, including total trihalomethanes. These will be addressed in a future required report after these PHGs have been adopted.

Detected Constituents

All of the water quality data collected by SqCWD's water system in the years 2013 through 2015 were considered. This data was summarized in our 2013, 2014 and 2015 Annual Consumer Confidence/Water Quality Reports delivered to all of our customers by July 1st of the following year.

The following section is a discussion of constituents with primary MCLs that were detected at or above the applicable California detection limit for purposes of reporting (DLR) at entry points to and within the distribution system, at levels above the PHG, or if no PHG exists, above the MCLG. The table on the next page summarizes these constituents.

Constituent/ Year(s)	Health Risk Category	PHG (MCLG)	Cancer Risk at PHG	MCL	Cancer Risk at MCL	SqCWD Maximum Level	SqCWD Average Level	Best Available Technology (BAT) Options	Potential Treatment Cost
Arsenic 2013 to 2015	Carcinogenicity (may cause cancer)	0.004 µg/L (ppb)	One per million	10 µg/L (ppb)	2.5 per thousand	3.3 µg/L (ppb)	Not detected at or above 2.0 µg/L (ppb)	Activated Alumina; Coagulation/Filtration; Ion Exchange; Lime Softening; Reverse Osmosis; Electrodialysis; and Oxidation/ Filtration	Already implementing coagulation and filtration; No Cost Estimate provided – average level is below the California DLR (detection limit for purposes of reporting).
Copper 2013 to 2015	Digestive system toxicity (may cause nausea, vomiting, diarrhea)	0.3 mg/L (ppm)	N/A	1.3 mg/L (action level)	N/A	0.34 mg/L (ppm) ***(90th percentile, see discussion)***	0.19 mg/L (ppm)	Optimized corrosion control	N/A - Already meeting requirement
Chromium, hexavalent (Chromium 6) 2013 to 2014	Carcinogenicity (may cause cancer)	0.02 ug/L (ppb)	One per million	10 ug/L (ppb)	5 per ten thousand	22 ug/L (ppb)	14 ug/L (ppb)	Coagulation Filtration; Ion Exchange; and Reverse Osmosis	Already implementing Ion Exchange; $80 to $107/year per service connection for Reverse Osmosis
Chromium, hexavalent (Chromium 6) 2015						8.4 ug/L (ppb)	3.2 ug/L (ppb)		

Arsenic

The PHG for arsenic is 0.004 µg/L (parts per billion or ppb). The MCL for arsenic is 10 µg/L. With the arsenic PHG set at 0.004 µg/L, the DDW may enact a lower MCL for California in the future. The maximum reported arsenic concentration in SqCWD supplied water from 2013 through 2015 was 3.3 µg/L, with the average concentration below the DLR of 2.0 µg/L.

Arsenic is a naturally occurring element in the earth's crust and is widely distributed in the environment. Humans are exposed to arsenic mostly through food, and to a lesser degree from drinking water and air (OEHHA, 2004).

Long-term exposure to arsenic in drinking water can increase the risk of skin, lung, bladder and kidney cancer, as well as hyperkeratosis and pigmentation skin changes (World Health Organization, 2011). Other serious health effects stemming from long-term ingestion of arsenic in drinking water include heart attacks, stroke, diabetes and hypertension (OEHHA, 2004). The numerical health risk for the PHG of 0.004 µg/L is one excess cancer case per million people. The numerical health risk for the MCL of 10 µg/L is 2.5 excess cancer cases per thousand people (ACWA, 2016).

SqCWD's water meets all federal and state water quality standards for the presence of arsenic. Two of SqCWD's 15 active wells have had arsenic detected above the DLR of 2.0 µg/L, and above the PHG. Although not required by the DDW, SqCWD voluntarily operates an arsenic removal plant for these two wells. (SqCWD also operates a second plant for a well with arsenic levels below the DLR.) The arsenic is reduced by coagulation and filtration. The treatment over the past 3 years removed an average of 48% of the arsenic, reducing the average arsenic concentration in water supplied by these wells to below the DLR.

