SOQUEL CREEK WATER DISTRICT
REPORT ON DISTRICT'S WATER QUALITY
RELATIVE TO PUBLIC HEALTH GOALS
2016 - 2018

September 17, 2019

MAIL TO: P. O. Box 1550 • Capitola, CA 95010
5180 Soquel Drive • TEL: 831-475-8500 • FAX: 831-475-4291 • WEBSITE: www.soquelcreekwater.org

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ACRONYM DEFINITIONS

ACWA	Association of California Water Agencies
ATSDR	Agency for Toxic Substances and Disease Registry
BAT	Best Available Technologies
DDW	Division of Drinking Water (California)
District	Soquel Creek Water District
DLR	California Detection Limit for Purposes of Reporting
EPA	Environmental Protection Agency
IO	Ion Exchange
LCR	Lead and Copper Rule
MCL	California Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/L	milligrams per liter, or parts per million
ng/L	nanograms per liter, or parts per trillion
O&M	Operations & Maintenance
OEHHA	California EPA Office of Environmental Health Hazard Assessment
PHG	California Public Health Goal
pCi/L	pico curies per liter
ppb	parts per billion, or micrograms per liter
ppm	parts per million, or milligrams per liter
ppt	parts per trillion, or nanograms per liter
RCF	Reduction, Coagulation and Filtration
RO	Reverse Osmosis
SWRCB	State Water Resources Control Board (California)
TCP	1,2,3-Trichloropropane
µg/L	micrograms per liter, or parts per billion

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1.0 BACKGROUND

The California Health and Safety Code [Section §116470(b)] requires larger water utilities (>10,000 service connections) every 3 years to prepare a special report if water quality measurements exceed any Public Health Goal (PHG). PHGs are non-enforceable goals established by California Environmental Protection Agency's (EPA's) Office of Environmental Health Hazard Assessment (OEHHA). The law also requires that if OEHHA has not adopted a PHG for a constituent, the water suppliers are to use the Maximum Contaminant Level Goals (MCLGs) adopted by US EPA.

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. The Soquel Creek Water District (District) will continue to report annually in greater depth on water quality in the system.

The purpose of the legislative requirement for PHG reports is to give water system customers access to information on levels of constituents even below the enforceable, mandatory Maximum Contaminant Levels (MCLs). Included in this information 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 (BAT) 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, such as trihalomethanes. These will be addressed in a future required report if these PHGs are adopted.

2.0 WHAT ARE PHGs?

PHGs are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the US EPA or 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 available, 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.

3.0 WATER QUALITY DATA CONSIDERED

All the water quality data collected by our water system from 2016 to 2018 for purposes of determining compliance with drinking water standards were considered. This data was summarized in our 2016, 2017 and 2018 Consumer Confidence Reports that were electronically distributed to customers. If a constituent was detected in the District's water supply in this time period at a level exceeding an applicable PHG or MCLG, this report provides the information required by the law.

4.0 GUIDELINES FOLLOWED

The Association of California Water Agencies (ACWA) formed a workgroup which produces guidelines for water utilities to use in preparing PHG reports. The District used these ACWA

guidelines, updated in 2019, in the preparation of this report. No formal guidance is available from state regulatory agencies. However, the local office of the DDW provided some emailed guidance on one issue. ACWA interprets the law to mean that only constituents exceeding a PHG that also have an established California primary MCL or Action Level (AL) be included in the PHG report. The local DDW office stated that all constituents with a PHG should be included in the report, regardless of whether MCLs are set for the constituent. Therefore, this report includes hexavalent chromium, which does not have an MCL.

5.0 BEST AVAILABLE TREATMENT TECHNOLOGIES AND COST ESTIMATES

Both the US EPA and 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 all MCLGs are set much lower than the MCL, it is not always possible nor feasible to determine what treatment is needed to further reduce a constituent downward to or near the PHG or MCLG, many of which are set at zero. Estimating 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.

Cost information included in the next section is from the ACWA guidance document except for hexavalent chromium, which is from Seidel and others (2013). Costs were calculated using projected production volumes from District sources when the Pure Water Soquel project is implemented.

6.0 CONSTITUENTS DETECTED THAT EXCEED A PHG OR A MCLG

A constituent is considered detected if it equals or exceeds the state regulatory Detection Limit for Purposes of Reporting (DLR). If compliance with an MCL is determined by an average, then that average is compared to the DLR to determine if it is detected.

Six constituents were detected at or above the applicable DLR at entry points to or within the distribution system, at levels above the PHG, or if no PHG exists, above the MCLG. The table on the next page summarizes the detections, which are also referenced in the discussion that follows.

