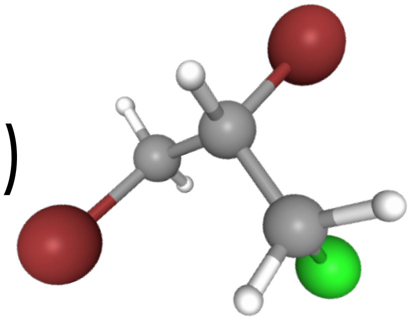
Groundwater Fact Sheet
Dibromochloropropane (DBCP)



Constituent of Concern
Dibromochloropropane

Synonym
1,2-Dibromo-3-chloropropane, BBC 12, Fumagon, Fumazone, Nemabrom, Nemafume, Nemagon, Nemanax, Nematocide, Nematox, Nemazon, OS 1987, Gro-Tone Nematode

Chemical Formula
$C_3H_5Br_2Cl$

CAS Number
96-12-8

Storet Number
38761

Summary
1,2-dibromo-3-chloropropane (DBCP) is a regulated chemical with an established Maximum Contaminant Level (MCL) of 0.2 micrograms per liter (µg/L). DBCP is a colorless liquid, denser than water, that can be tasted in water at very low concentrations. It is an organochlorine compound and it is a manufactured chemical, not naturally found in the environment. It was used as a soil fumigant in the control of nematodes (a parasite harming crops). DBCP's use in California was stopped in 1977 and the Environmental Protection Agency (EPA) banned the agricultural application of DBCP in the continental United States in 1979. It was banned because of evidence of infertility in men and induction of a variety of tumors in laboratory animals. Despite the ban on the use of DBCP, this pesticide remains persistent in soil and continues to be detected as a groundwater contaminant in areas of past high use. Very small quantities are still used as an intermediate in chemical synthesis.

Based on SWRCB data from 2007 to 2017, 149 active and standby public water wells (of 5,931 wells tested, 930 detections), had at least one detection above the MCL. Most detections of DBCP above the MCL have occurred in Fresno (68 wells), San Joaquin (22 wells) and San Bernardino (19 wells) counties.

REGULATORY WATER QUALITY LEVELS[1] DIBROMOCHLOROPROPANE (DBCP)		
Type	**Agency**	**Concentration**
Federal MCL	EPA[2]	0.2 µg/L
Federal Maximum Contaminant Level Goal (MCLG)	EPA[2]	0 µg/L
State MCL	SWRCB[3]	0.2 µg/L
Detection Limit for Purposes of Reporting (DLR)	SWRCB[3]	0.01 µg/L
Public Health Goal (PHG)	OEHHA[4]	0.0017 µg/L

[1]These levels are generally related to drinking water. Other water quality levels may exist. For further information, see "A Compilation of Water Quality Goals", 17th Edition (SWRCB 2016).
[2]EPA – United States Environmental Protection Agency
[3]SWRCB - State Water Resources Control Board.
[4]OEHHA – Office of Environmental Health Hazard Assessment

DBCP DETECTIONS IN PUBLIC WATER WELL SOURCES[5]	
Number of active and standby public water wells with DBCP concentrations > 0.2 µg/L[6]	149 of 5,931 wells tested with 930 detections
Top 3 counties with DBCP detection in public wells above the MCL	Fresno (68), San Joaquin (22) and San Bernardino (19)

[5]Based on 2007-2017 public standby and active well (groundwater sources) data collected by the SWRCB.
[6]Water from active and standby wells is treated to prevent exposure to chemical concentrations above the MCL. Data from private domestic wells and wells with less than 15 service connections are not available.

ANALYTICAL INFORMATION		
Approved EPA methods	504.1/551.1	524.1/524.2
Detection Limit (µg/L)	0.01	0.05
Notes	Division of Drinking Water (DDW) approved for public drinking water systems	
Known Limitations to Analytical Methods	Samples are preserved with sodium thiosulfate to avoid possible reactions between residual chlorine and contaminants present in some solvents. Potential for interference with impurities contained in extracting solvents. The EPA recommends methods 504.1 and 551.1. DBCP can be misidentified as ethylene dibromide. Laboratory confirmation procedures outlined by the EPA should be strictly adhered to.	
Public Drinking Water Testing Requirements	DDW established a MCL of 0.2 µg/L for this pesticide in 1989, with associated requirements for quarterly monitoring, compliance determinations, and treatment. In 1991, the EPA adopted a MCL of 0.2 µg/L and required monitoring for public water sources.	