Both the US EPA and the DDW adopt what are known as BATs or Best Available Technologies, which are the best known methods of reducing constituent levels to the MCL. Costs can be estimated for such technologies. However, since many PHGs (and MCLGs) are set much lower than the MCL, such as for arsenic, it is not always possible nor feasible to determine what treatment is needed to further reduce a constituent downward to or near the PHG. Estimating the costs to reduce a constituent to such a low level is difficult, if not impossible, because it is not possible to verify by analytical means that the level has been decreased to that low level. For example, the arsenic PHG is 0.004 µg/L, and the California DLR is 2.0 µg/L, 500 times higher than the PHG. The PHG level cannot be measured by the practically available analytical methods (Grosser, 2010).

There may not be commercially available technology to reduce arsenic concentrations to the PHG. However, reverse osmosis (RO) would likely reduce the arsenic concentrations in SqCWD water lower than that of our existing coagulation/filtration treatment plant. According to ACWA's guidance, if the

average concentration of a constituent is below the DLR, then calculating a cost estimate for treatment is not required.

Copper

There is no MCL for copper. Instead, according to the DDW, the 90th percentile value of all samples from household taps in the distribution system cannot exceed a Copper Action Level of 1.3 mg/L for copper. The PHG for copper was established by OEHHA in February 2008 at a level of 0.30 mg/L.

Copper is a naturally occurring element and is an essential nutrient in humans. The category of health risk for copper is digestive system toxicity (OEHHA, 2016). Copper is not classified by the US EPA as a human carcinogen (ATSDR, 2004). However, children may be especially susceptible to the effects of excess copper.

Copper was not detected in any of our source water samples collected from 2013 through 2015 above the DLR (0.05 mg/L). Based on sampling of SqCWD's distribution system in 2013, the 90th percentile value for copper was 0.34 mg/L (parts per million or ppm), above the PHG of 0.30 mg/L. The average copper concentration was 0.19 mg/L, below the PHG. However, the water system is in full compliance with the federal and state Lead and Copper Rule. Therefore, SqCWD is deemed by the DDW to have "optimized corrosion control" for the water system.

In general, optimizing corrosion control is considered to be the Best Available Technology (BAT) to deal with corrosion issues and with any copper findings. We continue to monitor our 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 we are meeting the "optimized corrosion control" requirements, it is not prudent to initiate additional corrosion control treatment as it involves the addition of other chemicals and there could be additional water quality issues raised. Therefore, no estimate of cost has been included.

Chromium, Hexavalent (Chromium 6)

The PHG for Hexavalent Chromium (also known as Chromium 6) was established by OEHHA in July 2011 at a level of 0.02 ug/L (ppb). In 2014, the MCL for Chromium 6 was adopted by the DDW at a level of 10 ug/L (ppb), with regulatory compliance becoming effective January 01, 2015.

Chromium 6 is a heavy metal that is commonly found at low levels in drinking water. It can occur naturally but can also enter drinking water sources by historic leaks from industrial plants' hazardous waste sites. Various other sources also contribute to the amount of hexavalent chromium in groundwater (OEHHA, 2011). The Chromium 6 found in SqCWD's source water is naturally occurring – it does not come from industrial waste.

Chromium is found in drinking water sources and the environment in two principal forms: trivalent Chromium (Chromium 3) and Chromium 6. Chromium 3 is found naturally in foods at low levels and is an essential human dietary nutrient (OEHHA, 2011). Chromium 6 is the more toxic form of chromium and has been known to cause cancer when inhaled. In recent scientific studies in laboratory animals, Chromium 6 has also been linked to cancer when ingested (SWRCB, 2015).

The numerical health risk for the Chromium 6 PHG of 0.02 µg/L is one excess cancer case per million people. The numerical health risk for the Chromium 6 MCL of 10 µg/L is five excess cancer cases per ten-thousand people (ACWA, 2016).

