

Health Risk Information for Public Health Goal Exceedance Reports

Prepared by

Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

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Under the Calderon-Sher Safe Drinking Water Act of 1996 (the Act), water utilities are required to prepare a report every three years for contaminants that exceed public health goals (PHGs) (Health and Safety Code Section 116470 (b)(2)). The numerical health risk for a contaminant is to be presented with the category of health risk, along with a plainly worded description of these terms. The cancer health risk is to be calculated at the PHG and at the California maximum contaminant level (MCL). This report is prepared by the Office of Environmental Health Hazard Assessment (OEHHA) to assist the water utilities in meeting their requirements.

PHGs are concentrations of contaminants in drinking water that pose no significant health risk if consumed for a lifetime. PHGs are developed and published by OEHHA (Health and Safety Code Section 116365) using current risk assessment principles, practices and methods.

Numerical health risks. Table 1 presents health risk categories and cancer risk values for chemical contaminants in drinking water that have PHGs.

The Act requires that OEHHA publish PHGs based on health risk assessments using the most current scientific methods. As defined in statute, PHGs for non-carcinogenic chemicals in drinking water are set at a concentration “at which no known or anticipated adverse health effects will occur, with an adequate margin of safety.” For carcinogens, PHGs are set at a concentration that “does not pose any significant risk to health.” PHGs provide one basis for revising MCLs, along with cost and technological feasibility. OEHHA has been publishing PHGs since 1997 and the entire list published to date is shown in Table 1.

Table 2 presents health risk information for contaminants that do not have PHGs but have state or federal regulatory standards. The Act requires that, for chemical contaminants with California MCLs that do not yet have PHGs, water utilities use the

federal maximum contaminant level goal (MCLG) for the purpose of complying with the requirement of public notification. MCLGs, like PHGs, are strictly health based and include a margin of safety. One difference, however, is that the MCLGs for carcinogens are set at zero because the United States Environmental Protection Agency (U.S. EPA) assumes there is no absolutely safe level of exposure to them. PHGs, on the other hand, are set at a level considered to pose no *significant* risk of cancer; this is usually a no more than one-in-a-million excess cancer risk (1×10^{-6}) level for a lifetime of exposure. In Table 2, the cancer risks shown are based on the U.S. EPA's evaluations.

For more information on health risks: The adverse health effects for each chemical with a PHG are summarized in each PHG technical support document. These documents are available on the OEHHA Web site (<http://www.oehha.ca.gov>). Also, U.S. EPA has consumer and technical fact sheets on most of the chemicals having MCLs. For copies of the fact sheets, call the Safe Drinking Water Hotline at 1-800-426-4791, or explore the U.S. EPA Ground Water and Drinking Water web page at <http://water.epa.gov/drink/>.

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category ¹	California PHG (mg/L) ²	Cancer Risk ³ at the PHG	California MCL ⁴ (mg/L)	Cancer Risk at the California MCL
<u>Alachlor</u>	carcinogenicity (causes cancer)	0.004	NA ⁵	0.002	NA
<u>Aluminum</u>	neurotoxicity and immunotoxicity (harms the nervous and immune systems)	0.6	NA	1	NA
<u>Antimony</u>	digestive system toxicity (causes vomiting)	0.02	NA	0.006	NA
<u>Arsenic</u>	carcinogenicity (causes cancer)	0.000004 (4×10 ⁻⁶)	1×10 ⁻⁶ (one per million)	0.01	2.5×10 ⁻³ (2.5 per thousand)
<u>Asbestos</u>	carcinogenicity (causes cancer)	7 MFL ⁶ (fibers >10 microns in length)	1×10 ⁻⁶	7 MFL (fibers >10 microns in length)	1×10 ⁻⁶ (one per million)
<u>Atrazine</u>	carcinogenicity (causes cancer)	0.00015	1×10 ⁻⁶	0.001	7×10 ⁻⁶ (seven per million)

¹ Based on the OEHHA PHG technical support document unless otherwise specified. The categories are the hazard traits defined by OEHHA for California's Toxics Information Clearinghouse (online at: http://oehha.ca.gov/multimedia/green/pdf/GC_Regtext011912.pdf).