Constituent and Year(s)	Health Risk Category	PHG (MCLG)	Cancer Risk at PHG/MCLG	MCL	Cancer Risk at MCL	SqCWD Maximum Level	SqCWD Average Level	Best Available Technology (BAT) Options	Annual Potential Treatment Costs (Annualized Capital and O&M)
Copper 2016	Digestive system toxicity (may cause nausea, vomiting, diarrhea)	0.3 mg/L (ppm)	N/A	1.3 mg/L (action level)	N/A	0.37 mg/L (ppm) ***90th percentile, see discussion)***	0.24 mg/L (ppm)	Optimized Corrosion Control	N/A - Already meeting requirement
Chromium, hexavalent (Chromium 6) 2016 to 2017	Carcinogenicity (may cause cancer)	0.02 ug/L (ppb)	One per million	N/A	N/A	7.2 ug/L (ppb)	Not detected	Reduction, Coagulation & Filtration (RCF); Ion Exchange (IO); and Reverse Osmosis (RO)	$110,000 to $190,000; $8 to $14 per service connection
Chromium, hexavalent (Chromium 6) 2018						21 ug/L (ppb)	4.1 ug/L (ppb)		
Gross Alpha 2016	Carcinogenicity (may cause cancer)	(0 pCi/L)	0	15 pCi/L	Up to one per thousand	3.3 pCi/L in one well	Not detected	RO	$72,000 to $170,000; $5 to $12 per service connection
Radium 226	Carcinogenicity (may cause cancer)	0.05 pCi/L	One per million	5 pCi/L	One per ten thousand	1.4 pCi/L in one well	Not detected	IX and RO	$130,000 to $530,000; $17 to $38 per service connection
Radium 228 2016 and 2017		0.019 pCi/L	One per million		Three per ten thousand	1.2 to 2.6 pCi/L in three wells	Not detected		
1,2,3-Trichloro-propane 2016 and 2017	Carcinogenicity (may cause cancer)	0.7 ng/L (ppt)	One per million	5 ng/L	Seven per million	11 ng/L in one well	Not detected	Granulated Activated Carbon	$8,700 to $37,000; $1 to $3 per service connection
1,2,3-Trichloro-propane 2018						Not detected	Not detected		

Notes:
1,2,3-TCP = 1,2,3-Trichloropropane
mg/L = milligrams per liter of water
ppm = parts per million
pCi/L = picocuries per liter of water
ug/L = micrograms per liter of water
ppb = parts per billion
ng/L = nanograms per liter of water
ppt = parts per trillion

6.1 Copper

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 does not have a primary drinking water standard in the form of an MCL. Instead, according to the DDW, the 90th percentile value of all Lead and Copper Rule (LCR) samples from household taps in the distribution system cannot exceed the copper AL of 1.3 mg/L or parts per million (ppm) for copper. The PHG for copper is 0.3 mg/L.

Copper was not detected in any District source water sample collected from 2016 through 2018 at or above the DLR (0.05 mg/L). Based on sampling of the District's distribution system in 2016, the 90th percentile value for copper was 0.37 mg/L, above the PHG of 0.30 mg/L. The average copper concentration was 0.24 mg/L, below the PHG. The water system is in full compliance with the federal and state Lead and Copper Rule. Therefore, the District is deemed by the DDW to have "optimized corrosion control" for the water system.

In general, optimizing corrosion control is the BAT to deal with corrosion issues and with any copper findings. The District continues to monitor water quality parameters that relate to corrosivity, such as pH, hardness, alkalinity, and total dissolved solids, and will act if necessary to maintain the system in an "optimized corrosion control" condition.

The District's last LCR monitoring in 2016 meets the "optimized corrosion control" requirements. Additional corrosion control treatment involves the addition of other chemicals that could raise additional water quality issues. Therefore, no estimate of treatment cost has been included.

6.2 Hexavalent Chromium (Chromium 6)

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 the District'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 some scientific studies in laboratory animals, chromium 6 has also been linked to cancer when ingested (SWRCB, 2015).

The PHG for chromium 6 was established by OEHHA in July 2011 at a level of 0.02 ug/L or parts per billion (ppb). In 2014, an MCL for chromium 6 was adopted by the DDW at a level of 10 ug/L, with regulatory compliance becoming effective January 2015. In May 2017, the Superior Court of Sacramento County issued a judgment invalidating the chromium 6 MCL. The DDW subsequently revoked the MCL in September 2017. Since then, chromium 6 has been regulated under the 50 ug/L MCL for total chromium. The District meets both the 50 ug/L total chromium MCL, and met the 10 ug/L MCL when it was in place.

In 2014, the District implemented Ion Exchange (IX) treatment ahead of the then-pending MCL, and reduced chromium 6 values with a demonstration-scale treatment plant. Treatment was discontinued at the end of 2017 when the MCL was repealed.

