Rachel's Environment & Health News
#267 - Popular Solvent, TCE, Seems To Cause Serious Birth Defects In Animals, Humans
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The solvent trichloroethylene or TCE is the contaminant found most often at hazardous waste dumps and in groundwater (underground water supplies). The federal government has found TCE at 614 (47%) of the nation's 1300 official Superfund sites. [1, pg. 1] TCE causes leukemia and liver cancer in laboratory animals and it may cause leukemia in humans, though the studies showing this have been challenged. [2, pgs. 185-187.]

There is substantial recent evidence that TCE causes birth defects in newborn animals and is associated with similar defects in humans; specifically, TCE exposure causes heart defects in baby chickens and rats [5], and is associated with similar defects in human newborns [6]. Heart defects are the fastest-growing type of birth defects in the U.S. population [3].

TCE is mainly used as a degreasing solvent in the metal products and automotive industries, though it can also be found in some typewriter correction fluids, paint removers/strippers, adhesives, spot removers, and rug-cleaning fluids. [1, pgs. 69, 71]

Humans invented TCE; it does not occur in nature, so the human body has not had an opportunity to develop detoxifying or other protective mechanisms specific to TCE. In 1990 only two U.S. companies manufactured trichloroethylene (Dow Chemical in Freeport, TX, and PPG Industries at Lake Charles, LA) but each of the 50 states has large industrial users of TCE--some 878 major users in all [1, pg. 70], plus countless smaller users. Total U.S. estimated use of TCE exceeded 200 million pounds in 1990. All 200 million pounds entered the general environment sooner or later.

When it gets loose, TCE has a strong tendency to enter the atmosphere. Average air concentrations for TCE range from 0.04 ppb [parts per billion] in Portland, Oregon in 1984, to 0.29 ppb in Philadelphia in 1983-84, and 0.1 to 0.225 ppb in 10 major cities across the country in 1980-81. The air over six landfills in New Jersey ranges from 0.08 to 2.43 ppb TCE (maximum: 12.3 ppb). But even remote, unspoiled areas have TCE in their air; in the Arctic in 1982-83 air averaged 0.008 to 0.009 ppb TCE. In other words, the whole atmosphere is contaminated with TCE at low concentrations.

Any particular molecule of TCE only remains in the atmosphere a few days. Rain brings TCE back to the ground where it then moves into streams, rivers, lakes, and oceans. Once it enters water, much of it moves back into the atmosphere quickly, but some of it enters plants, then small animals, then fish. Fish from various waterways contain TCE in the range of 10 to 100 ppb. Clams and oysters in Louisiana contain TCE (0.8 to 5.7 ppb). Snow in Alaska contains TCE (0.03 to 0.039 ppb). Rain contains TCE. So naturally, fresh tomatoes, potatoes, apples and pears contain TCE (1.7, 0-3, 5 and 4 ppb, respectively). [1, pgs. 77- 85]

It helps to understand that EPA [U.S. Environmental Protection Agency] has set 5 ppb as the maximum allowable concentration in drinking water- -so finding 5 ppb in a fresh apple should give us pause. Many processsed foods contain TCE because they are often made with water contaminated with TCE. The federal Agency for Toxic Substances and Disease Registry [ATSDR] reports: Chinese-style sauce (28 ppb), quince jelly (40 ppb), chocolate sauce (50 ppb), grape jelly (20 ppb). Fresh bread contains 7 ppb, various brands of margarine contain 440 to 3600 ppb. These are not national averages, so the foodstuffs in your refrigerator may contain less or more than these values.

In sum, we industrial humans have managed to spread TCE everywhere.

Humans ingest TCE by drinking fluids, by breathing, and through their skin. In 133 American cities, TCE averaged 0.47 ppb in water samples at the tap. If you take a shower in such water, you inhale considerable TCE but you also absorb an equal amount through your skin. [2, pg. 117]

All of this explains why Americans have measurable amounts of TCE on their breath.