² mg/L = milligrams per liter of water or parts per million (ppm)

³ Cancer Risk = Upper estimate of excess cancer risk from lifetime exposure. Actual cancer risk may be lower or zero. 1×10⁻⁶ means one excess cancer case per million people exposed.

⁴ MCL = maximum contaminant level.

⁵ NA = not applicable. Risk cannot be calculated. The PHG is set at a level that is believed to be without any significant public health risk to individuals exposed to the chemical over a lifetime.

⁶ MFL = million fibers per liter of water.

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category¹	California PHG (mg/L)²	Cancer Risk³ at the PHG	California MCL⁴ (mg/L)	Cancer Risk at the California MCL
<u>Barium</u>	cardiovascular toxicity (causes high blood pressure)	2	NA	1	NA
<u>Bentazon</u>	hepatotoxicity and digestive system toxicity (harms the liver, intestine, and causes body weight effects ⁷)	0.2	NA	0.018	NA
<u>Benzene</u>	carcinogenicity (causes leukemia)	0.00015	1×10^{-6}	0.001	7×10^{-6} (seven per million)
<u>Benzo[a]pyrene</u>	carcinogenicity (causes cancer)	0.000007	1×10^{-6}	0.0002	3×10^{-5} (three per hundred thousand)
<u>Beryllium</u>	digestive system toxicity (harms the stomach or intestine)	0.001	NA	0.004	NA
<u>Bromate</u>	carcinogenicity (causes cancer)	0.0001	1×10^{-6}	0.01	1×10^{-4} (one per ten thousand)
<u>Cadmium</u>	nephrotoxicity (harms the kidney)	0.00004	NA	0.005	NA
<u>Carbofuran</u>	reproductive toxicity (harms the testis)	0.0017	NA	0.018	NA

⁷ Body weight effects are an indicator of general toxicity in animal studies.

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Chemical	Health Risk Category ¹	California PHG (mg/L) ²	Cancer Risk ³ at the PHG	California MCL ⁴ (mg/L)	Cancer Risk at the California MCL
<u>Carbon tetrachloride</u>	carcinogenicity (causes cancer)	0.0001	1×10^{-6}	0.0005	5×10^{-6} (five per million)
<u>Chlordane</u>	carcinogenicity (causes cancer)	0.00003	1×10^{-6}	0.0001	3×10^{-6} (three per million)
<u>Chlorite</u>	hematotoxicity (causes anemia) neurotoxicity (causes neurobehavioral effects)	0.05	NA	1	NA
<u>Chromium, hexavalent</u>	carcinogenicity (causes cancer)	0.00002	1×10^{-6}	---	NA
<u>Copper</u>	digestive system toxicity (causes nausea, vomiting, diarrhea)	0.3	NA	1.3 (AL) ⁸	NA
<u>Cyanide</u>	neurotoxicity (damages nerves) endocrine toxicity (affects the thyroid)	0.15	NA	0.15	NA
<u>Dalapon</u>	nephrotoxicity (harms the kidney)	0.79	NA	0.2	NA
<u>1,2-Dibromo-3-chloropropane (DBCP)</u>	carcinogenicity (causes cancer)	0.0000017 (1.7×10^{-6})	1×10^{-6}	0.0002	1×10^{-4} (one per ten thousand)

⁸ AL = action level. The action levels for copper and lead refer to a concentration measured at the tap. Much of the copper and lead in drinking water is derived from household plumbing (The Lead and Copper Rule, Title 22, California Code of Regulations [CCR] section 64672.3).

