State of Alaska Epidemiology Bulletin

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Trichloroethylene (TCE) in Well Water, Fairbanks
Public Health and Environmental Protection

Statement of the Problem: On September 15, 1995, the Alaska Department of Environmental Conservation (ADEC) issued a health alert for residents living near Fairbanks because several residential wells had levels of trichloroethylene (TCE) in excess of the drinking water standard of 5 parts per billion (ppb). Because the health implications of TCE in drinking water were unclear, ADEC asked that the Alaska Department of Health and Social Services, Section of Epidemiology to review the available data and develop health recommendations.

Review of the Issue: The health alert area is roughly bounded by the Old and New Richardson Highways and by Badger Road and Davison Street. The primary source of water for community residents is from private wells drawing on a shallow aquifer. On October 11, 1995, the Section of Epidemiology received results on 84 separate wells sampled by Shannon and Wilson, the primary contractor to ADEC. Of the 84 wells tested, 14 (17%) exceed the drinking water standard for TCE of 5 ppb. Additional testing is underway to identify the source of TCE and to characterize the aquifer.

Response: ADEC and the Section of Epidemiology reviewed information on TCE and consulted with toxicologists at the Agency for Toxic Substances and Disease Registry (ATSDR) in Seattle, WA and Atlanta, GA. Information regarding the acute or short-term health hazards of TCE in drinking water demonstrated that TCE does not present a short-term health hazard. For example, the Suggested-No-Adverse-Response-Level (SNARL) for a 24-hr exposure is 105,000 ppb, while an individual could be exposed to 15,000 ppb over 7 days without exceeding the SNARL.[1] Because the highest level of TCE in the well water was only 22 ppb, the levels of TCE found in Fairbanks pose no short-term health risks.

To investigate long-term health risks, we reviewed information on both cancer and non-cancer health effects of TCE. At this time, there is insufficient evidence to list TCE as a cancer-causing agent. Several epidemiological investigations have made associations between oral exposure to low levels of TCE and cancer. The most notable of these was an investigation of contaminated well water in Woburn, Massachusetts.[2] This study reported that there was an increase in the incidence of childhood leukemia associated with TCE exposure (>250 ppb). However, this investigation is controversial, because the exposures were not to TCE alone, but to a mix of chemical solvents, and the exposure duration and extent were poorly characterized. There are other epidemiological studies which have found no association between ingestion of TCE and cancer. For example, a study of three communities in Michigan demonstrated no significant increases in cancers or leukemias among individuals exposed to chlorinated solvents which included TCE (200-1,000 ppb, 10 years). [3] No non-cancer health effects have been attributed to such low level (<22 ppb) exposures as exist in Fairbanks.

We also reviewed the literature on TCE exposure and cancers in laboratory animals. These investigations demonstrated that life-time exposures to extremely high levels of TCE may result in hepatic and renal cancer. However, these results are equivocal and hard to interpret, because the levels of TCE required to induce cancer in these animals is high enough to kill them through cancer-independent pathways. The levels of TCE which caused cancers in animals following life-time exposures are on the order of 1.1 million times higher than the highest level (22 ppb) found in Fairbanks, AK.

Conclusion: A review of the available toxicologic and epidemiologic information shows TCE to be of very low human toxicity. Risk cannot be said to be zero, but the levels of TCE in well water and the dosage to exposed individuals are so small as to constitute no basis for public health concern. This is true despite the fact that the levels found in Fairbanks drinking water exceed the drinking water standard of 5 ppb. This drinking water standard was developed to be exceedingly conservative and to incorporate a very large margin of safety. In fact, the allowable TCE levels in drinking water vary considerably among states (Table 1).

The Section of Epidemiology does not recommend clinical examination or measurement of blood/urine TCE or TCA levels as indicators of individual TCE exposures. Because of the low levels of TCE found in drinking water in the Fairbanks area, the potential for exposure from other routes, and the rapid metabolism of TCE, the tests would not be a valid measure of individual exposure and would be useless.

Table 1. Drinking Water (DW) TCE Standards of Selected States or Agencies

State/Agency	DW Std	State/Agency	DW Std
New Jersey	1 ppb	Connecticut	25 ppb
US EPA	5 ppb	World Health Organization	30 ppb
Utah	5 ppb	Minnesota	31.2 ppb
Alaska	**5 ppb**	New Mexico	100 ppb

Summary: . TCE is a man-made chemical that does not occur naturally in the environment. The ideal amount of TCE is water is zero.

. No human illness or disease would occur from water with TCE at levels measured around 6-Mile Richardson Highway.

. There are no medical examinations or tests that could be of value, because TCE levels are so low.

Recommendations:

. Additional tests need to be made to characterize the aquifer and to identify the source(s) of TCE.

. Residents whose wells have levels of TCE that exceed 5 ppb can choose from among several options; doing nothing and continuing to use their well water, installing carbon filtration units that can remove TCE, or purchasing bottled water.

. Residents and public agencies and officials should take the time necessary to acquire adequate information upon which to select the best permanent solution to assure a safe water system that meets all standards.

1 Toxicological Profile for Trichloroethylene (1993) U.S. Department of Health and Social Services, Agency for Toxic Substances and Disease Registry, Atlanta, GA.

2 Parker, G.S. and S.L. Rosen (1981) Cancer Incidence and Environmental Hazards 1960-1978. Massachusetts Department of Public Health.

3 Freni, S.C. and A.W. Bloomer (1988) Report on the Battle Creek Health Study, Lansing MI, Michgan Department of Health.

4 National Toxicology Program(1990) Technical report series no. 243. Carcinogenesis studies oftrichloroethylene (without epichlorhydrin) in Fischer-344/N rats and B6C3F1 mice (gavage studies). Research Triangle Park, NC, National Institutes ofHealth, NIH Publication number 90-1799.

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