GROUNDWATER INFORMATION SHEET

Dibromochloropropane (DBCP)

The purpose of this groundwater information sheet is to provide general information regarding a specific constituent of concern (COC). The information, provided herein relates to wells (groundwater sources) used for public drinking water, not water served at the tap.

GENERAL INFORMATION	
Constituent of Concern	Dibromochloropropane (DBCP)
Synonyms	1,2-Dibromo-3-chloropropane, BBC 12, Fumagon, Fumazone, Nemabrom, Nemafume, Nemagon, Nemanax, Nemapaz, Nemaset, Nematocide, Nematox, Nemazon, OS 1987, Oxy-DBCP, Gro-Tone Nematode, Durham Nematicide, OS 1897
Chemical Formula	$C_3H_5Br_2Cl$
CAS No.	96-12-8
Storet No.	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 was used as a soil fumigant in the control of nematodes. DBCP's use in California was stopped in 1977, and EPA had banned the agricultural application of DBCP in the continental United States in 1979. Very small quantities are still used as an intermediate in chemical synthesis. Public well data from January 2006 to July 2016 indicates that there are 156 active and standby public water wells (12,337 wells tested), with at least one detection above the MCL. Most detections of DBCP above the MCL have occurred in Fresno, San Joaquin and San Bernardino counties.

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

[1]These levels generally relate to drinking water. Other water quality levels may exist. For further information, see *A Compilation of Water Quality Goals* (Marshack, 2016).
[2]US EPA- US Environmental Protection Agency
[3]SWRCB-DDW - State Water Resources Control Board-Division of Drinking Water – formerly the California Department of Public Health (CDPH)
[4]OEHHA- Office of Environmental Health Hazard Assessment

SUMMARY OF DETECTIONS IN PUBLIC WATER WELLS[5]	
Detection Type	**Number of Groundwater Wells**
Number of active and standby public water wells[6] with DBCP concentrations > 0.2 µg/L	156 of approximately 12,337 tested
Top 3 counties with active and standby public water wells with DBCP concentrations > 0.2 µg/L	Fresno (63), San Joaquin (23) and San Bernardino (19)

[5]Based on 2006-2016 public standby and active well (groundwater sources) data collected by the SWRCB-DDW.
[6]Water from active and standby wells is treated to prevent exposure to chemical concentrations above the MCLs. Statewide data from private domestic wells and wells with less than 15 service connections are not available.

ANALYTICAL INFORMATION		
Method	**Detection Limit**	**Note**
US EPA 504.1, 551.1	0.01 µg/L	DDW approved for public drinking water systems
US EPA 524.1; 524.2	0.05 µg/L	
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 US EPA recommends methods 504.1 and 551.1. DBCP can be misidentified as ethylene dibromide. Laboratory confirmation procedures outlined by the US EPA should be strictly adhered to.	
Public Drinking Water Testing Requirements	The 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 US 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 & TREATMENT TECHNOLOGIES

The removal of DBCP from water can be accomplished through different methodologies, including air-stripping and filtration using granulated activated carbon. DBCP can also be removed using hydrogen peroxide combined with a catalyst (Fenton's Reagent). Ozone is a strong oxidant that can react with and oxidize DBCP to carbon dioxide and water.

Zero-valent iron (Fe^0) is frequently 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.

The US EPA approved treatment method for the removal of DBCP in drinking water is to use granulated activated carbon in combination with packed tower aeration.

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 REFERENCES

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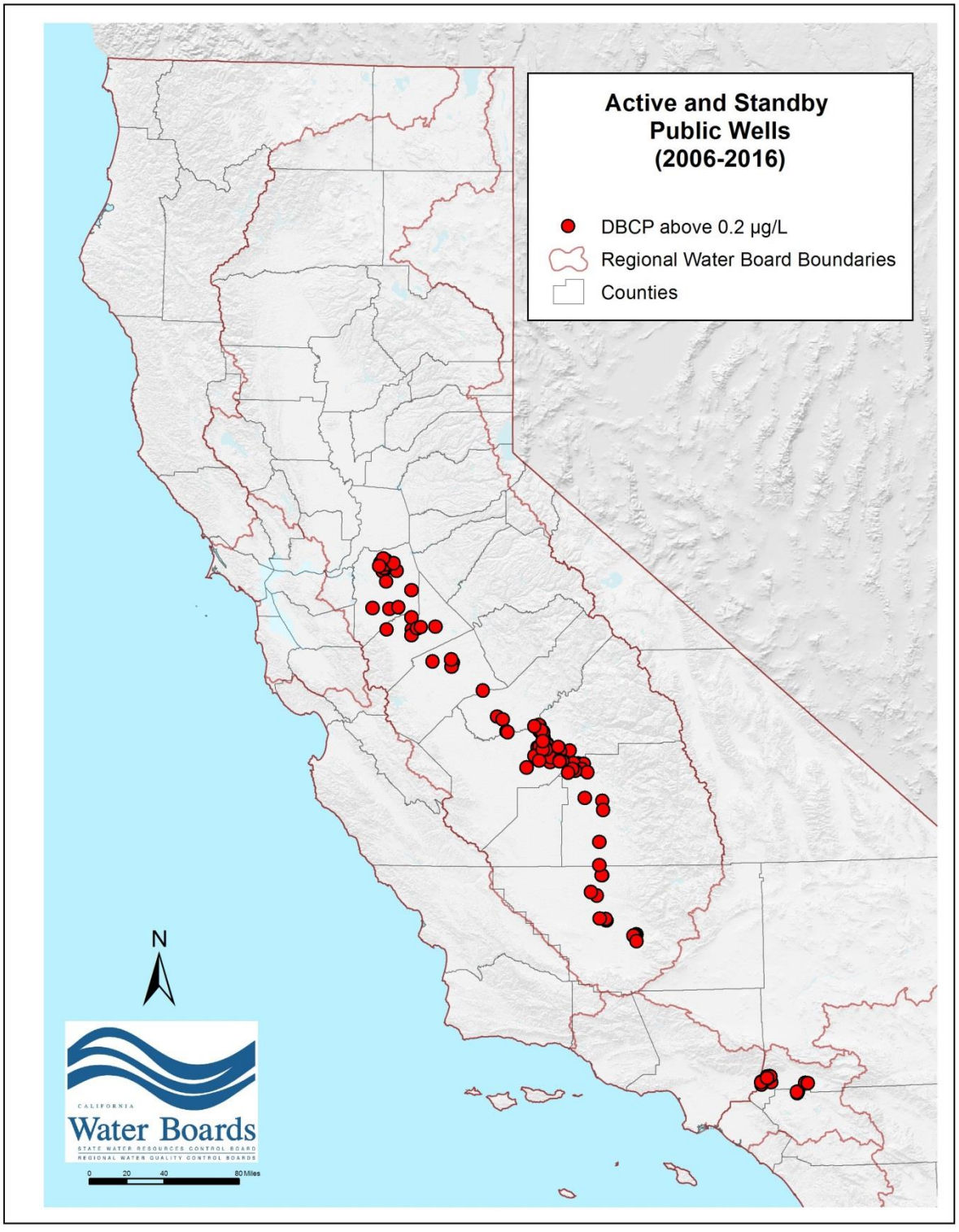

Active and Standby Public Wells with at least one detection of DBCP above the MCL of 0.2 µg/L, 156 wells. (*Source: Public well data using GeoTracker GAMA)*

Revised: July, 2016