The District currently has five active or standby wells with Chromium 6 levels above the PHG and DLR; Altivo, Bonita, Country Club, San Andreas and Seascape Wells. Since chromium 6 was not tested for in all wells during the 2016 – 2018 period, total chromium values are used to estimate the chromium 6 levels during that period. The maximum detection in 2016 to 2017 was 7.2 ug/L and was 21 ug/L in 2018. The overall average concentration in all District wells in 2016 to 2017 was non-detect, with an overall average of 4.1 ug/L in 2018.

There are three BATs for Chromium 6. Reduction-Coagulation-Filtration (RCF), IX, and Reverse Osmosis (RO). The calculated cost assumes one central treatment plant will treat water from Bonita, San Andreas and Seascape Wells, and another plant at Country Club Well. Since Altivo Well is not currently in regular operation or anticipated to be in the future, a cost estimate for treatment is not considered. The annualized capital and O&M costs are estimated to be $110,000 to $190,000 per year, or $8 to $14 per year per service connection.

6.3 Radiological Constituents

Elements that contain unstable nuclei are said to be radioactive or are called radionuclides. This instability is manifested as the potential to decay or fall into a lower energy state by releasing principally either alpha or beta particles, or gamma rays. An alpha particle is defined as a positively charged particle consisting of two protons and two neutrons. A beta particle is either a negatively charged negatron/electron or a positively charged particle (positron). Radioactive emissions are measured by an activity unit called a Curie (Ci), representing $3.7x10^{10}$ disintegrations per second. For drinking water, the common representation of activity is the picoCurie (pCi), equal to 10-12 Ci. (OEHHA 2003).

The primary drinking water standards for the state of California include MCLs for natural and man-made radioactivity (California Code of Regulations Title 22, Division 4, Chapter 15, Article 5). Section 64441 of the California code addresses Natural Radioactivity and states the following:

> a) All community water systems shall monitor their water supplies for radium-226, radium-228 and uranium at least once every four years. Compliance with maximum radioactivity levels shall be based on the average of the analysis of four consecutive quarterly samples.
> (b) Gross alpha particle measurement may be substituted for measurement of radium-226 and radium-228.
>
> (1) The supply is considered to be in compliance with maximum radioactivity levels if the gross alpha particle activity does not exceed 5 picocuries per liter (pCi/L).
> (2) If gross alpha activity exceeds 5 pCi/L, measurement of radium-226 shall be made.
> (3) If radium-226 exceeds 3 pCi/L, measurement of radium-228 shall be made.
> (4) The sum of the radium-226 and radium-228 shall not exceed 5 pCi/L.
>
> (c) If the average maximum contaminant level for gross alpha particle activity, total radium or uranium exceeds the MCLs, the water supplier shall report this information to the Department within 48 hours. (OEHHA December 2003).

6.3.1 Gross Alpha

The US EPA has set the MCLG for Gross Alpha at zero (0) pCi/L. OEHHA concluded that it would not be practical to develop a PHG for the category of alpha emitters, even though this category has a primary standard, or MCL, which is currently set at 15 pCi/L under both federal and California law. There are several reasons for this conclusion; the most important is that the designation of gross alpha does not refer to a specific chemical contaminant, but rather to a group of radioactive elements. Furthermore, the MCL represents only a screening level for assay of radioactivity produced by alpha emitters. If excessive activity levels are found, further sample characterization is required, and

selected alpha emitters are subject to regulation under specific MCLs. OEHHA is developing PHGs for the selected isotopes for which there are MCLs (OEHHA 2003).

Gross alpha particle activity was detected in a single source – Ledyard Well – at 3.3 pCi/L in 2016. Historical gross alpha data for Ledyard Well is included in the table below, to demonstrate that gross alpha is usually not detected in this well.

Ledyard Well Gross Alpha – Historical Monitoring	
Collection Date	**Gross Alpha (pCi/L)**
04/08/1987	ND*
04/18/1989	ND
05/01/1990	ND
04/24/1991	ND
04/28/1992	ND
08/23/1994	ND
11/01/1994	ND
02/10/1995	ND
03/28/1995	6.8
02/24/1998	3.0
05/27/1998	ND
09/10/1998	ND
12/15/1998	ND
04/04/2001	ND
02/27/2002	ND
05/07/2002	ND
08/07/2002	ND
10/20/2004	ND
08/02/2005	ND
02/15/2006	ND
05/23/2006	ND
08/30/2006	ND
11/30/2006	ND
09/28/2015	ND
10/19/2016	3.3

*Not Detected at or above 3 pCi/L

RO is the BAT for gross alpha particle activity. The annualized capital and O&M costs for treatment at Ledyard Well are estimated to be $72,000 to $170,000 per year, or $5 to $12 per year per service connection.

6.3.2 Radium-226 and Radium-228

OEHHA established PHGs of 0.05 pCi/L and 0.019 pCi/L for radium-226 and radium-228, respectively. These PHG values are based on the known carcinogenic effects of radiation observed in humans (OEHHA, 2006).

