2015 MCL Review in Response to PHGs

March 1, 2015

[Note: On July 1, 2014, the Drinking Water Program in the California Department of Public Health (CDPH) transferred to the SWRCB (Water Board), where it is now the Division of Drinking Water (DDW).]

Health and Safety Code §116365(g) requires the Water Board, at least once every five years to review its MCLs. In the review, the Water Board's MCLs are to be consistent with criteria of §116365(a) and (b). Those criteria state that the MCLs cannot be less stringent than federal MCLs, and must be as close as is technically and economically feasible to the public health goals (PHGs) established by the Office of Environmental Health Hazard Assessment (OEHHA). Consistent with those criteria, the Water Board is to amend any standard if any of the following occur: (1) Changes in technology or treatment techniques that permit a materially greater protection of public health or attainment of the PHG, or (2) New scientific evidence indicates that the substance may present a materially different risk to public health than was previously determined. Each year by March 1, the Water Board is to identify each MCL it intends to review that year.

For a list of all regulated chemicals' MCLs and PHGs, click here (Excel).

The Process of Review

The first step in the review process is an initial screening. The criteria for this screening include: (1) The relationship between the PHG and both federal and state MCLs (PDF); (2) any changes in treatment techniques for chemical removal that would provide for a materially greater protection of public health; and (3) any new scientific evidence indicating that the substance might present a materially different risk to public health than was previously determined.

To assess chemical occurrence in drinking water sources, we obtained four years of recent analytical data from the Water Quality Monitoring (WQM) database and analyzed each chemical being considered for review.

For each chemical in WQM, we have established in regulation a standardized quantification level called the "detection level for purposes of reporting" (DLR). The DLR represents the level at which we are confident about the accuracy of the quantity of contaminant being reported. Although any findings below DLRs are considered "non-detects" and are not technically required to be reported, some laboratories may on occasion report lower levels for chemicals. For some chemicals, the DLR affects the technical feasibility of revising the MCL.

Since this process began, MCLs for these chemicals have been revised downward: cyanide, ethylbenzene, 1,2,4-trichlorobenzene, atrazine, oxamyl, and methoxychlor.

MCL Review and Status

The steps in selecting contaminants for possible MCL review are as follows:

1. Regulated contaminants with PHGs - The selection process for MCLs for possible review first considers the regulated chemicals with PHGs. From the list of regulated contaminants, those with PHGs established through 2014 were identified. (see OEHHA's list of contaminants with PHGs)

In 2014, OEHHA revised PHGs for five contaminants: monochlorobenzene, trichlorofluoromethane (Freon 11), endothal, hexachlorocyclopentadiene, and 2,4,5-TP (Silvex).

At the request of CDPH (now DDW), OEHHA has established PHGs for two unregulated chemicals, N-nitrosodimethylamine (NDMA) and 1,2,3-trichloropropane (1,2,3-TCP). We have not yet proposed MCLs for NDMA and 1,2,3-TCP, and they are not considered further in this review. Note that US EPA is considering regulating nitrosamines such as NDMA, which may occur as disinfection byproducts, as a group in its Drinking Water Strategy.

There are 87 contaminants with MCLs that have PHGs (Table 1) (Excel).

2. Contaminants with MCLs greater than PHGs - The selection process then identified contaminants with MCLs greater than PHGs.

There are 37 chemicals with MCLs equal to or below their PHGs that were not considered for further review, since their MCLs provide the same or greater protection to the drinking water consumer as their PHGs. For this step in the process, chemicals with an MCL 1.3 times the PHG were considered to have an MCL equivalent to the PHG: 1,2-dichloroethane, dichloromethane, diquat, endrin, and heptachlor.

In addition, 6 other chemicals were excluded at this stage:

- **Chemicals Regulated by the Lead and Copper Rule:** Lead and copper do not have MCLs (they are covered by "action levels" and a different regulatory approach, as set forth in 22 CCR §64678) and were not considered further. The action level for lead is 3 times its DLR; its DLR is 25 times the PHG. The action level for copper is 4.3 times its PHG.

- **Chemicals Used in Drinking Water Treatment to Provide a Public Health Benefit:** Aluminum and fluoride may also be added in drinking water treatment to provide a public health benefit, so they are not necessarily always "contaminants." They were not considered further. Their MCLs are 1.7 and 2 times their PHGs, respectively. Aluminum also has a secondary MCL that is more restrictive than its PHG.

