

Health Risk Information for Public Health Goal Exceedance Reports

April 2010

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 (2)[b]). The numerical health risk is to be presented with the category of health risk, along with a plainly worded description of these terms. PHGs are published by the Office of Environmental Health Hazard Assessment (OEHHA) as concentrations of contaminants in drinking water that OEHHA, using current risk assessment principles, practices and methods, considers to pose no significant health risk if consumed for a lifetime (Health and Safety Code Section 116365). This report is prepared by OEHHA to assist the water utilities in meeting their requirements.

Numerical health risks. The tables that follow summarize health risks for chemical contaminants in drinking water that have PHGs and state and/or federal regulatory standards. The regulatory standards are maximum contaminant levels (MCLs). As defined in statute, PHGs for noncarcinogenic 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.

The Act requires that for chemical contaminants with California MCLs that do not yet have PHGs, water utilities will 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. Chemicals with MCLGs but no PHGs are presented in Table 2. The cancer risks shown are based on the U.S. EPA’s evaluations.

Please note that draft PHGs for dioxin (2,3,7,8-TCDD), hexavalent chromium, selenium, styrene and the trihalomethanes (THMs) have been posted for review and comment on the OEHHA web site at <http://www.oehha.ca.gov/water/phg/index.html>. These may be of interest to water agencies as an indication of the proposed direction of the OEHHA

risk assessments, but are not required to be cited in communications with the public because they are not yet final.

Health risk categories. The following information can be used for presenting the health risk categories in “exceedance reports.” The health risks shown in the tables are based on long-term exposures to low levels of contaminants as would occur with drinking water (unless otherwise stated), rather than high doses from a single or short-term exposure. The potential health effects are the most sensitive adverse effects that occur when chemical exposure reaches a sufficient level and duration to produce toxicity. Health goals that protect against these risks also protect against health risks that would occur from short-term exposures. For most health risk categories, the specific health outcome or the organ or system that is affected is also given. The health effects are given in nontechnical terms when possible, and the categories are described below.

Acute toxicity - adverse health effects that develop after a short-term exposure to a chemical (minutes to days).

Subchronic toxicity – adverse health effects that develop after repeated or longer-term exposures to a chemical (days to months).

Carcinogenic - capable of producing cancer.

Chronic toxicity - adverse effects that usually develop gradually from low levels of chemical exposure over a long period of time (months to years).

Developmental toxicity - adverse effects on the developing organism that may result from exposure prior to conception (either parent), during prenatal development, or postnatally to the time of sexual maturation. Adverse developmental effects may be detected at any point in the life span of the organism. The major manifestations include: (1) death of the developing organism, (2) structural abnormality (birth defects), (3) altered growth, and (4) functional deficiency.

Neurotoxic - capable of adversely affecting or destroying parts of the nervous system or interfering with nerve signal transmission. Effects may be reversible (for example, effects on chemicals that carry nerve signals across gaps between nerve cells) or irreversible (for example, destruction of nerve cells).

Reproductive effects - the occurrence of adverse effects on the reproductive system of females or males that may result from exposure to environmental agents. The toxicity may cause changes to the female or male reproductive organs, the regulating endocrine system, or pregnancy outcomes. Examples of such toxicity may include adverse effects on onset of puberty, egg production and transport, menstrual cycle normality, sexual behavior such as sexual urge, lowered fertility, sperm production, length of pregnancy, and milk production.

The tables further note whether the health risk category is based on human or animal data. Data on health effects of toxic substances are usually obtained from studies on laboratory animals.

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 Office of Ground Water and Drinking Water's home page at <http://www.epa.gov/OGWDW/hfacts.html>.

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

Chemical	Health Risk Category ¹ (more specific information in parentheses)	California PHG (mg/L) ²	Cancer Risk ³ @ PHG	California MCL ⁴ (mg/L)	Cancer Risk @ California MCL
Alachlor	cancer	0.004 ⁵	NA ⁶	0.002	NA
Aluminum	chronic toxicity (increased serum aluminum level) (human data)	0.6	NA	1	NA
Antimony	chronic toxicity (shortened lifespan)	0.02	NA	0.006	NA
Arsenic	cancer	0.000004 (4x10 ⁻⁶)	1x10 ⁻⁶ (one per million)	0.01	2.5x10 ⁻³ (2.5 per thousand)
Asbestos	cancer	7 MFL (fibers >10 microns in length)	1x10 ⁻⁶	7 MFL ⁷ (fibers >10 microns in length)	1x10 ⁻⁶ (one per million)
Atrazine	cancer	0.00015	1x10 ⁻⁶	0.001	7x10 ⁻⁶ (seven per million)

¹ Health risk category based on experimental animal testing data evaluated in the OEHHA PHG technical support document unless otherwise specified.