The radionuclides Radium-226 and Radium-228 are naturally occurring. They are formed from the decay of the primordial radionuclides Uranium-238 and Thorium-232, respectively, in the earth's crust. As such, there is a small amount of Radium-226 and Radium-228 in most environmental media including drinking water. Radium-226 decays by emitting an alpha particle, and Radium-226 decays by beta particle emissions, in both cases accompanied by gamma emissions (OEHHA, 2006).

Radium-226 was detected in one District source; Altivo Well, at a level of 1.4 pCi/L. Radium-228 was detected in in the following three District sources: Altivo Well, Aptos Jr. High Well 2, and Madeline Well, at levels of 2.3 pCi/L, 2.6 pCi/L, and 1.2 pCi/L, respectively. Neither Radium-226 nor Radium-228 are regulated with individual MCLs. Instead, Radium-226 and Radium-228 are regulated with a

combined MCL value of 5 pCi/L. The tables below summarize the historical Radium 226 and 228 data for these three wells.

Altivo Well Radium-226 and Radium-228 – Historical Monitoring		
Collection Date	**Radium-226 (pCi/L)**	**Radium-228 (pCi/L)**
08/30/2006	NT*	ND**
08/30/2006	NT	ND
11/30/2006	NT	ND
11/30/2006	NT	ND
02/15/2007	NT	ND
06/13/2007	NT	ND
12/09/2016	1.4	2.3

*NT = Not Tested
**ND = Not Detected at or above 1 pCi/L

Aptos Jr High Well 2 Radium-228 – Historical Monitoring	
Collection Date	**Radium-228 (pCi/L)**
10/20/2016	ND*
01/31/2017	1.4
05/15/2017	1.7
07/27/2017	2.6

*ND = Not Detected at or above 1 pCi/L

Madeline Well Radium-228 – Historical Monitoring	
Collection Date	**Radium-228 (pCi/L)**
08/30/2006	2.0
11/30/2006	ND*
02/15/2007	ND
06/13/2007	ND
12/30/2016	1.2

*ND = Not Detected at or above 1 pCi/L

IX and RO are two of three BATs for which there are treatment cost estimates available. The third BAT is lime softening. ACWA guidance does not provide a cost estimate for lime softening.

The annualized capital and O&M costs for treatment at both Aptos Jr. High Well 2 and Madeline Well is estimated to be $130,000 to $530,000 per year, or $17 to $38 per year per service connection. Since Altivo Well is not currently in regular operation or anticipated to be in the future, a cost estimate for treatment is not considered.

6.4 1,2,3-Trichloropropane

The PHG for 1,2,3-Trichloropropane (TCP) is 0.7 ng/L (parts per trillion) and the MCL is 5 ng/L. TCP is found in one District well, Country Club, detected at levels from 5.6 ng/L to 11 ng/L with an average of 8.3 ng/L. TCP is exclusively a human-made chemical. The source of TCP in Country Club Well is the agricultural use of soil fumigants in the 1950s that contained TCP as an impurity.

TCP causes cancer in laboratory animals. It is reasonably anticipated to be a human carcinogen.

During 2016 and most of 2017, TCP was not a regulated compound and there was no MCL in place. Country Club was taken offline in July 2017 in anticipation of the December 2017 MCL effective date.

The BAT for TCP treatment is granulated activated carbon. The District is planning to conduct a treatment feasibility study for Country Club Well. The well will remain offline pending treatment system installation.

The annualized capital and O&M costs for treatment at Country Club Well is estimated to be $8,700 to $37,000 per year, or $1 to $3 per year per service connection.

6.5 Arsenic

The District treats two of its wells for arsenic. The average arsenic level in delivered water was not detected during the reporting period at or above the DLR of 2 ug/L, therefore it is not required to include arsenic in this PHG report. However, it is included here for informational purposes. The PHG for arsenic is 0.004 ug/L and the MCL is 10 ug/L.

RECOMMENDATIONS FOR FURTHER ACTION

The District's supplied drinking water 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, additional or different costly treatment processes would be required, and nonrevenue water from treated wells would increase. The health protection benefits of these further hypothetical reductions are not clear and may not be quantifiable. Initiation of treatment is not recommended at this time. Treatment options will be considered upon promulgation of a Chromium 6 MCL, as necessary.

REFERENCES

Agency for Toxic Substances and Disease Registry (ASTDR), September 2004, Public Health Statement for Copper

ACWA, April 2019, Suggested Guidelines for Preparation of Required Reports on Public Health Goals (PHGs) to Satisfy Requirements of California Health and Safety Code Section 116470(b)

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http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/chromium6/chromium_fact_sheet_2015_final.pdf