JUNE 2019

CITY OF ORANGE
REPORT ON WATER QUALITY
RELATIVE TO PUBLIC HEALTH GOALS
FOR YEARS 2016, 2017 and 2018

Purpose

Provisions of the California Health and Safety Code (Section 116470 (b)) specify that larger water utilities (>10,000 service connections) prepare a special report by July 1, 2019 if their water quality measurements have exceeded any Public Health Goals (PHGs). PHGs are non-enforceable goals established by the Cal-EPA's Office of Environmental Health Hazard Assessment (OEHHA). The law also 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 United States Environmental Protection Agency (USEPA). 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. This report covers the "detection" of contaminants above both PHGs and MCLGs found in the City's water system during calendar years 2016, 2017, and 2018.

If a constituent was detected in the City's water supply between 2016 and 2018 at a level exceeding an applicable PHG or MCLG, this report provides the information required by law. Included is the 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

Background

The USEPA and the OEHHA established very conservative water quality standards for domestic drinking water systems. These standards are based on various risk-assessment factors and are expressed in terms of an allowable Maximum Contaminant Level (MCL) for every regulated contaminant. The MCL is the regulatory definition of what is "safe". The MCLs are strictly

enforced. Water agencies are required to take specific actions to notify consumers and to mitigate the problem if an MCL is exceeded. *The City of Orange water system consistently meets all federal and state drinking water MCL standards.*

OEHHA also establishes PHGs for drinking water systems. PHGs are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the USEPA or the California State Water Resources Control Board (SWRCB) 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 federal equivalent to PHGs are called Maximum Contaminant Level Goals (MCLGs). *PHGs and MCLGs are not enforceable standards. Water agencies are not required to take any actions regarding them*. These goals are not based on a comprehensive risk assessment analysis. Instead, they are set to only represent a contaminant level that would result in either zero health risk or "no significant" (one in a million) health risk for a lifetime of exposure. Determinations of health risks at these low levels are frequently and theoretically, based on risk assessments with many assumptions. Many PHGs are set at zero.

California legislation requires water agencies to prepare a special report every three years, if their water exceeds any PHG or MCLG. The report must identify all contaminants in excess of a PHG/MCLG, the public health risks involved and a general estimate of the costs that would be involved in removing the contaminants in order to meet the goals. The purpose of this report is to provide consumers with additional information on the contaminant levels and to furnish information about the cost to reduce to below the PHG/MCLG level or basically eliminate even small traces of contaminants from the water supply.

Both the USEPA and SWRCB adopt what are known as BATs or 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, 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 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.

All of the water quality data collected in 2016, 2017 and 2018, for the purposes of determining compliance with drinking water MCL standards, was considered for the purposes of this report. Every year all water quality results are summarized in the Annual Consumer Confidence Report which is made available to all customers and is posted online at www.cityoforange.org/ccr. As indicated previously, the City of Orange water system complies with all federal and state MCL standards. The City of Orange water supply, which includes water from wells and imported sources meets all of the PHG and MCLG standards, with only three exceptions during the last three years.

PHG/MCLG Compliance Exceptions
During Calendar Years 2016, 2017 and 2018

- Gross (Total) Alpha Activity (Excluding Uranium) was detected in one source water sample (well) from not detected to 4.55 pico Curies per liter (pCi/L). The MCL is 15 pCi/L. The EPA MCLG is 0 (zero).

- (Natural) Uranium was detected in import and five sources water samples (wells) from not detected to 7.65 pico Curies per liter (pCi/L). The MCL is 20 pCi/L. The PHG is 0.43 pCi/L. The EPA MCLG is 0 (zero).

- Hexavalent Chromium was detected in one source water sample (well) from not detected to 1.30 ppb. The MCL is 10 ppb and the PHG is 0.02 ppb.