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category ¹	California PHG (mg/L) ²	Cancer Risk ³ at the PHG	California MCL ⁴ (mg/L)	Cancer Risk at the California MCL
<u>1,2-Dichlorobenzene (o-DCB)</u>	hepatotoxicity (harms the liver)	0.6	NA	0.6	NA
<u>1,4-Dichlorobenzene (p-DCB)</u>	carcinogenicity (causes cancer)	0.006	1×10^{-6}	0.005	8×10^{-7} (eight per ten million)
<u>1,1-Dichloroethane (1,1-DCA)</u>	carcinogenicity (causes cancer)	0.003	1×10^{-6}	0.005	2×10^{-6} (two per million)
<u>1,2-Dichloroethane (1,2-DCA)</u>	carcinogenicity (causes cancer)	0.0004	1×10^{-6}	0.0005	1×10^{-6} (one per million)
<u>1,1-Dichloroethylene (1,1-DCE)</u>	hepatotoxicity (harms the liver)	0.01	NA	0.006	NA
<u>1,2-Dichloroethylene, cis</u>	nephrotoxicity (harms the kidney)	0.1	NA	0.006	NA
<u>1,2-Dichloroethylene, trans</u>	hepatotoxicity (harms the liver)	0.06	NA	0.01	NA
<u>Dichloromethane (methylene chloride)</u>	carcinogenicity (causes cancer)	0.004	1×10^{-6}	0.005	1×10^{-6} (one per million)
<u>2,4-Dichlorophenoxyacetic acid (2,4-D)</u>	hepatotoxicity and nephrotoxicity (harms the liver and kidney)	0.02	NA	0.07	NA

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category ¹	California PHG (mg/L) ²	Cancer Risk ³ at the PHG	California MCL ⁴ (mg/L)	Cancer Risk at the California MCL
<u>1,2-Dichloro-propane</u> (propylene dichloride)	carcinogenicity (causes cancer)	0.0005	1×10^{-6}	0.005	1×10^{-5} (one per hundred thousand)
<u>1,3-Dichloro-propene</u> (Telone II®)	carcinogenicity (causes cancer)	0.0002	1×10^{-6}	0.0005	2×10^{-6} (two per million)
<u>Di(2-ethylhexyl) adipate (DEHA)</u>	developmental toxicity (disrupts development)	0.2	NA	0.4	NA
<u>Diethylhexyl-phthalate (DEHP)</u>	carcinogenicity (causes cancer)	0.012	1×10^{-6}	0.004	3×10^{-7} (three per ten million)
<u>Dinoseb</u>	reproductive toxicity (harms the uterus and testis)	0.014	NA	0.007	NA
<u>Dioxin (2,3,7,8-TCDD)</u>	carcinogenicity (causes cancer)	5×10^{-11}	1×10^{-6}	3×10^{-8}	6×10^{-4} (six per ten thousand)
<u>Diquat</u>	ocular toxicity (harms the eye) developmental toxicity (causes malformation)	0.015	NA	0.02	NA
<u>Endothall</u>	digestive system toxicity (harms the stomach or intestine)	0.58	NA	0.1	NA
<u>Endrin</u>	hepatotoxicity (harms the liver) neurotoxicity (causes convulsions)	0.0018	NA	0.002	NA

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Chemical	Health Risk Category¹	California PHG (mg/L)²	Cancer Risk³ at the PHG	California MCL⁴ (mg/L)	Cancer Risk at the California MCL
<u>Ethylbenzene (phenylethane)</u>	hepatotoxicity (harms the liver)	0.3	NA	0.3	NA
<u>Ethylene dibromide</u>	carcinogenicity (causes cancer)	0.00001	1×10^{-6}	0.00005	5×10^{-6} (five per million)
<u>Fluoride</u>	musculoskeletal toxicity (causes tooth mottling)	1	NA	2	NA
<u>Glyphosate</u>	nephrotoxicity (harms the kidney)	0.9	NA	0.7	NA
<u>Heptachlor</u>	carcinogenicity (causes cancer)	0.000008	1×10^{-6}	0.00001	1×10^{-6} (one per million)
<u>Heptachlor epoxide</u>	carcinogenicity (causes cancer)	0.000006	1×10^{-6}	0.00001	2×10^{-6} (two per million)
<u>Hexachlorobenzene</u>	carcinogenicity (causes cancer)	0.00003	1×10^{-6}	0.001	3×10^{-5} (three per hundred thousand)
<u>Hexachlorocyclopentadiene (HEX)</u>	digestive system toxicity (causes stomach lesions)	0.05	NA	0.05	NA

