

Which of the following organic compounds has the highest carcinogenicity (cancer risk) in drinking water?

- A. Ethylene dibromide B. Vinyl chloride C. Dichloromethane D. Heptachlor epoxide

Water is a powerful solvent that readily dissolves many natural and synthetic substances from the environment (e.g. inorganic salts, humic acids and pesticide residues). The composition of drinking water, therefore, is complex and varies between sites and with the seasons. Modern technology is employed to minimise the amounts of many of these substances, but some may persist, including derivatives generated by halogenation and ozonation for disinfection. Some of the substances are genotoxic in the laboratory and a few are proven experimental carcinogens - all at much higher concentrations than those normally found in a drinking water supply.¹

Numerous studies have been conducted in order to determine exactly which chemicals are showing up in the water supply and exactly how dangerous these chemicals are, and toxicity can be compared and analysed by giving substances a Maximum Contaminant Level (MCL) value - The highest level of a contaminant that is allowed in drinking water, measured in µg/L.² These compounds are of concern in drinking water because of regular exposure and their pseudo-persistence (though even non-persistent contaminants can be a risk of cancer in water).

A study by the school of public health at University of California Berkeley stated that in general, halogenated compounds tend to pose a higher cancer risk of than non-halogenated ones.³

Chemical	MCL (53) (µg/liter)	Cancer risk at MCL per 100,000
Arsenic	50	1300 (16) 1650* (4)
Benzene	5	0.2-0.8 (54)
Benz[a]pyrene	0.2	4.2 (54)
Carbon tetrachloride	5	1.9 (54)
Chlordane	2	2 (54)
1,2-Dichloroethane	5	1.3 (54)
Dichloromethane	5	0.1 (54)
Di(2-ethylhexyl)phthalate	6	0.2 (54)
Ethylene dibromide	0.05	12.5 (54)
Heptachlor	0.4	5.2 (54)
Heptachlor epoxide	0.2	5.2 (54)
Hexachlorobenzene	1	4.6 (54)
Polychlorinated biphenyls (PCBs)	0.5	0.5 (54)
Pentachlorophenol	1	0.3 (54)
Toxaphene	3	9.6 (54)
Vinyl chloride	2	8.4 (54)

*Extrapolated upward from results given for 20 µg/liter

1. Dayan, A. D. (1993), Carcinogenicity and Drinking Water. *Pharmacology & Toxicology*, 72: 108–115. doi:10.1111/j.1600-0773.1993.tb01678.x

2. <https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants#one>

3. http://asrg.berkeley.edu/Index_files/Publications_PDF/02SmithAsEpidDWStand.pdf

4. <https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants#one>

Table reference 53. www.epa.gov/safewater/mcl.html.

Table reference 54. cfpub.epa.gov/ncea/iris2/atoz.cfm