- **Chemicals That Are Byproducts of Disinfection Treatment:** Bromate and chlorite are byproducts of drinking water disinfection, which is required for public health protection. They were not considered further. The MCL for bromate is 2 times its DLR; its DLR is 50 time the PHG. The MCL for chlorite is 20 times its PHG.

When chemicals with MCLs equivalent to or below their PHGs and the additional chemicals identified above are excluded from the regulated contaminants in Step 1, there remain 45 contaminants with MCLs greater than their PHGs (Table 2) (Excel).

3. Recent detections of contaminants with MCLs greater than PHGs - The selection process excludes contaminants with no recent detections at or above the DLR in at least one drinking water source. Two detections in a source at or above the DLR is a "detection" for purposes of this step.

There are 22 contaminants with recent (2011-2014) detections (Table 3) (Excel). The most commonly detected contaminants with MCLs greater than PHGs include arsenic, hexavalent chromium, uranium, tetrachloroethylene (or perchloroethylene, PCE), trichloroethylene (TCE), and 1,2-dibromo-3-chloropropane (DBCP).

4. Contaminants for further review - 22 contaminants with MCLs greater than their PHGs and with recent detections were evaluated to determine chemicals for further review of the MCL. They were considered in terms of the number of sources (active and standby) with reported detections above the PHG or the MCL, and in terms of the criteria presented earlier. Based on these considerations, we determined whether or not a more extensive review and evaluation - including a cost-benefit analysis of possible MCL reductions - would be appropriate. The 22 contaminants are discussed individually below.

Notes pertinent to individual chemicals:

(1) With regard to the basis for the PHG mentioned below, PHGs for cancer-causing substances are set at a level of 1 X 10-6, or up to one excess case of cancer per million people per 70-year lifetime exposure. This is also called "*de minimis*" cancer risk. Public health and environmental regulatory agencies generally consider risks within the 10-6 to 10-4 cancer risk range to be "acceptable," though on occasion a higher theoretical cancer risk may be acceptable, when setting a health-based standard.

(2) For chemicals considered to be non-carcinogens, PHGs are set at a level equivalent to the no observed adverse effect level (NOAEL) divided by an uncertainty factor (UF) that reflects limitations in available scientific information related to the evaluation of effects. For some contaminants, the UF may include an extra 10-fold factor to account for a possibility of cancer -- this would occur, for example, if the chemical is known to be carcinogenic when inhaled, but hasn't been found to be carcinogenic when ingested.

(3) Where California and federal MCLs differ, this is noted in the chemical-specific information.

(4) Detections refer to the number of drinking water sources with a peak detection above the PHG and above the MCL, based on sampling from 2011 through 2014, unless otherwise noted.

Inorganic Chemicals (8)

- Arsenic - MCL = 10 ppb; DLR = 2 ppb; PHG = 0.004 ppb.
  Basis for PHG: Cancer risk, based upon epidemiological studies in people, along with studies in experimental animals.
  Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 5 X 10-4. Cancer risk at MCL: 2.5 X 10-3.
  Detections: Arsenic is among the most frequently detected contaminants. The Final Statement of Reasons for the arsenic MCL (2008) identified 2,642 sources with detections above 2 ppb and 593 above 10 ppb.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from arsenic in drinking water. Thus, we do not plan on further review of the arsenic MCL.
- Beryllium - MCL = 4 ppb; DLR = 1 ppb; PHG = 1 ppb.
  Basis for PHG: Non-cancer effects, based upon gastrointestinal lesions in dogs fed beryllium in their diets. The PHG includes a 1,000-fold UF (including a 10-fold factor reflecting the possible carcinogenic potential from ingested beryllium).
  Detections (2011-2014): 1 source with a detection above the PHG and above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from beryllium in drinking water. Thus, and considering the single detection of beryllium and that the MCL is just four times the PHP, we do not plan on further review of the beryllium MCL.
- Cadmium - MCL = 5 ppb; DLR = 1 ppb; PHG = 0.04 ppb.
  Basis for PHG: Non-cancer effects, based upon tubular damage in human kidneys indicated by the presence of small proteins and other substances. The PHG includes a 50-fold UF (including a 10-fold factor reflecting the possible carcinogenic potential from ingested cadmium).
  Detections (2011-2014): 17 sources with a detection above the PHG and 5 above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from cadmium in drinking water. Thus, and considering the few detections of cadmium, we do not plan on further review of the cadmium MCL.
- Chromium, Hexavalent - MCL = 10 ppb (there is no federal MCL specific for hexavalent chromium); DLR = 1 ppb; PHG = 0.02 ppb.
  Basis for PHG: Cancer risk, based upon studies in experimental animals.
  Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 5 X 10-4. Cancer risk at MCL: 5 X 10-4.
  Detections: Hexavalent chromium is also among the most frequently detected contaminants. The Initial Statement of Reasons for the hexavalent chromium MCL (2014) included increased monitoring and treatment requirements for an estimated 2487 sources above 1 ppb and 311 above 10 ppb.
  The MCL for hexavalent chromium was adopted in 2014. We are not aware of changes in treatment techniques or new evidence regarding risks to public health from hexavalent chromium in drinking water. Thus, we do not plan on further review of the hexavalent chromium MCL.
- Mercury - MCL = 2 ppb; DLR = 1 ppb; PHG = 1.2 ppb.
  Basis for PHG: Non-cancer effects, based on kidney toxicity in short term studies in rats. PHG includes a 1,000-fold UF.
  Detections (2011-2014): 6 sources with a detection above the PHG and 5 above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from mercury in drinking water. Thus, and considering the few detections of mercury and that the MCL is 1.7 times the PHG, we do not plan on further review of the mercury MCL.
- Nickel - MCL = 100 ppb (no federal MCL); DLR = 10 ppb; PHG = 12 ppb.
  Basis for the PHG: Non-cancer effects, based upon reproduction toxicity studies in rats. PHG includes a 1,000-fold UF (including a 10-fold factor reflecting the possible carcinogenic potential from ingested nickel).
  Detections (2011-2014): 44 sources with a detection above the PHG and 7 above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from nickel in drinking water. Thus, and considering the few detections, we do not plan on further review of the nickel MCL.
- Selenium - MCL = 50 ppb; DLR = 5 ppb; PHG = 30 ppb.
  Basis for the PHG: Non-cancer effects, based upon hair loss and nail damage in people. PHG includes a 3-fold UF.

