

Health Risk Information for Public Health Goal Exceedance Reports

March 2004

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)(Health and Safety Code Section 116365) 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. 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). The Act also requires that OEHHA publish “PHGs” based on health risk assessments using the most current scientific methods. 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 as they are completed 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.

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 destroying or adversely affecting 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 are available on the OEHHA Web site (<http://www.oehha.ca.gov>) or may be ordered in print. Please call OEHHA at 510/622-3170 for details. 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 Category¹ (more specific information in parentheses)	California PHG (mg/L)²	Cancer Risk³ @ PHG	California MCL⁴ (mg/L)	Cancer Risk @ California MCL
Alachlor	carcinogenicity (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
Asbestos	carcinogenicity (cancer)	7 MFL (fibers >10 microns in length)	1 x 10 ⁻⁶	7 MFL ⁷ (fibers >10 microns in length)	1x10 ⁻⁶
Atrazine	carcinogenicity (cancer)	0.00015	1x10 ⁻⁶ (one per million)	0.001	7x10 ⁻⁶ (seven per million)
Barium	chronic toxicity (hypertension)	2	NA	1	NA

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, e.g., 1x10⁻⁶ means one excess cancer case per million population; 5x10⁻⁵ means five excess cancer cases per 100,000 population.

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.

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

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
Bentazon	chronic toxicity (clinical, body weight, liver and intestinal effects)	0.2	NA	0.018	NA
Benzene	carcinogenicity (leukemia)	0.00015	1 x 10 ⁻⁶	0.001	7 x 10 ⁻⁶
Benzo[a]pyrene	carcinogenicity (cancer)	0.000004	1x10 ⁻⁶	0.0002	5x10 ⁻⁵
Beryllium	chronic toxicity (gastrointestinal lesions)	0.001	NA	0.004	NA
Cadmium	chronic toxicity (kidney effects, human data)	0.00007	NA	0.005	NA
Carbofuran	chronic toxicity (enzyme inhibition, blood chemistry and testis effects)	0.0017	NA	0.018	NA
Carbon tetrachloride	carcinogenicity (cancer)	0.0001	1x10 ⁻⁶	0.0005	5x10 ⁻⁶
Chlordane	carcinogenicity (cancer)	0.00003	1x10 ⁻⁶	0.0001	3x10 ⁻⁶
Copper	acute toxicity (gastrointestinal effects in children, human data)	0.17	NA	1.3 (AL) ⁸	NA
Cyanide	chronic toxicity ⁹ (no clinical and histopathological effects observed)	0.15	NA	0.15	NA

⁸ AL = action level.

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

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

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
Dalapon	chronic toxicity (kidney effects)	0.79	NA	0.2	NA
1,2-Dibromo-3-chloropropane (DBCP)	carcinogenicity (cancer)	0.0000017	1×10 ⁻⁶	0.0002	1×10 ⁻⁴
1,2-Dichlorobenzene (o-DCB)	chronic toxicity (liver effects)	0.6	NA	0.6	NA
1,4-Dichlorobenzene (p-DCB)	carcinogenicity (cancer)	0.006	1×10 ⁻⁶	0.005	8×10 ⁻⁷
1,1-Dichloroethane (1,1-DCA)	carcinogenicity (cancer)	0.003	1×10 ⁻⁶	0.005	2×10 ⁻⁶
1,2-Dichloroethane (1,2-DCA)	carcinogenicity (cancer)	0.0004	1×10 ⁻⁶	0.0005	1×10 ⁻⁶
1,1-Dichloroethylene (1,1-DCE)	chronic toxicity (liver effects)	0.01	NA	0.006	NA
Dichloromethane (methylene chloride)	carcinogenicity (cancer)	0.004	1×10 ⁻⁶	0.005	1×10 ⁻⁶
2,4-Dichlorophenoxyacetic acid (2,4-D)	chronic toxicity (liver and kidney effects)	0.07	NA	0.07	NA
1,2-Dichloropropane (propylene dichloride)	carcinogenicity (cancer)	0.0005	1×10 ⁻⁶	0.005	1×10 ⁻⁵
1,3-Dichloropropene (Telone II®)	carcinogenicity (cancer)	0.0002	1×10 ⁻⁶	0.0005	2×10 ⁻⁶
Di(2-ethylhexyl) adipate (DEHA)	developmental toxicity (disrupted development)	0.2	NA	0.4	NA
Diethylhexylphthalate (DEHP)	carcinogenicity (cancer)	0.012	1×10 ⁻⁶	0.004	3×10 ⁻⁷

