

*Selected references on pregnancy and THMs*

**Bove F, et al. Drinking water contaminants and adverse pregnancy out-comes: A review. Environmental Health Perspectives 110 (Suppl 1):61-74 (2002).**

A recent review article presents evidence linking maternal exposure to drinking water contaminants and increased risk of adverse birth outcomes. The review specifically examined the epidemiologic evidence for disinfection by-products (formed when chlorine reacts with organic matter during water treatment and distribution) and chlorinated solvents in drinking water. Moderate associations were found between exposure to trihalomethanes, a class of disinfection by-products, and effects such as small fetal size for gestational age, neural tube defects, and spontaneous abortion. ... the evidence raises important concerns for the health effects of these drinking water contaminants on both mother and child.

**Aschengrau, A., S. Zierler and A. Cohen (1993). "Quality of community drinking water and the occurrence of late adverse pregnancy outcomes." Arch Environ Health 48(2): 105-13.**

**Abstract:** The relationship between community drinking water quality and the occurrence of late adverse pregnancy outcomes was investigated by conducting a case-control study among women who delivered infants during August 1977 through March 1980 at Brigham and Women's Hospital in Massachusetts. Among the babies of 2,348 Massachusetts women, researchers found increased rates of stillbirth, neonatal deaths, major congenital malformations, and respiratory and urinary tract defects associated with mothers drinking from disinfected public water supplies

**Bove, F. J., M. C. Fulcomer, J. B. Klotz, et al. (1995). "Public drinking water contamination and birth outcomes." Am J Epidemiol 141(9): 850-62. Abstract:**

The effects of public drinking water contamination on birth outcomes were evaluated in an area of northern New Jersey. After excluding plural births and chromosomal defects, 80,938 live births and 594 fetal deaths that occurred during the period 1985-1988 were studied. The babies showed increased risk of low weight, central nervous system defects, neural tube defects, major cardiac defects, and oral cleft defects when their mothers drank tap water with high levels of THMs (>100 ppb) based on quarterly measurements

**Dodds, L., W. King, C. Woolcott and J. Pole (1999). "Trihalomethanes in public water supplies and adverse birth outcomes." Epidemiology 10(3): 233-7. Abstract:**

A retrospective cohort study to evaluate the relation between the level of total trihalomethanes in drinking water and adverse birth outcomes. The study population comprised women residing in an area with municipal surface water who had a singleton birth in Nova Scotia between January 1, 1988, and December 31, 1995, or a pregnancy termination for a major fetal anomaly. The study included 49,842 births and found a drop in gestational size, and an increased risk of stillbirth, chromosomal abnormalities, and neural tube defects associated with a mother's drinking tap water with high levels of THMs

**Gallagher, M. D., J. R. Nuckols, L. Stallones and D. A. Savitz (1998). "Exposure to trihalomethanes and adverse pregnancy outcomes." Epidemiology**

**9(5): 484-9.** Performed a retrospective cohort study to examine the relation of trihalomethane exposure during the third trimester of pregnancy to low birthweight, term low birthweight, and preterm delivery. Colorado birth certificates from January 1, 1990, through December 31, 1993, were matched to historical water sample data with respect to time and location of maternal

residence based on census block groups. Researchers found increased risk of low birth weight associated with a mother's ingestion of high THMs in tap water during the last trimester of pregnancy

**Kanitz, S., Y. Franco, V. Patrone, et al. (1996). "Association between drinking water disinfection and somatic parameters at birth." *Environ Health Perspect* 104(5): 516-20.**

An epidemiological study in Liguria, Italy, on the association between somatic parameters at birth and drinking water disinfection with chlorine dioxide and/or sodium hypochlorite. Over 2 years (1988-1989), 676 births at two public hospitals, one in Genoa (548 cases) and another in Chiavari (128 cases) were examined and data regarding both mother and child were obtained from hospital records. Researchers found increased rates of neonatal jaundice, low birth weight, small body length, and small heads associated with a mother's ingestion of disinfected tap water

**Klotz, J. B. and L. A. Pyrch (1999). "Neural tube defects and drinking water disinfection by-products." *Epidemiology* 10(4): 383-90.**

A population-based case control study of neural tube defects and drinking water contaminants, specifically, disinfection by-products which used public monitoring records concurrent with the first month of gestation to assess exposure. Researchers found that among 360 pregnant women studied, babies were twice as likely to have neural tube defects for tap water with greater than 40 ppb THMs than for mothers drinking water with less than 5 ppb THMs

**Kramer, M. D., C. F. Lynch, P. Isacson and J. W. Hanson (1992). "The association of waterborne chloroform with intrauterine growth retardation." *Epidemiology* 3(5): 407-13.**

Studied the association of waterborne chloroform with low birthweight (less than 2,500 gm), prematurity (less than 37 weeks gestation), and intrauterine growth retardation (less than 5th percentile of weight for gestational age). The study included 4,028 pregnancies among Iowa women and shows low newborn weight (intrauterine growth retardation) for babies whose mothers drank tap water containing at least 10 ppb of THMs through pregnancy.

**King, W. D., L. Dodds, and A. C. Allen (2000). "Relation between Stillbirth and Specific Chlorination By-Products in Public Water Supplies." *Environmental Health Perspectives* 108(9).**

Among nearly 50,000 births in Nova Scotia between 1988 and 1995, researchers found the risk of stillbirth to be nearly double among pregnancies exposed to 20 ppb of a single chlorination byproduct called bromodichloromethane, compared to pregnancies exposed to low concentrations

**Magnus, P., J. J. Jaakkola, A. Skrandal, et al. (1999). "Water chlorination and birth defects." *Epidemiology* 10(5): 513-7.**

Linked the Norwegian waterwork registry, containing 1994 data on chlorination practice and color (an indicator for natural organic matter), with the Medical Birth Registry for 1993-1995. The proportion of the population exposed to chlorination and a weighted mean color number in drinking water was computed for each municipality. Among 141,077 births in Norway, a mother's reliance on a chlorinated tap water supply was linked to increased rates of all birth defects, urinary tract defects, neural tube defects, major cardiac defects, and respiratory tract defects

**Savitz, D. A., K. W. Andrews and L. M. Pastore (1995). "Drinking water and pregnancy outcome in central North Carolina: source, amount, and trihalomethane levels." *Environ Health Perspect* 103(6): 592-6.**

Using data from a case-control study of miscarriage, preterm delivery, and low birth weight in central North Carolina, risks associated with water source, amount, and trihalomethane (THM) concentration were evaluated. The study included 1003 pregnant women and found elevated rates of miscarriage and low birth weight among women drinking high levels of THMs, based on quarterly monitoring from their water suppliers

**Waller, K., S. H. Swan, G. DeLorenze and B. Hopkins (1998). "Trihalomethanes in drinking water and spontaneous abortion." *Epidemiology* 9(2): 134-40.**

Examined exposure to trihalomethanes and spontaneous abortion in a prospective study of 5,144 pregnant women in a prepaid health plan. Seventy-eight drinking water utilities provided concurrent trihalomethane sampling data. Total trihalomethane levels were calculated by averaging all measurements taken by the subject's utility during her first trimester. In a population of 5,144 pregnant women from California, researchers found increased risk of spontaneous abortion associated with high THM levels, with the highest risks associated with bromodichloromethane in particular