Detections (2011-2014): 19 sources with a detection above the PHG and 8 above the MCL.
Selenium is an essential nutrient. We are not aware of changes in treatment techniques or new evidence regarding risks to public health from selenium in drinking water. Thus, and considering the few detections and that the MCL is 1.7 times the PHG, we do not plan on further review of the selenium MCL.

- Thallium - MCL = 2 ppb; DLR = 1 ppb; PHG = 0.1 ppb.
  Basis for the PHG: Non-cancer effects, based upon hair loss in rats. PHG includes a 3,000-fold UF.
  Detections (2011-2014): 1 source with a detection above the PHG (i.e., >= DLR) and 0 above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from thallium in drinking water. Thus, and considering the few detections and that the MCL is 2 times the DLR, we do not plan on further review of the thallium MCL.

Radionuclides (3)

- Radium 226 - MCL = 5 picocuries per liter (pCi/L) for sum of Ra-226 + Ra-228; DLR = 1 pCi/L; PHG = 0.05 pCi/L.
  Basis for PHG: Cancer risk, based upon human epidemiological data for exposures to ionizing radiation. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 2 X 10-5. Cancer risk at MCL, if all from Ra-226: 1 X 10-4.
  Detections (2011-2014): 23 sources with a detection above the PHG (i.e., >= DLR) and 5 above 5 pCi/L. These raw values do not take into account statistical evaluations required to determine compliance with the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from radium-226 in drinking water. Thus, we do not plan on further review of the radium-226 = radium-228 MCL.
- Radium 228 - MCL = 5 pCi/L for sum of Ra-226 + Ra-228; DLR = 1 pCi/L; PHG = 0.019 pCi/L.
  Basis for PHG: Cancer risk, based upon human epidemiological data for exposures to ionizing radiation. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 5 X 10-5. Cancer risk at MCL, if all from Ra-228: 2.6 X 10-4.
  Detections (2011-2014): 57 sources with a detection above the PHG (i.e., >= DLR) and 1 above 5 pCi/L. These raw values do not take into account statistical evaluations required to determine compliance with the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from radium-228 in drinking water. Thus, we do not plan on further review of the radium-226 + radium-228 MCL.
- Uranium - MCL = 20 pCi/L (federal MCL is 30 µg/L); DLR = 1 pCi/L; PHG = 0.43 pCi/L.
  Basis for PHG: Cancer risk, based upon human epidemiological data for exposures to ionizing radiation. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 2.3 X 10-6. Cancer risk at MCL: 4.7 X 10-5.
  Detections (2011-2014): Uranium is a frequently detected contaminant. 967 sources with a detection above the PHG (i.e., >= DLR) and 224 above the MCL. These raw values do not take into account statistical evaluations required to determine compliance with the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from uranium in drinking water. Thus, we do not plan on further review of the uranium MCL.