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Chemical	Health Risk Category¹	California PHG (mg/L)²	Cancer Risk³ at the PHG	California MCL⁴ (mg/L)	Cancer Risk at the California MCL
<u>Lead</u>	developmental neurotoxicity (causes neurobehavioral effects in children) cardiovascular toxicity (cause high blood pressure) carcinogenicity (causes cancer)	0.0002	3×10 ⁻⁸ (PHG is not based on this effect)	0.015 (AL) ⁸	2×10 ⁻⁶ (two per million)
<u>Lindane (γ-BHC)</u>	carcinogenicity (causes cancer)	0.000032	1×10 ⁻⁶	0.0002	6×10 ⁻⁶ (six per million)
<u>Mercury (inorganic)</u>	nephrotoxicity (harms the kidney)	0.0012	NA	0.002	NA
<u>Methoxychlor</u>	endocrine toxicity (causes hormone effects)	0.00009	NA	0.03	NA
<u>Methyl tertiary-butyl ether (MTBE)</u>	carcinogenicity (causes cancer)	0.013	1×10 ⁻⁶	0.013	1×10 ⁻⁶ (one per million)
<u>Molinate</u>	carcinogenicity (causes cancer)	0.001	1×10 ⁻⁶	0.02	2×10 ⁻⁵ (two per hundred thousand)
<u>Monochlorobenzene (chlorobenzene)</u>	hepatotoxicity (harms the liver)	0.2	NA	0.07	NA
<u>Nickel</u>	developmental toxicity (causes increased neonatal deaths)	0.012	NA	0.1	NA

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Chemical	Health Risk Category¹	California PHG (mg/L)²	Cancer Risk³ at the PHG	California MCL⁴ (mg/L)	Cancer Risk at the California MCL
<u>Nitrate</u>	hematotoxicity (causes methemoglobinemia)	45 as nitrate	NA	45 as NO ₃	NA
<u>Nitrite</u>	hematotoxicity (causes methemoglobinemia)	1 as nitrogen	NA	1 as nitrite-nitrogen	NA
<u>Nitrate and Nitrite</u>	hematotoxicity (causes methemoglobinemia)	10 as nitrogen	NA	10 as nitrogen	NA
<u>N-nitroso-dimethyl-amine (NDMA)</u>	carcinogenicity (causes cancer)	0.000003	1x10 ⁻⁶	---	NA
<u>Oxamyl</u>	general toxicity (causes body weight effects)	0.026	NA	0.05	NA
<u>Pentachloro-phenol (PCP)</u>	carcinogenicity (causes cancer)	0.0003	1x10 ⁻⁶	0.001	3x10 ⁻⁶ (three per million)
<u>Perchlorate</u>	endocrine toxicity (affects the thyroid) developmental toxicity (causes neurodevelopmental deficits)	0.006 ⁹	NA	0.006	NA
<u>Picloram</u>	hepatotoxicity (harms the liver)	0.5	NA	0.5	NA

⁹ This is the current PHG value for perchlorate. A revised draft PHG for perchlorate was posted online for public comment on December 7, 2012. <http://www.oehha.ca.gov/water/phg/120712Perchlorate.html>.

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category ¹	California PHG (mg/L) ²	Cancer Risk ³ at the PHG	California MCL ⁴ (mg/L)	Cancer Risk at the California MCL
<u>Polychlorinated biphenyls (PCBs)</u>	carcinogenicity (causes cancer)	0.00009	1×10 ⁻⁶	0.0005	6×10 ⁻⁶ (six per million)
<u>Radium-226</u>	carcinogenicity (causes cancer)	0.05 pCi/L	1×10 ⁻⁶	5 pCi/L	1×10 ⁻⁴ (one per ten thousand)
<u>Radium-228</u>	carcinogenicity (causes cancer)	0.019 pCi/L	1×10 ⁻⁶	5 pCi/L (combined Ra ²²⁶⁺²²⁸)	3×10 ⁻⁴ (three per ten thousand)
<u>Selenium</u>	integumentary toxicity (causes hair loss and nail damage)	0.03	NA	0.05	NA
<u>Silvex (2,4,5-TP)</u>	hepatotoxicity (harms the liver)	0.025	NA	0.05	NA
<u>Simazine</u>	general toxicity (causes body weight effects)	0.004	NA	0.004	NA
<u>Strontium-90</u>	carcinogenicity (causes cancer)	0.35 pCi/L	1×10 ⁻⁶	8 pCi/L	2×10 ⁻⁵ (two per hundred thousand)
<u>Styrene (vinylbenzene)</u>	carcinogenicity (causes cancer)	0.0005	1×10 ⁻⁶	0.1	2×10 ⁻⁴ (two per ten thousand)