Radionuclides

Many naturally occurring substances and a few man-made ones have the potential to emit ionizing radiation, and are therefore referred to as radionuclides. Of the radionuclides that have been observed in drinking water, most are naturally occurring. The naturally occurring constituents of greatest concern in drinking water are uranium and radium-226 and radium-228. Most of the naturally occurring radionuclides are alpha particle emitters. Contamination by man-made nuclear materials can also occur. The man-made radionuclides, which are primarily beta and photon emitters, are produced by a number of activities that involve the use of concentrated radioactive materials. These include production of electricity, nuclear medicines used in therapy and diagnosis, and various commercial products such as televisions or smoke detectors. The City of Orange is only required to monitor its ground water and surface water supplies for naturally occurring radionuclides. Exposure to radionuclides from drinking water results in an increased risk of cancer. In addition to cancer, exposure to uranium has the potential to cause kidney damage. In California, the radionuclides currently regulated in drinking water are gross alpha particle activity, radium-226 and radium-228, uranium; and beta and photon emitters. Of those radionuclides, gross alpha particle activity and uranium were detected in import and ground water sources serving the City of Orange below the MCL but above the PHG/MCLG.

Gross (Total) Alpha

Gross or total alpha particle activity is used as a screening tool to possibly avoid testing for other radionuclides. There is no PHG for gross alpha particle activity but the MCLG set by the USEPA is 0 (zero) pico Curies per liter (pCi/L). The MCL for drinking water standard is 15 pCi/L. Orange is required to monitor each of its drinking water wells for gross alpha particle activity at least once every four years. During the three-year period (2016-2018) covered by this report, gross alpha particle activity was measured in 1 of the City's wells in amounts ranging from not-detected to 4.55 pCi/L. Gross Alpha particle was NOT detected in any import water sources. The levels detected were below the MCL at all times. *The City water system is in full compliance with federal and state rules for gross alpha particle activity.*

The category of health risk associated with gross alpha particle activity is carcinogenicity. People who drink water containing gross alpha particle activity above the MCL throughout their

lifetime could experience an increased risk of getting cancer. The Best Available Treatment Technologies (BAT) to lower the level of alpha particles to the MCLG is reverse osmosis, while ion exchange is also a possible treatment option. It is not known if either technology is feasible of achieving the MCLG level of zero pCi/L. In studies conducted to remove contaminant via Reverse Osmosis by CH2M Hill for City of Scottsdale, AZ, the annualized capital and O&M costs ranged from $1.82 to $6.65 per 1,000 gallons treated. To treat the affected well, it is estimated that it would cost approximately $9 million per year to reduce the level of alpha particle activity. While one well is currently affected, with the randomly occurring nature of how total alpha particle activity is being detected in the wells, successful reduction treatment for total alpha particle activity over time may include more wells, which in turn, would considerably raise the cost. In addition, since there is little data readily available to estimate cost of treatment to achieve absolute zero, installation of treatment may not necessarily achieve the MCLG and the costs may be significantly higher to do so.

Uranium

Uranium is the heaviest naturally occurring element. It is a mixture of three radioactive isotopes: U-238, U-235, and U-234. The isotope U-238 comprises over 99% of naturally occurring uranium. A Public Health Goal (PHG) for uranium was first established in 2001. The MCL for Uranium is 20 pico-Curies per liter (pCi/l). The PHG for uranium is 0.43 pCi/l. The EPA MCLG is 0 (zero). The category of health risk for uranium is cancer and possible kidney toxicity.

Uranium test results for the City for the period 2016-2018 from all groundwater and import sources had a range of not detected to 7.65 pCi/l. Uranium was found to occur in five groundwater wells. Uranium was also detected in import water sources in amounts ranging from not detected to 3.0 pCi/L. The levels detected were below the MCL at all times. *The City water system is in full compliance with federal and state rules for uranium.*

Treatment considerations would again focus on the five affected groundwater (well) sources and import connections. Treatment options include reverse osmosis or ion exchange. As similarly discussed for gross alpha particle activity, costs to remove uranium are estimated to run upwards of $36 million annually. It is to be noted that in treating (for removal) of any one of the above contaminants, would effectively remove all the noted contaminates in this report. Efficiencies in excess of 95% removal would be necessary to achieve PHG levels for uranium and could likely be more costly than referenced due to the variable removal rate. Likewise and similar to gross alpha, the randomly occurring nature of uranium may necessitate further treatment at differing wells which could raise the cost significantly.