Volatile Organic Chemicals (9)

- Benzene - MCL = 1 ppb (federal MCL = 5 ppb); DLR = 0.5 ppb; PHG = 0.15 ppb.
  Basis for PHG: Cancer risk, based upon human data from workplace exposures. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 3.3 X 10-6. Cancer risk at the 1-ppb MCL: 6.7 X 10-6.
  Detections (2011-2014): 6 sources with a detection above the PHG (i.e. >= DLR) and 3 above the MCL (2 above the federal MCL).
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from benzene in drinking water. Thus, and considering the few detections and that the MCL is 2 times the DLR, we do not plan on further review of the benzene MCL.
- Carbon tetrachloride - MCL = 0.5 ppb (federal MCL = 5 ppb); DLR = 0.5 ppb; PHG = 0.1 ppb.
  Basis for PHG: Cancer risk, based upon experimental studies in mice. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 5 X 10-6. Cancer risk at MCL: 5 x 10-6.
  Detections (2011-2014): 54 sources with a detection above the PHG (i.e. >= DLR) and the MCL (9 above the federal MCL).
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from

carbon tetrachloride in drinking water. Thus, and considering the constraints by the DLR (MCL = DLR), and that the MCL is just 5 times the PHG, we do not plan on further review of the carbon tetrachloride MCL.

- 1,1-Dichloroethane - MCL = 5 ppb (there is no federal MCL); DLR = 0.5 ppb: PHG = 3 ppb.
  Basis for PHG: Cancer risk, based upon experimental studies in rates. Cancer risk at PHG: 1X10-6. Cancer risk at MCL: 1.7 X 10-6 ppb.
  Detections (2011-2014): 2 sources with a detection above the PHG and 0 above the MCL.
  CDPH is not aware of changes in treatment techniques or new evidence regarding risks to public health from 1,1-dichloroethane in drinking water. Thus, and considering the few detections above the PHG and that MCL is 1.7 times the PHG, we donot plan on further review of the 1,1-dichloroethane MCL.
- 1,2-Dichloropropane - MCL = 5 ppb; DLR = 0.5 ppb; PHG = 0.5 ppb.
  Basis for PHG: Cancer risk, based upon experimental studies in mice. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 1 X 10-6. Cancer risk at MCL: 1 X 10-5.
  Detections (2010-2013): 13 sources with a detection above the PHG and 0 above the MCL.
  CDPH is not aware of changes in treatment techniques or new evidence regarding risks to public health from 1,2-dichloropropane in drinking water. Thus, and considering the few detections, CDPH does not plan on further review of the 1,2-dichloropropane MCL.
- 1,3-Dichloropropene - MCL = 0.5 ppb; DLR = 0.5 ppb; PHG = 0.2 ppb.
  Basis for PHG: Cancer risk, based upon experimental studies in rodents. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 2.5 X 10-6. Cancer risk at MCL: 2.5 X 10-6.
  Detections (2011-2014): 2 sources with a detection above the PHG (i.e. >= DLR) and the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from 1,3-dichloropropene in drinking water. Thus, and considering the few detections and the constraints by the DLR (MCL = DLR), and that the MCL is just 2.5 times the PHG, we do not plan on further review of the 1,3-dichloropropene MCL.
- Styrene - MCL = 100 ppb; DLR = 0.5 ppb; PHG = 0.5 ppb.
  Basis for the PHG: Cancer risk, based upon laboratory studies in rodents. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 1 x 10-6. Cancer risk at MCL: 2 X 10-4.
  Detections (2011-2014): 2 sources with detections above the PHG and 0 above the MCL.
  We are not aware of changes in treatment techniques related to styrene in drinking water. However, the PHG, which was established in 2010, is now based on cancer risk. In 2011-2014, styrene was detected in a single source with a peak concentration of 1.1 ppb. Given these limited findings, even though the PHG presents new evidence regarding the health risks of styrene in drinkng drinking water, we do not plan on further review of the styrene MCL at this time.
- Tetrachloroethylene (Perchlorethylene, PCE) - MCL = 5 ppb; DLR = 0.5 ppb; PHG = 0.06 ppb.
  Basis for the PHG: Cancer risk, based upon experimental studies in rodents. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 8.3 X 10-6. Cancer risk at MCL: 8.3 x 10-5.
  Detections (2011-2014): 441 sources with a detection above the PHG (i.e. >= DLR), and 120 above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from PCE in drinking water. PCE is among the more frequently detected organic contaminants. Even though there are constraints associated with the DLR, we have previously mentioned our intention to examine the PCE detections, and to develop a cost benefit analysis of possible MCL revisions. Our intention is to perform this evaluation along with a similar analysis for TCE, another frequently detected contaminant (see below). However, because OEHHA is reviewing the TCE PHG, we have put the review of both of these VOCs on hold. We note at the federal level, in 2012 US EPA released its evaluation of PCE and determined that a concentration of 20 ppb in drinking water is associated with a 10-6 lifetime cancer risk. (Go to US EPA's Integrated Risk Information System (IRIS) - PCE). In addition, US EPA in its Drinking Water Strategy is considering the regulation of volatile organic chemicals as a group; this would include PCE and TCE.
- 1,1,2-Trichloroethane - MCL = 5 ppb; DLR = 0.5 ppb; PHG = 0.3 ppb.
  Basis for PHG: Cancer risk, based on experimental studies in mice. Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 1.7 X 10-6. Cancer risk at MCL: 1.7 X 10-5.
  Detections (2011-2014): 5 sources with a detection above the PHG (i.e. >= DLR) and 1 above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from 1,1,2-trichloroethane in drinking water. Thus, and considering the few detections, We do not plan on further review of the 1,1,2-trichloroethane MCL.
- Trichloroethylene (TCE) - MCL = 5 ppb; DLR = 0.5 ppb; PHG = 1.7 ppb.
  Basis for the PHG: Cancer risk, based upon experimental studies in mice. Cancer risk at PHG: 1 X 10-6.