² mg/L = milligrams per liter of water or parts per million (ppm) (PHGs are expressed here in milligrams per liter for consistency with the typical unit used for MCLs and MCLGs.)

³ Cancer Risk = theoretical 70-year lifetime excess cancer risk at the statistical upper confidence limit. Actual cancer risk may be lower or zero. Cancer risk is stated in terms of excess cancer cases per million (or fewer) population exposed for a lifetime.

⁴ MCL = maximum contaminant level.

⁵ Non-linear approach used for alachlor risk assessment, no cancer risk assumed at the PHG level.

⁶ NA = not applicable. Noncarcinogenic, or a cancer risk cannot be calculated. The PHG for these chemicals is set at a level that is believed to be without any significant public health risk to individuals exposed to that chemical over a lifetime.

⁷ MFL = million fibers per liter.

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Chemical	Health Risk Category¹ (more specific information in parentheses)	California PHG (mg/L)²	Cancer Risk³ @ PHG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Barium	chronic toxicity (hypertension)	2	NA	1	NA
Bentazon	chronic toxicity (clinical, body weight, liver and intestinal effects)	0.2	NA	0.018	NA
Benzene	cancer (leukemia)	0.00015	1×10^{-6}	0.001	7×10^{-6} (seven per million)
Benzo[a]pyrene	cancer	0.000004	1×10^{-6}	0.0002	5×10^{-5} (five per hundred thousand)
Beryllium	chronic toxicity (gastrointestinal lesions)	0.001	NA	0.004	NA
Bromate	cancer	0.0001	1×10^{-6}	0.01	1×10^{-4} (one per ten thousand)
Cadmium	chronic toxicity (kidney effects, human data)	0.00004	NA	0.005	NA
Carbofuran	chronic toxicity (enzyme inhibition, blood chemistry and testis effects)	0.0017	NA	0.018	NA
Carbon tetrachloride	cancer	0.0001	1×10^{-6}	0.0005	5×10^{-6} (five per million)

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Chemical	Health Risk Category ¹ (more specific information in parentheses)	California PHG (mg/L) ²	Cancer Risk ³ @ PHG	California MCL ⁴ (mg/L)	Cancer Risk @ California MCL
Chlordane	cancer	0.00003	1×10^{-6}	0.0001	3×10^{-6} (three per million)
Chlorite	chronic toxicity (anemia) and neurotoxicity (infants and children, human data)	0.05	NA	1	NA
Copper	acute toxicity (gastrointestinal effects in children, human data)	0.3	NA	1.3 (AL) ⁸	NA
Cyanide	chronic toxicity ⁹ (no clinical and histopathological effects observed)	0.15	NA	0.15	NA
Dalapon	chronic toxicity (kidney effects)	0.79	NA	0.2	NA
1,2-Dibromo-3-chloropropane (DBCP)	cancer	0.0000017 (1.7×10^{-6})	1×10^{-6}	0.0002	1×10^{-4} (one per ten thousand)
1,2-Dichloro-benzene (o-DCB)	chronic toxicity (liver effects)	0.6	NA	0.6	NA
1,4-Dichloro-benzene (p-DCB)	cancer	0.006	1×10^{-6}	0.005	8×10^{-7} (eight per ten million)

⁸ AL = action level.

⁹ Cyanide: Acute toxicity of concern is respiratory arrest. Long-term exposure allows for detoxification.