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

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
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	carcinogenicity (cancer)	0.00001	1×10^{-6}	0.00005	5×10^{-6}
Fluoride	chronic toxicity (tooth mottling, human data)	1	NA	2	NA
Glyphosate	chronic toxicity (kidney effects)	1	NA	0.7	NA
Heptachlor	carcinogenicity (cancer)	0.000008	1×10^{-6}	0.00001	1×10^{-6}
Heptachlor epoxide	carcinogenicity (cancer)	0.000006	1×10^{-6}	0.00001	2×10^{-6}
Hexachlorobenzene	carcinogenicity (cancer)	0.00003	1×10^{-6}	0.001	3×10^{-5}
Hexachlorocyclopentadiene (HEX)	chronic toxicity (stomach lesions)	0.05	NA	0.05	NA

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

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
Lead	chronic toxicity (neurobehavioral effects in children, hypertension in adults) and carcinogenicity (cancer)	0.002	NA	0.015 (AL)	NA
Lindane (γ -BHC)	carcinogenicity (cancer)	0.000032	1×10^{-6}	0.0002	6×10^{-6}
Monochlorobenzene (chlorobenzene)	subchronic toxicity (liver damage)	0.2	NA	0.07	NA
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)	carcinogenicity (cancer)	0.013	1×10^{-6}	0.013	1×10^{-6}
Nickel	developmental toxicity (increased neonatal deaths)	0.012	NA	0.1	NA
Nitrate	acute toxicity (methemoglobinemia, human data)	10 as nitrate-nitrogen	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
Oxamyl	chronic toxicity (body weight effects)	0.05	NA	0.05	NA
Pentachlorophenol (PCP)	carcinogenicity (cancer)	0.0004	1×10^{-6}	0.001	3×10^{-6}

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

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
Picloram	chronic toxicity (liver effects)	0.5	NA	0.5	NA
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
1,1,2,2-Tetrachloroethane	carcinogenicity (cancer)	0.0001	1×10^{-6}	0.001	1×10^{-5}
Tetrachloroethylene (perchloroethylene, or PCE)	carcinogenicity (cancer)	0.00006	1×10^{-6}	0.005	8×10^{-5}
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
Toluene (methylbenzene)	chronic toxicity (liver and thymus effects)	0.15	NA	0.15	NA
Toxaphene	carcinogenicity (cancer)	0.00003	1×10^{-6}	0.003	1×10^{-4}
1,2,4-Trichlorobenzene (Unsym-TCB)	chronic toxicity (effects on adrenal glands)	0.005	NA	0.005	NA
1,1,2-Trichloroethylene (TCE)	carcinogenicity (cancer)	0.0008	1×10^{-6}	0.005	6×10^{-6}
Trichlorofluoromethane (Freon 11)	chronic toxicity (liver effects)	0.7	NA	0.15	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	chronic toxicity (liver effects)	4	NA	1.2	NA