DBCP Occurrence

Anthropogenic Sources

Prior to 1979, DBCP was primarily used as a soil fumigant for the control of nematodes in over 40 different crops in the United States. Today, very small quantities of DBCP are manufactured only for the purpose of chemical synthesis of other compounds.

Natural Sources

DBCP is a manufactured chemical that does not occur naturally in the environment.

History of Occurrence

Data collected on workers involved in the manufacturing and formulation of DBCP has shown that DBCP can cause sterility at very low levels of exposure. Agricultural application of DBCP was banned in the United States in 1979, with the exception of use in the Hawaiian pineapple industry. Usage of DBCP in the pineapple farming industry was banned in 1985. Today, DBCP is only used as a chemical intermediary in the manufacturing of synthetic compounds. The total volume of DBCP manufactured for this purpose is believed to be very small.

In California, DBCP was used extensively prior to 1979. DBCP was one of the most useful and simple to use nematicides. In 1977, 426,000 pounds of DBCP were used in California, primarily on grapes and tomatoes. DBCP has been detected in public groundwater sources in California, with the majority of occurrences in Fresno, San Bernardino, Stanislaus, and Tulare counties.

Contaminant Transport Characteristics

DBCP dissolves in water and may occur as a dense non-aqueous phase liquid. Its density is greater than water and free phase DBCP may sink to the bottom of an aquifer where it can persist for long periods of time. The half-life of DBCP in an aquifer with a temperature of 15° C is estimated at 141 years. In the atmosphere, DBCP is easily broken down by sunlight. DBCP is not likely to accumulate in aquatic life.

Remediation and Treatment Technologies

The EPA recommends the removal of DBCP in drinking water through granulated activated carbon in combination with packed tower aeration.

DBCP may also react like other halogenated alkanes to in situ oxidation by heat-activated persulfate, but it has shown to react poorly with permanganate, Fenton's reagent, hydrogen peroxide, and ozone.

Zero-valent iron (Fe^0) can be used in situ to remove DBCP in passive remediation systems. In the simplest application of this technology, a permeable reactive barrier or iron wall, is installed by digging a trench perpendicular to the direction of groundwater flow and back-filling it with iron. Water that passes through the zero-valent iron barrier is stripped of DBCP.

Health Effect Information

Ingestion of DBCP results in gastrointestinal distress and pulmonary edema. The likelihood of exposure to DBCP through food sources is extremely low since DBCP rapidly volatilizes when exposed to air and sunlight. Additional exposure pathways are through inhalation and direct contact.

Acute inhalation exposure to DBCP in humans results in moderate depression of the central nervous system, kidney and liver damage, and pulmonary congestion. Dermal exposure may irritate the skin and eyes in humans and animals. Even low exposure to DBCP by humans may cause sterility in men or other male reproductive effects, such as decreased, or no sperm counts. There is some evidence that DBCP may have the potential to cause cancer with lifetime exposure at levels above the MCL.

Key Resources

1. California State Water Resources Control Board. A Compilation of Water Quality Goals, 17th Edition, (SWRCB 2016). http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/index.shtml
2. Centers for Disease Control and Prevention. Toxicological Profile for 1,2-dibromo-3-chloropropane, ATSDR. Publication TP-91/12. http://stacks.cdc.gov/view/cdc/23452
3. Clark HA, Snedeker SM. Critical evaluation of the cancer risk of dibromochloropropane (DBCP). J Environ Sci Health C Environ Carcinog Ecotoxicol Rev. 2005;23(2):215-60. doi: 10.1080/10590500500234996.
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5. Office of Environmental Health Hazard Assessment. Public Health Goal for 1,2-Dibromo-3-chloropropane (DBCP) in Drinking Water. https://oehha.ca.gov/media/downloads/water/chemicals/phg/dbcpphg071720.pdf
6. U.S. Environmental Protection Agency. 2007. Technology Transfer Network. DBCP. https://www.epa.gov/haps/health-effects-notebook-hazardous-air-pollutants
7. U.S. Environmental Protection Agency. Groundwater and Drinking Water Fact Sheet, 1,2-Dibromo-3-chloropropane (DBCP). https://archive.epa.gov/water/archive/web/pdf/archived-technical-fact-sheet-on-dibromochlorpropane.pdf
8. U. S. Environmental Protection Agency. 2012 Edition of Drinking Water Standards and Health Advisories. http://nepis.epa.gov/Exe/ZyNET.EXE?ZyActionL=Register&User=anonymous&Password=anonymous&Client=EPA&Init=1%3E%3Ctitle%3EEPA%20-%20Home%20Page%20for%20the%20Search%20site%3C/title%3E%3Clink%20rel
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10. U.S. Environmental Protection Agency. Contaminated Site Clean-Up Information, Technologies-Remediation, https://clu-in.org/remediation/
11. U.S. Department of Labor. 2007. Medical surveillance guidelines for DBCP- 1910.1044. https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10064&p_table=STANDARDS