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Chemical	Health Risk Category¹ (more specific information in parentheses)	California PHG (mg/L)²	Cancer Risk³ @ PHG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
1,1-Dichloroethane (1,1-DCA)	cancer	0.003	1×10^{-6}	0.005	2×10^{-6} (two per million)
1,2-Dichloroethane (1,2-DCA)	cancer	0.0004	1×10^{-6}	0.0005	1×10^{-6} (one per million)
1,1-Dichloroethylene (1,1-DCE)	chronic toxicity (liver effects)	0.01	NA	0.006	NA
1,2-Dichloroethylene, cis	Subchronic toxicity (kidney effects)	0.1	NA	0.006	NA
1,2-Dichloroethylene, trans	Subchronic toxicity (liver effects)	0.06	NA	0.01	NA
Dichloromethane (methylene chloride)	cancer	0.004	1×10^{-6}	0.005	1×10^{-6} (one per million)
2,4-Dichlorophenoxyacetic acid (2,4-D)	chronic toxicity (liver and kidney effects)	0.02	NA	0.07	NA
1,2-Dichloropropane (propylene dichloride)	cancer	0.0005	1×10^{-6}	0.005	1×10^{-5} (one per hundred thousand)
1,3-Dichloropropene (Telone II®)	cancer	0.0002	1×10^{-6}	0.0005	2×10^{-6} (two per million)
Di(2-ethylhexyl) adipate (DEHA)	developmental toxicity (disrupted development)	0.2	NA	0.4	NA

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Chemical	Health Risk Category ¹ (more specific information in parentheses)	California PHG (mg/L) ²	Cancer Risk ³ @ PHG	California MCL ⁴ (mg/L)	Cancer Risk @ California MCL
Diethylhexyl-phthalate (DEHP)	cancer	0.012	1×10^{-6}	0.004	3×10^{-7} (three per ten million)
Dinoseb	reproductive toxicity (uterus and testis effects)	0.014	NA	0.007	NA
Diquat	chronic toxicity (eye effects) and developmental toxicity (malformation)	0.015	NA	0.02	NA
Endothall	chronic toxicity (stomach effects)	0.58	NA	0.1	NA
Endrin	chronic toxicity (liver effects) and neurotoxicity (convulsions)	0.0018	NA	0.002	NA
Ethylbenzene (phenylethane)	chronic toxicity (liver effects)	0.3	NA	0.3	NA
Ethylene dibromide	cancer	0.00001	1×10^{-6}	0.00005	5×10^{-6} (five per million)
Fluoride	chronic toxicity (tooth mottling, human data)	1	NA	2	NA
Glyphosate	chronic toxicity (kidney effects)	0.9	NA	0.7	NA
Heptachlor	cancer	0.000008	1×10^{-6}	0.00001	1×10^{-6} (one per million)

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Chemical	Health Risk Category¹ (more specific information in parentheses)	California PHG (mg/L)²	Cancer Risk³ @ PHG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Heptachlor epoxide	cancer	0.000006	1×10^{-6}	0.00001	2×10^{-6} (two per million)
Hexachlorobenzene	cancer	0.00003	1×10^{-6}	0.001	3×10^{-5} (three per hundred thousand)
Hexachlorocyclopentadiene (HEX)	chronic toxicity (stomach lesions)	0.05	NA	0.05	NA
Lead	chronic toxicity (neurobehavioral effects in children, hypertension in adults) and cancer	0.0002	3×10^{-8} (PHG is not based on this effect)	0.015 (AL)	2×10^{-6} (two per million)
Lindane (γ -BHC)	cancer	0.000032	1×10^{-6}	0.0002	6×10^{-6} (six per million)
Mercury (inorganic)	chronic toxicity (kidney effects)	0.0012	NA	0.002	NA
Methoxychlor	reproductive toxicity (vagina, ovary, uterus and hormonal effects)	0.03	NA	0.03	NA
Methyl tertiary-butyl ether (MTBE)	cancer	0.013	1×10^{-6}	0.013	1×10^{-6} (one per million)
Molinate	cancer	0.001	1×10^{-6}	0.02	2×10^{-5} (two per hundred thousand)