Cancer risk at MCL: 2.9 x 10-6.
Detections (2011-2014): 255 sources with a detection above the PHG and 126 above the MCL.
We are not aware of changes in treatment techniques or new evidence regarding risks to public health from TCE in drinking water. TCE is among the more frequently detected organic contaminants. In 2001, when the PHG was at a lower concentration (0.8 ppb), considering the large number of TCE detections, even though there were no changes in treatment techniques nor new scientific evidence regarding risks to public health, we developed a draft cost benefit analysis (PDF) of possible MCL revisions. No public comment period was scheduled for that document. In July 2004, when OEHHA announced its plans to review the PHG for TCE, we suspended our evaluation of TCE. The current PHG was established in 2009. In 2012, OEHHA announced its intention to review the PHG for TCE. At the present time CDPH has put on hold plans to re-examine the TCE detections, and the associated development of a cost benefit analysis of possible MCL revisions. If a review is performed in the future, it will likely be done along with a similar analysis for PCE, as mentioned above. At the federal level, in 2011 US EPA released an assessment of the human health risks associated with TCE and determined that a concentration of 0.5 ppb is associated with a 10-6 lifetime cancer risk. (Go to US EPA's IRIS - TCE). As mentioned above for PCE, US EPA is considering the regulation of volatile organic chemicals as a group in its Drinking Water Strategy.

Synthetic Non-Volatile Organic Chemicals (2)

- 1,2-Dibromo-3-chloropropane (DBCP) - MCL = 0.2 ppb; DLR = 0.01 ppb; PHG = 0.0017 ppb.
  Basis for PHG: Cancer risk, based upon experimental studies in mice. Cancer risk at PHG: 1 X 10-6.
  Cancer risk at DLR: 5.9 X 10-6. Cancer risk at MCL: 1.2 x 10-4.
  Detections (2011-2014): 369 sources with a detection above the PHG (i.e. >= DLR), and 95 above the MCL, even though DBCP's use as a fumigant has been prohibited for many years.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from DBCP in drinking water. Previously DBCP was considered a candidate for possible MCL revision, given the number of detections and the 20-fold difference between the MCL and the DLR. At the end of the process, we concluded (PDF) that reduction of the current MCL (i.e., making it more stringent) would not be economically feasible. As a result of the findings of the prior evaluation, we do not plan on further review of the DBCP MCL.
- Ethylene dibromide (EDB) - MCL = 0.05 ppb; DLR = 0.02 ppb; PHG = 0.01 ppb.
  Basis for PHG: Cancer risk, based upon forestomach tumors in experimental studies in rats and mice.
  Cancer risk at PHG: 1 X 10-6. Cancer risk at DLR: 2 X 10-6. Cancer risk at MCL: 5 X 10-6.
  Detections (2011-2014): 6 sources with a detection above the PHG and 4 above the MCL.
  We are not aware of changes in treatment techniques or new evidence regarding risks to public health from EDB in drinking water. Thus, and considering the few detections and that the MCL is just 2.5 times the DLR and 5 times the PHG, we do not plan on further review of the EDB MCL.

(Updated 11/16/15)