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

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
Uranium	carcinogenicity (cancer)	0.43 pCi/L or 0.5 ppb	1×10^{-6}	20 pCi/L	5×10^{-5}
Vinyl chloride	carcinogenicity (cancer)	0.00005	1×10^{-6}	0.0005	1×10^{-5}
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
Arsenic	carcinogenicity (cancer, human data)	0	0	0.05	$1-2 \times 10^{-2}$
Chromium	chronic toxicity (stomach, liver effects), immunotoxicity (allergic dermatitis)	0.1	NA	0.05	NA
1,2-Dichloro-ethylene (cis)	chronic toxicity (liver and kidney effects)	0.07	NA	0.006	NA
1,2-Dichloro-ethylene (trans)	chronic toxicity (blood chemistry and liver effects)	0.1	NA	0.01	NA
Dioxin (2,3,7,8-TCDD)	carcinogenicity (cancer) reproductive effects	0	0	0.00000003	1×10^{-5}
Molinate	reproductive effects (decreased number of offspring)	none	NA	0.02	NA
Polychlorinated biphenyls (PCBs)	carcinogenicity (cancer)	0	0	0.0005	1×10^{-4}
Perchlorate	subchronic toxicity (thyroid and reproductive effects)	none	NA	0.004 (AL)	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 population; 5×10^{-5} means five excess cancer cases per 100,000 population.

⁴ California MCL = maximum contaminant level established by California.

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
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
1,1,1-Trichloroethane (1,1,1-TCA)	reproductive toxicity (decreased number of offspring), chronic toxicity (liver and blood effects) and neurotoxicity	0.2	NA	0.2	NA
1,1,2-Trichloroethane (1,1,2-TCA)	chronic toxicity (liver and kidney effects) and immunotoxicity	0.003	NA	0.005	NA
Disinfection byproducts (DBPS)					
bromate	carcinogenicity (cancer)	0	0	none	NA
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
chlorine dioxide	chronic toxicity (anemia) and neurotoxicity (infants and young children, human data)	0.8 ⁵	NA	none	NA

⁵ Maximum Residual Disinfectant Level Goal, or MRDLG

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
chlorite	chronic toxicity (anemia) and neurotoxicity (infants and children, human data)	0.8	NA	none	NA
Disinfection byproducts: haloacetic acids (HAA5)					
chloroacetic acid	NA	none	NA	none	NA
dichloroacetic acid	carcinogenicity (cancer)	0	0	none	NA
trichloroacetic acid	developmental toxicity (nervous system effects)	0.3	0	none	NA
bromoacetic acid	NA	none	NA	none	NA
dibromoacetic acid	NA	none	NA	none	NA
total haloacetic acids	carcinogenicity (cancer)	none	NA	none	NA
Disinfection byproducts: trihalomethanes (THMS)					
bromodichloromethane (BDCM)	carcinogenicity (cancer)	0	0	none	NA
bromoform	carcinogenicity (cancer)	0	0	none	NA
chloroform	carcinogenicity (cancer)	none	NA	none	NA
dibromo-chloromethane (DBCM)	chronic toxicity (liver and kidney effects) and neurotoxicity	0.06	NA	none	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
total (sum of BDCM, bromoform, chloroform and DBCM)	carcinogenicity (cancer), chronic toxicity (liver and kidney effects), and neurotoxicity	none	NA	0.1	NA
Radionuclides⁶					
gross alpha particles	carcinogenicity (cancer)	0 (as of 12/08/2003) (²¹⁰ Po included)	0	15 pCi/L ⁷ (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	carcinogenicity (cancer)	0 (as of 12/08/2003) (²¹⁰ Pb included)	0	50 pCi/L	up to 2x10 ⁻³ (for ²¹⁰ Pb, the most potent beta-emitter)
radium 226 and 228 (combined)	carcinogenicity (cancer)	0 (as of 12/08/2003)	0	5 pCi/L	7x10 ⁻⁵ for ²²⁶ Ra and 3x10 ⁻⁴ for ²²⁸ Ra
strontium 90	carcinogenicity (cancer)	none	NA	8 pCi/L	2x10 ⁻⁵
tritium	carcinogenicity (cancer)	none	NA	20,000 pCi/L	5x10 ⁻⁵

⁷ pCi/L = picocuries per liter of water.