There is no doubt that TCE causes leukemia in animals. But the evidence for leukemia in humans is not so clear. People at Woburn, Massachusetts, drinking a TCE-contaminated water supply, did get leukemia in unusually high numbers but some people in the communty also got leukemia even though they had a different water supply, so the picture is not crystal clear. [1, pgs. 35-36]

In 1990, two studies were published linking TCE to heart defects. A large group of people in Tucson, Arizona, drank TCE-contaminated water for up to a decade. A careful study of children born to these families revealed an unusually large number of birth defects of the heart. Among these children, the chances of being born with a heart defect were three times the normal chances of having such a defect. [6] Earlier studies of baby chicks, and in 1990 of baby rats [5] revealed that TCE causes heart defects in these species. Although cause-and-effect has not been shown to a scientific certainty by the Tucson study, after reading the available evidence, pregnant women will almost certainly want to minimize their exposure to TCE. The families in Tucson were drinking water that contained from 6 to 200 ppb of TCE.

Another long-term effect of TCE exposure was revealed in a 1988 study of nerve function in people in Woburn, Massachusetts who had been drinking water contaminated with TCE (118 to 267 ppb). The people had stopped drinking the contaminated water six years prior to the test, yet there was unmistakable evidence of damage to their cranial (brain) nerves. [4]

In addition, there is now a growing body of medical and scientific literature showing associations between exposure of men to solvents (including TCE) in the workplace, and birth defects and cancers in their children. [8, 9] Damage to the men's sperm is the suspected mechanism for effects in the children.

TCE evaporates easily and is difficult to control. It is representative of a large number of chlorinated chemicals that now appear to be more dangerous than we previously knew. Subtle but important health effects, which were never looked for during previous decades, are now being discovered. The more we look, the more bad news we learn.

Our present industrial patterns--called loosely "business as usual"--do not appear to be sustainable.

--Peter Montague

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[1] Agency for Toxic Substances and Disease Registry [ATSDR]. DRAFT TOXICOLOGICAL PROFILE FOR TRICHLOROETHYLENE. Atlanta, GA: Agency for Toxic Substances and Disease Registry [Division of Toxicology, Mail Stop E-29, Atlanta, GA 30333], October, 1991. Free as long as supplies last but requests must be in writing.

[2] Anthony B. Miller and others, ENVIRONMENTAL EPIDEMIOLOGY VOL. 1; PUBLIC HEALTH AND HAZARDOUS WASTES (Washington, DC: National Academy Press, 1991).

[3] Larry D. Edmonds and Levy M. James, "Temporal Trends in the Prevalence of Congenital Malformations at Birth Based on the Birth Defects Monitoring Program, United States, 1979-1987," MMWR [MORBIDITY AND MORTALITY WEEKLY REPORT] CDC [CENTERS FOR DISEASE CONTROL] SURVEILLANCE SUMMARIES, Vol. 39 No. SS-4 (December, 1990), pgs. 19-23.

[4] Robert G. Feldman and others, "Blink Reflex Latency after Exposure to Trichloroethylene in Well Water," ARCHIVES OF

ENVIRONMENTAL HEALTH Vol. 43, No. 2 (March/April, 1988), pgs. 143-148.

[5] Brenda V. Dawson and others, "Cardiac Teratogenesis of Trichloroethylene and Dichloroethylene in a Mammalian Model," JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY Vol. 16, No. 5 (November 1, 1990), pgs. 1304-1309.

[6] Stanley J. Goldberg, "An Association of Human Congenital Cardiac Malformations and Drinking Water Contaminants," JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY Vol. 16, No. 1 (July, 1990), pgs. 155-164.

[7] M.K. Smith and others, "Development Effects of Dichloroacetic Acid in Long-Evans Rats," TERATOLOGY Vol. 39 (1989), pg. 482.

[8] John M. Peters and others, "Brain Tumors in Children and Occupational Exposure of Parents," SCIENCE Vol. 213 (July 10, 1981), pgs. 235-236.

[9] Helena Taskinen and others, "Spontaneous abortions and congenital malformations among the wives of men occupationally exposed to organic solvents," SCANDINAVIAN JOURNAL OF WORK, ENVIRONMENT AND HEALTH Vol. 15 (1989), pgs. 345-352.

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