Table 1: Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Chemical	Health Risk Category ¹	California PHG (mg/L) ²	Cancer Risk ³ at the PHG	California MCL ⁴ (mg/L)	Cancer Risk at the California MCL
<u>1,1,2,2-Tetrachloroethane</u>	carcinogenicity (causes cancer)	0.0001	1×10 ⁻⁶	0.001	1×10 ⁻⁵ (one per hundred thousand)
<u>Tetrachloroethylene (perchloroethylene, or PCE)</u>	carcinogenicity (causes cancer)	0.00006	1×10 ⁻⁶	0.005	8×10 ⁻⁵ (eight per hundred thousand)
<u>Thallium</u>	integumentary toxicity (causes hair loss)	0.0001	NA	0.002	NA
<u>Thiobencarb</u>	general toxicity (causes body weight effects) hematotoxicity (affects red blood cells)	0.07	NA	0.07	NA
<u>Toluene (methylbenzene)</u>	hepatotoxicity (harms the liver) endocrine toxicity (harms the thymus)	0.15	NA	0.15	NA
<u>Toxaphene</u>	carcinogenicity (causes cancer)	0.00003	1×10 ⁻⁶	0.003	1×10 ⁻⁴ (one per ten thousand)
<u>1,2,4-Trichlorobenzene (Unsym-TCB)</u>	endocrine toxicity (harms adrenal glands)	0.005	NA	0.005	NA

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Chemical	Health Risk Category ¹	California PHG (mg/L) ²	Cancer Risk ³ at the PHG	California MCL ⁴ (mg/L)	Cancer Risk at the California MCL
<u>1,1,1-Trichloroethane</u>	neurotoxicity (harms the nervous system), reproductive toxicity (causes fewer offspring) hepatotoxicity (harms the liver) hematotoxicity (causes blood effects)	1	NA	0.2	NA
<u>1,1,2-Trichloroethane</u>	carcinogenicity (causes cancer)	0.0003	1x10 ⁻⁶	0.005	2x10 ⁻⁵ (two per hundred thousand)
<u>1,1,2-Trichloroethylene (TCE)</u>	carcinogenicity (causes cancer)	0.0017	1x10 ⁻⁶	0.005	3x10 ⁻⁶ (three per million)
<u>Trichlorofluoromethane (Freon 11)</u>	hepatotoxicity (harms the liver)	0.7	NA	0.15	NA
<u>1,2,3-Trichloropropane (1,2,3-TCP)</u>	carcinogenicity (causes cancer)	0.0000007	1x10 ⁻⁶	---	NA
<u>1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)</u>	hepatotoxicity (harms the liver)	4	NA	1.2	NA
<u>Tritium</u>	carcinogenicity (causes cancer)	400 pCi/L	1x10 ⁻⁶	20,000 pCi/L	5x10 ⁻⁵ (five per hundred thousand)

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Chemical	Health Risk Category¹	California PHG (mg/L)²	Cancer Risk³ at the PHG	California MCL⁴ (mg/L)	Cancer Risk at the California MCL
<u>Uranium</u>	carcinogenicity (causes cancer)	0.43 pCi/L	1×10^{-6}	20 pCi/L	5×10^{-5} (five per hundred thousand)
<u>Vinyl chloride</u>	carcinogenicity (causes cancer)	0.00005	1×10^{-6}	0.0005	1×10^{-5} (one per hundred thousand)
<u>Xylene</u>	neurotoxicity (affects the senses, mood, and motor control)	1.8 (single isomer or sum of isomers)	NA	1.75 (single isomer or sum of isomers)	NA