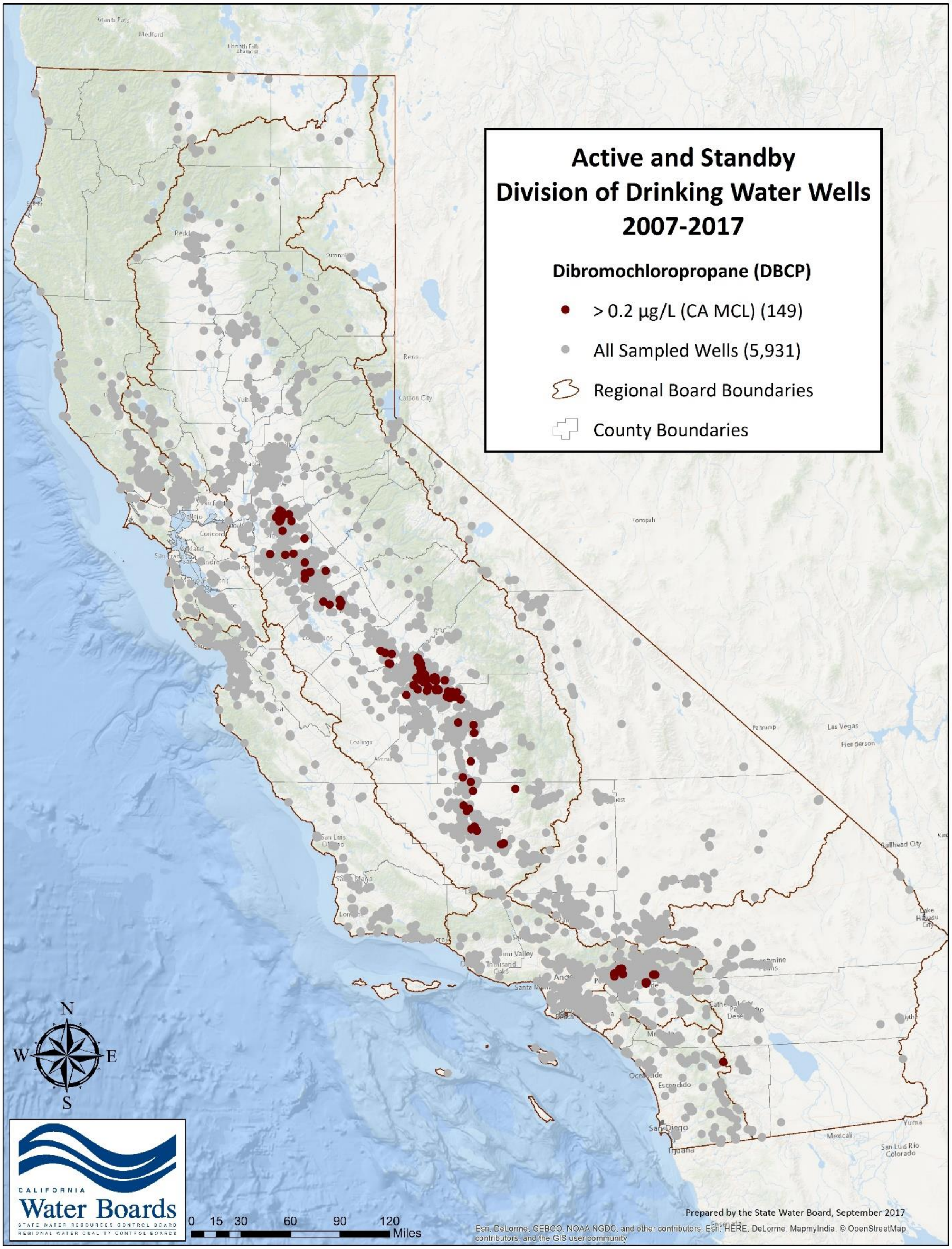

Figure 1. Active and standby public drinking water wells that had at least one detection of DBCP above the MCL, 2007-2017, 149 wells. (*Source: Public supply well data in GAMA GIS*).