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Chemical	Health Risk Category¹ (more specific information in parentheses)	California PHG (mg/L)²	Cancer Risk³ @ PHG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Monochlorobenzene (chlorobenzene)	subchronic toxicity (liver damage)	0.2	NA	0.07	NA
Nickel	developmental toxicity (increased neonatal deaths) and possible cancer risk	0.012	NA	0.1	NA
Nitrate	acute toxicity (methemoglobinemia, human data)	45 as NO ₃	NA	45 as NO ₃	NA
Nitrite	acute toxicity (methemoglobinemia, human data)	1 as nitrite-nitrogen	NA	1 as nitrite-nitrogen	NA
Nitrate and Nitrite	acute toxicity (methemoglobinemia, human data)	10 as nitrogen	NA	10 as nitrogen	NA
N-nitrosodimethylamine (NDMA)	cancer	0.000003	1x10 ⁻⁶	---	---
Oxamyl	chronic toxicity (body weight effects)	0.026	NA	0.05	NA
Pentachlorophenol (PCP)	cancer	0.0003	1x10 ⁻⁶	0.001	3x10 ⁻⁶ (three per million)
Perchlorate	subchronic toxicity (thyroid and reproductive effects)	0.006	NA	0.006	NA
Picloram	chronic toxicity (liver effects)	0.5	NA	0.5	NA

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Chemical	Health Risk Category ¹ (more specific information in parentheses)	California PHG (mg/L) ²	Cancer Risk ³ @ PHG	California MCL ⁴ (mg/L)	Cancer Risk @ California MCL
Polychlorinated biphenyls (PCBs)	cancer	0.00009	1×10 ⁻⁶	0.0005	6×10 ⁻⁶ (six per million)
Radium-226	cancer	0.05 pCi/L	1×10 ⁻⁶	5 pCi/L	1×10 ⁻⁴ (one per ten thousand)
Radium-228	cancer	0.019 pCi/L	1×10 ⁻⁶	5 pCi/L (combined Ra ²²⁶⁺²²⁸)	3×10 ⁻⁴ (three per ten thousand)
Silvex (2,4,5-TP)	chronic toxicity (liver effects)	0.025	NA	0.05	NA
Simazine	chronic toxicity (reduced body weight)	0.004	NA	0.004	NA
Strontium-90	cancer	0.35 pCi/L	1×10 ⁻⁶	8 pCi/L	2×10 ⁻⁵ (two per hundred thousand)
1,1,2,2-Tetrachloroethane	cancer	0.0001	1×10 ⁻⁶	0.001	1×10 ⁻⁵ (one per hundred thousand)
Tetrachloroethylene (perchloroethylene, or PCE)	cancer	0.00006	1×10 ⁻⁶	0.005	8×10 ⁻⁵ (eight per hundred thousand)
Thallium	subchronic toxicity (hair loss)	0.0001	NA	0.002	NA
Thiobencarb	chronic toxicity (body weight, food efficiency and enzyme activity effects)	0.07	NA	0.07	NA

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Chemical	Health Risk Category ¹ (more specific information in parentheses)	California PHG (mg/L) ²	Cancer Risk ³ @ PHG	California MCL ⁴ (mg/L)	Cancer Risk @ California MCL
Toluene (methylbenzene)	chronic toxicity (liver and thymus effects)	0.15	NA	0.15	NA
Toxaphene	cancer	0.00003	1×10^{-6}	0.003	1×10^{-4} (one per ten thousand)
1,2,4-Trichlorobenzene (Unsym-TCB)	chronic toxicity (effects on adrenal glands)	0.005	NA	0.005	NA
1,1,1-Trichloroethane	neurotoxicity (structural changes), reproductive toxicity (fewer offspring), chronic toxicity (liver and blood effects)	1	NA	0.2	NA
1,1,2-Trichloroethane	cancer	0.0003	1×10^{-6}	0.005	2×10^{-5} (two per hundred thousand)
1,1,2-Trichloroethylene (TCE)	cancer	0.0017	1×10^{-6}	0.005	3×10^{-6} (three per million)
Trichlorofluoromethane (Freon 11)	chronic toxicity (liver effects)	0.7	NA	0.15	NA
1,2,3-Trichloropropane	cancer	0.0000007	1×10^{-6}	---	---
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	chronic toxicity (liver effects)	4	NA	1.2	NA