For 2013 and 2014, SqCWD was not required to treat any source water for the removal of Chromium 6, as DDW had not yet established an MCL for Chromium 6. SqCWD implemented Ion Exchange treatment ahead of the then-pending MCL, and was able to significantly reduce Chromium 6 values with a demonstration-scale Chromium 6 treatment plant. SqCWD currently has four active or standby wells with ambient Chromium 6 levels above both the DLR and the MCL, and one well (Country Club) with Chromium 6 below the MCL but above the DLR. Chromium 6 values from all five wells averaged 14 ug/L in 2013 and 2014. Two of the four wells, Altivo and Seascape Wells, were changed from Active to Standby status in December 2014 to comply with the MCL regulation. The other two wells, Bonita and San Andreas, are treated at SqCWD's Chromium 6 removal treatment plant at San Andreas Well. The Chromium 6 running annual average for the compliance point effluent (after treatment) was 2.4 ug/L in 2015. The last test for Chromium 6 in Country Club Well in 2013 measured 6.3 ug/L, and total chromium (the sum of Chromium 3 and Chromium 6) measured 3.4 ug/L in 2015. The weighted average of Chromium 6 for these two entry points (Country Club Well and San Andreas Treatment Plant) to the distribution system in 2015 was 3.2 ug/L.

There are three Best Available Technologies (BATs) for Chromium 6. Reduction-Coagulation-Filtration (RCF), Ion Exchange, and Reverse Osmosis (RO). SqCWD began implementing Ion Exchange (Strong Base Anion Exchange) in October 2014 for the reduction of Chromium 6 in two wells – Bonita and San Andreas Wells. Full compliance has been achieved using Strong Base Anion Exchange (SBA-IX), and SqCWD does not anticipate changing this technology. A full-scale, permanent SBA-IX treatment plant is planned for construction at the Bonita Well site, to treat water from Bonita, San Andreas and Seascape Wells. Seascape Well's status will be changed to active, and Altivo Well will remain as a standby well. As a BAT, only RO would be likely to remove more Chromium 6 than SBA-IX.

Cost estimating guides from ACWA (2016) were used in determining the estimated cost to implement RO. Accurate cost estimates are difficult, if not impossible, to calculate and are highly speculative and theoretical. All costs including annualized capital, construction, engineering, planning, environmental, contingency and operations and maintenance costs are included but very general assumptions are

made for most of these items. Based on the pumping history of the four above-mentioned wells with Chromium 6 levels above the DLR (not including Altivo Well, where no treatment is currently planned), the total annual production volume (needing treatment) would be roughly 389 million gallons. An RO treatment plant for removal of Chromium 6 would need to be designed to account for 3 to 4 million gallons per day, and would be utilized at roughly 30-40% of the design capacity. The annual cost of treatment would range between $1.1 million to $1.5 million dollars. With 14,300 service connections, at $2.94 to $3.92 per thousand gallons treated, the annual cost per service connection would range between $80 and $107.

Recommendations For Further Action

The drinking water quality of SqCWD meets all State DDW and US EPA 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, additional or different costly treatment processes would be required. The health protection benefits of these further hypothetical reductions are not at all clear and may not be quantifiable. Therefore, no action is proposed.

List of Acronyms

ACWA	Association of California Water Agencies
ATSDR	Agency for Toxic Substances and Disease Registry
BAT	Best Available Technologies
DDW	Division of Drinking Water (California)
DLR	California Detection Limit for Purposes of Reporting
EPA	Environmental Protection Agency
MCL	California Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/L	milligrams per liter, or parts per million
OEHHA	California EPA Office of Environmental Health Hazard Assessment
PHG	California Public Health Goal
ppb	parts per billion, or micrograms per liter
ppm	parts per million, or milligrams per liter
RO	Reverse Osmosis
SqCWD	Soquel Creek Water District
SWRCB	State Water Resources Control Board (California)
µg/L	micrograms per liter, or parts per billion

References

Agency for Toxic Substances and Disease Registry, September 2004, Public Health Statement for Copper.

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