Table 2: Health Risk Categories and Cancer Risk Values for Chemicals without California Public Health Goals

Chemical	Health Risk Category ¹	U.S. EPA MCLG ² (mg/L)	Cancer Risk ³ @ MCLG	California MCL ⁴ (mg/L)	Cancer Risk @ California MCL
Disinfection byproducts (DBPS)					
Chloramines	acute toxicity (causes irritation) digestive system toxicity (harms the stomach) hematotoxicity (causes anemia)	4 ⁵	NA	none	NA
Chlorine	acute toxicity (causes irritation) digestive system toxicity (harms the stomach)	4 ⁵	NA	none	NA
Chlorine dioxide	hematotoxicity (causes anemia) neurotoxicity (harms the nervous system)	0.8 ⁵	NA	none	NA
Disinfection byproducts: haloacetic acids (HAA5)					
Chloroacetic acid	general toxicity (causes body and organ weight changes ⁶)	0.07	NA	none	NA
Dichloroacetic acid	carcinogenicity (causes cancer)	0	0	none	NA
Trichloroacetic acid	hepatotoxicity (harms the liver)	0.02	0	none	NA
Bromoacetic acid	NA	none	NA	none	NA

¹ Health risk category based on the U.S. EPA MCLG document or California MCL document unless otherwise specified.

² MCLG = maximum contaminant level goal established by U.S. EPA.

³ Cancer Risk = Upper estimate of excess cancer risk from lifetime exposure. Actual cancer risk may be lower or zero. 1×10^{-6} means one excess cancer case per million people exposed.

⁴ California MCL = maximum contaminant level established by California.

⁵ Maximum Residual Disinfectant Level Goal, or MRDLG

⁶ Body weight effects are an indicator of general toxicity in animal studies.

Table 2: Health Risk Categories and Cancer Risk Values for Chemicals without California Public Health Goals

Chemical	Health Risk Category¹	U.S. EPA MCLG² (mg/L)	Cancer Risk³ @ MCLG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Dibromoacetic acid	NA	none	NA	none	NA
Total haloacetic acids	carcinogenicity (causes cancer)	none	NA	0.06	NA
Disinfection byproducts: trihalomethanes (THMs)					
Bromodichloromethane (BDCM)	carcinogenicity (causes cancer)	0	0	none	NA
Bromoform	carcinogenicity (causes cancer)	0	0	none	NA
Chloroform	hepatotoxicity and nephrotoxicity (harms the liver and kidney)	0.07	NA	none	NA
Dibromo-chloromethane (DBCM)	hepatotoxicity, nephrotoxicity, and neurotoxicity (harms the liver, kidney, and nervous system)	0.06	NA	none	NA
Total (sum of BDCM, bromoform, chloroform and DBCM)	carcinogenicity (causes cancer), hepatotoxicity, nephrotoxicity, and neurotoxicity (harms the liver, kidney, and nervous system)	none	NA	0.08	NA

Table 2: Health Risk Categories and Cancer Risk Values for Chemicals without California Public Health Goals

Chemical	Health Risk Category ¹	U.S. EPA MCLG ² (mg/L)	Cancer Risk ³ @ MCLG	California MCL ⁴ (mg/L)	Cancer Risk @ California MCL
Radionuclides					
Gross alpha particles ⁷	carcinogenicity (causes cancer)	0 (²¹⁰ Po included)	0	15 pCi/L ⁸ (includes ²²⁶ Ra but not radon and uranium)	up to 1x10 ⁻³ (for ²¹⁰ Po, the most potent alpha emitter)
Beta particles and photon emitters ⁷	carcinogenicity (causes cancer)	0 (²¹⁰ Pb included)	0	50 pCi/L (judged equiv. to 4 mrem/yr)	up to 2x10 ⁻³ (for ²¹⁰ Pb, the most potent beta-emitter)

⁷ MCLs for gross alpha and beta particles are screening standards for a group of radionuclides. Corresponding PHGs were not developed for gross alpha and beta particles. See the OEHHA memoranda discussing the cancer risks at these MCLs at <http://www.oehha.ca.gov/water/phg/index.html>.

⁸ pCi/L = picocuries per liter of water.