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Chemical	Health Risk Category¹ (more specific information in parentheses)	California PHG (mg/L)²	Cancer Risk³ @ PHG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Tritium	cancer	400 pCi/L	1×10^{-6}	20,000 pCi/L	5×10^{-5} (five per hundred thousand)
Uranium	cancer	0.43 pCi/L	1×10^{-6}	20 pCi/L	5×10^{-5} (five per hundred thousand)
Vinyl chloride	cancer	0.00005	1×10^{-6}	0.0005	1×10^{-5} (one per hundred thousand)
Xylenes	neurotoxicity (effects on senses, mood and motor control, human data)	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 Category¹ (more specific information in parentheses)	U.S. EPA MCLG² (mg/L)	Cancer Risk³ @ MCLG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Chromium (total)	chronic toxicity (stomach, liver effects), immunotoxicity (allergic dermatitis)	0.1	NA	0.05	NA
Dioxin (2,3,7,8-TCDD)	cancer and reproductive effects	0	0	0.00000003	1×10 ⁻⁵ (one per hundred thousand)
Selenium	chronic toxicity (hair and nail changes, skin lesions, blood effects; human data) and neurotoxicity	0.05	NA	0.05	NA
Styrene (vinylbenzene)	chronic toxicity (liver, kidney and blood effects)	0.1	NA	0.1	NA
Disinfection byproducts (DBPS)					
Chloramines	acute toxicity (irritation) and chronic toxicity (stomach effects, anemia)	4 ⁵	NA	none	NA
Chlorine	acute toxicity (irritation) and chronic toxicity (stomach effects)	4 ⁵	NA	none	NA

¹ Health risk category based on experimental animal testing data evaluated in 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 = theoretical 70-year lifetime excess cancer risk at the statistical confidence limit. Actual cancer risk may be lower or zero. Cancer risk is stated in terms of excess cancer cases per million (or fewer) population, e.g., 1×10⁻⁶ means one excess cancer case per million people; 5×10⁻⁵ means five excess cancer cases per 100,000 people.

⁴ California MCL = maximum contaminant level established by California.

⁵ Maximum Residual Disinfectant Level Goal, or MRDLG

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Chemical	Health Risk Category¹ (more specific information in parentheses)	U.S. EPA MCLG² (mg/L)	Cancer Risk³ @ MCLG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Chlorine dioxide	chronic toxicity (anemia) and neurotoxicity (infants and young children, human data)	0.8 ⁵	NA	none	NA
Disinfection byproducts: haloacetic acids (HAA5)					
Chloroacetic acid	chronic toxicity (body and organ weight changes)	0.07	NA	none	NA
Dichloroacetic acid	cancer	0	0	none	NA
Trichloroacetic acid	chronic toxicity (liver effects)	0.02	0	none	NA
Bromoacetic acid	NA	none	NA	none	NA
Dibromoacetic acid	NA	none	NA	none	NA
Total haloacetic acids	cancer	none	NA	0.06	NA
Disinfection byproducts: trihalomethanes (THMs)					
Bromodichloromethane (BDCM)	cancer	0	0	none	NA
Bromoform	cancer	0	0	none	NA
Chloroform	chronic toxicity (liver and kidney effects)	0.07	NA	none	NA
Dibromochloromethane (DBCM)	chronic toxicity (liver and kidney effects) and neurotoxicity	0.06	NA	none	NA

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Chemical	Health Risk Category¹ (more specific information in parentheses)	U.S. EPA MCLG² (mg/L)	Cancer Risk³ @ MCLG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Total (sum of BDCM, bromoform, chloroform and DBCM)	cancer, chronic toxicity (liver and kidney effects), and neurotoxicity	none	NA	0.08	NA
Radionuclides					
Gross alpha particles ⁶	cancer	0 (²¹⁰ Po included)	0	15 pCi/L ⁷ (includes ²²⁶ Ra but not radon and uranium)	up to 1x10 ⁻³ (one per thousand for ²¹⁰ Po, the most potent alpha emitter)
Beta particles and photon emitters ⁶	cancer	0 (²¹⁰ Pb included)	0	50 pCi/L (judged equiv. to 4 mrem/yr)	up to 2x10 ⁻³ (two per thousand for ²¹⁰ Pb, the most potent beta-emitter)

⁶ MCLs for gross alpha and beta are screening standards for a group of radionuclides. A corresponding PHG was considered inappropriate because risks vary for the individual radionuclides covered by the screening level; see OEHHA memoranda discussing the cancer risks at these MCLs at <http://www.oehha.ca.gov/water/phg/index.html>.

⁷ pCi/L = picocuries per liter of water.