Hexavalent Chromium (Chromium VI)

Hexavalent chromium (or Chromium-6), is a highly toxic form of the naturally occurring metal chromium. It is an odorless and tasteless metallic element. Chromium is found naturally in rocks, plants, soil and volcanic dust, and animals. The most common forms of chromium that occur in natural waters in the environment are:

Trivalent chromium (chromium-3)
Hexavalent chromium (chromium-6)

Chromium-3 is an essential human dietary element. It is found in many vegetables, fruits, meats, grains and yeast. Chromium-6 occurs naturally in the environment from the erosion of natural chromium deposits. It can also be produced by industrial processes. There are demonstrated instances of chromium being released to the environment by leakage, poor storage, or inadequate industrial waste disposal practices.

Chromium-6 is recognized as a human carcinogen via inhalation, which can increase the risk of lung cancer. Exposure to hexavalent chromium from breathing dust or fumes is considered to have a much higher risk than exposure from drinking water. Research data collected from China found increased rates of stomach cancer in people who may have been exposed to very high levels of hexavalent chromium in drinking water.

In 2010, the USEPA released a draft human health assessment proposing to classify hexavalent chromium as a likely to be carcinogenic via ingestion. USEPA was advised by a peer review panel in 2012 to consider the results from research funded through the American Chemistry Council. The new research replicates the earlier National Toxicology Program (NTP) study at lower doses of hexavalent chromium and seeks to identify the underlying cause for carcinogenicity from oral exposure. The completion of the USEPA human risk assessment and final determination of human carcinogenicity of hexavalent chromium via oral ingestion is still pending. In 2012, the USEPA finalized the third Unregulated Contaminant Monitoring Rule (UCMR3) which requires water systems serving greater than 10,000 persons to monitor for hexavalent chromium and total chromium.

In July, 2011 California finalized its Public Health Goal at 0.02 ug/L in drinking water. California found sufficient evidence that hexavalent chromium is carcinogenic by oral exposure, based on the NTP long term animal study. The California PHG is based solely on health effects and is set at a level determined to not pose any significant risk to health.

Hexavalent chromium test results for the City for the period (2016-2018) from a single well that had one detection for a range of not detected to 1.3 ppb. Hexavalent chromium was NOT detected in any import water sources. The level detected was below the MCL of 10 ppb at all times. *The City water system is in full compliance with federal and state rules for hexavalent chromium.*

The treatment consideration for hexavalent chromium would focus on a single affected groundwater (well) source. Treatment options include reverse osmosis or ion exchange. As similarly discussed for gross alpha particle activity and uranium above, costs to remove hexavalent chromium are estimated to run upwards of $10 million annually.

Other Discussion (Lead & Copper)

There is no MCL for Lead or Copper. Instead, the 90th percentile value of all samples from household taps in the distribution system 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. The PHG for copper is 0.3 mg/l. The category of health risk for exposure to lead is potential damage to the brain, red blood cells, and kidneys especially in young children or pregnant women. The risk of exposure for copper is

stomach and intestinal distress, liver or kidney damage, and complications of Wilson's disease in genetically predisposed people

Lead and copper test results were not detected for all samples taken from imported water sources. Lead and copper tests results for wells were none detected for lead and 0.0014 to 0.0021 mg/L for copper over the test period. Based upon extensive sampling of our distribution system from customer's internal taps, our 90th percentile for lead was 0.0047 mg/L (no home above the AL) and the 90th percentile for copper was 0.16 mg/L (no homes above the AL). Therefore, Orange remains under the AL for lead and copper and are deemed to have "optimized corrosion control" for our system.

In general, optimizing corrosion control is considered to be the best available technology to deal with corrosion issues and with any lead or copper findings. We continue to monitor our water quality parameters related to corrosivity, such as pH, hardness, alkalinity, and total dissolved solids. The Langelier Index (LI) is another indicator of corrosivity. A positive LI indicates non-corrosive water. All City water sources have positive LI's and are therefore considered non-corrosive.

Conclusion

PHGs and MCLGs are not enforceable and are not required to be met by any public water system. They are set based upon "zero" or "no significant" risks without consideration of practical risk management factors such as analytical detection ability to test at PHG or MCLG threshold levels, available treatment technologies, benefits, and costs. Public water systems are held accountable to Maximum Contaminant Levels (MCLs) for compliance with water quality standards. *The City of Orange water system continues to meet all federal and state drinking water standards to protect public health.*