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### The Soil Fumigant Experts

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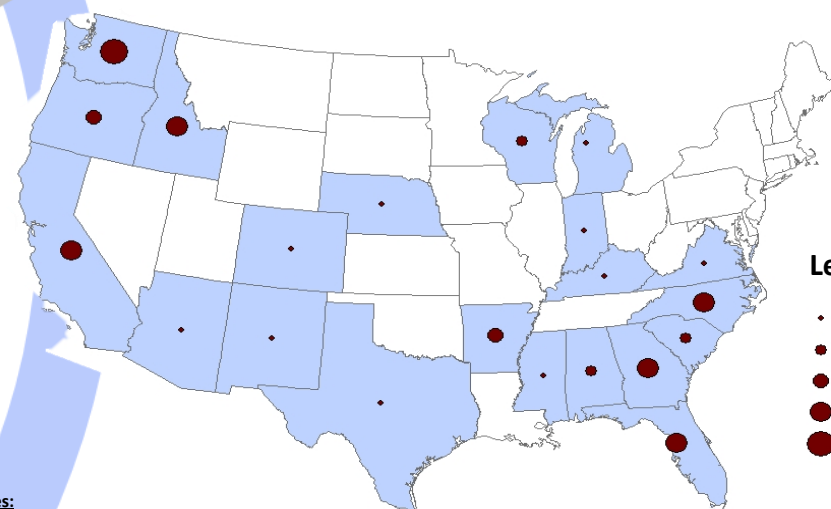
## What are Soil Fumigants?<sup>1,2,3</sup>

**1,2-Dibromo-3-chloropropane (DBCP)**, also known as Nemagon, was a fumigant used widely to kill nematodes in soil before planting. Between 1957 and 1977, about 32 million pounds of DBCP were sold and applied yearly in the United States, mainly for soybeans. California used 426,000 pounds at its peak use in 1977. DBCP's use in California stopped in 1977 after it was found to cause infertility and sterility in workers who formulated the pesticide. It is estimated that as many as 500,000 Californians have DBCP in their drinking water supply. DBCP has been detected in more than 2,000 wells, including more than 230 public drinking water wells, in agricultural areas of the state.

**1,3-Dichloropropene (Telone)** is a soil fumigant produced by Dow Chemical to control nematodes and plant pathogens. In 1990, 1,3-Dichloropropene use was suspended after the California Air Resources Board detected levels of concern in ambient air. However after field trials by Dow, the chemical was reintroduced in 1995 with strict control measures. Before 1990, it is estimated that 25 million pounds per year of 1,3-Dichloropropene were applied, and in 1999 approximately 3.5 million pounds were used in California.

**1,2-Dichloropropane-1,3-Dichloropropene (D-D)** was a soil fumigant produced by Shell Chemical Company to protect against nematodes, symphylids, and wireworms. It was used on pineapple, soybean, tobacco, and sugar beets, and was discontinued in the early 1980's due to "economic considerations". D-D was applied in conjunction with the fumigant DBCP at 40-60 gallons per acre every 3-5 years before planting.

## 1,3-Dichloropropene Pounds Applied<sup>4</sup>



### Legend

- 43,934 – 240,000
- 240,001 – 630,000
- 630,001 – 1,250,000
- 1,250,001 – 5,000,000
- 5,000,001 – 6,944,610

### Sources:

1. CDHS. DBCP Consumer Fact Sheet. [http://www.co.fresno.ca.us/uploadedFiles/Departments/Public\\_Health/Divisions/EH/content/Water\\_Surveillance/content/DBCP\\_State\\_Fact\\_Sheet.pdf](http://www.co.fresno.ca.us/uploadedFiles/Departments/Public_Health/Divisions/EH/content/Water_Surveillance/content/DBCP_State_Fact_Sheet.pdf).
2. DPR. (2002). California Management Plan: 1,3-Dichloropropene. <http://www.cdpr.ca.gov/docs/emon/methbrom/telone/mgmtplan.pdf>.
3. [http://pmp.cce.cornell.edu/profiles/fumigant/d\\_d\\_mixture/ddmix\\_prf\\_0684.html](http://pmp.cce.cornell.edu/profiles/fumigant/d_d_mixture/ddmix_prf_0684.html).
4. EPA. Overview of Soil Fumigant Uses. [www.epa.gov/soil\\_fumigants/m2-overview-of-uses.pdf](http://www.epa.gov/soil_fumigants/m2-overview-of-uses.pdf).
5. <http://www.gsi-net.com/en/publications/gsi-chemical-database.html>
6. CDPH. (2011). MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants. July 27.
7. EPA. (2008). Health Effects Support Document for 1,3-Dichloropropene. [http://www.epa.gov/ogwdw/ccl/pdfs/reg\\_determine2/healtheffects\\_ccl2-reg2\\_13dichloropropene.pdf](http://www.epa.gov/ogwdw/ccl/pdfs/reg_determine2/healtheffects_ccl2-reg2_13dichloropropene.pdf).
8. Values for 1,3-dichloropropene used.
9. <http://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+hsdb:@term+@DOCNO+6298>
10. Values for 1,2-dichloropropane used.
11. Burrow, K.R. et al. (1999). Evaluation of Processes Affecting 1,2-Dibromo-3-Chloropropane (DBCP) Concentrations in Ground Water in the Eastern San Joaquin Valley, California: Analysis of Chemical Data and Ground Water Flow Transport Simulations. <http://ca.water.usgs.gov/sanj/pub/usgs/wrir99-4059/wrir99-4059.pdf>.

## Soil Fumigant Property Comparison<sup>5</sup>

Compound	Molecular Weight	Density	Solubility	K <sub>n</sub>	log K <sub>ow</sub>	log K <sub>oc</sub>	PHG <sup>6</sup>	MCL (CA) <sup>6</sup>
	g/mol	g/cm <sup>3</sup> at 20-25°C	mg/L at 20-25°C	unitless	unitless	unitless	µg/L	µg/L
DBCP	236.33	2.08	1,000	0.0083	2.68	2.23	0.0017	0.2
Telone <sup>7</sup>	110.97	1.22	1,550	0.12	1.75	1.72	0.2 <sup>8</sup>	0.5 <sup>8</sup>
D-D <sup>9</sup>	223.96	1.16 <sup>10</sup>	2,800 <sup>10</sup>	0.12 <sup>10</sup>	2.25 <sup>10</sup>	1.77 <sup>10</sup>	0.5 <sup>10</sup>	5 <sup>10</sup>
1,2,3-TCP	147.43	1.38	1,900	0.016	2.50	2.59	0.0007	0.005
TCE	131.39	1.46	1,100	0.43	2.47	1.97	1.7	5

### Notes:

K<sub>n</sub> = Henry's Law Constant; K<sub>ow</sub> = Octanol-Water Partition Coefficient; K<sub>oc</sub> = Organic Carbon Partition Coefficient

## DBCP Degradation Pathways<sup>11</sup>

