

Rennaker, Joanne (DEQ)

From: Laura Sullivan <dr.laura2@gmail.com>
Sent: Tuesday, March 10, 2015 12:15 AM
To: Howard Croft
Cc: donna.cole; gdn2@aol.com; James Henry; John O'Brien; Kirk Smith; larry.koehler@mcc.edu; Mike Lane; Prysby, Mike (DEQ); Norb Birchmeier; Pete Levine; Russell Hudson; JoAnne Herman; Michael Glasgow; Daugherty Johnson; Brent Wright; Warren Green; Samir Matta; Robert Nicholas
Subject: Re: Literature
Attachments: Abstracts for references 1-6.pdf; Reference 7.pdf; Reference 8.pdf; Reference 9.pdf; Reference 10.pdf

All-

I want to thank Dr. Rose and Mr. Wright for providing these documents. I've read through them and made notes, and I thought I'd share my notes here. There are days when I just can't find the time to comb through references, so if you are having that kind of day, I hope that these notes will help.

Attachment #1 from the NRDC (1999) indicates that **bottled water isn't always safe**. One of the reasons why, interestingly, is that it sometimes contains Trihalomethanes. Two references notes in the article contain site 8 studies found **adverse health effects associated with TTHM** (in the 1990s).

- o R.D. Morris, "Chlorination, Chlorination By-Products, and Cancer: A Meta Analysis," *American Journal of Public Health*, vol. 82, no. 7, at 955-963 (1992); EPA, "Proposed National Primary Drinking Water Regulations for Disinfectants and Disinfection By-Products," 59 Fed. Reg. 38668 (July 29, 1994); NRDC, U.S. PIRG, and Clean Water Action, *Trouble on Tap: Arsenic, Radioactive Radon, and Trihalomethanes in Our Drinking Water* (1995)
- o S.H. Swan, et al., "A Prospective Study of Spontaneous Abortion: Relation to Amount and Source of Drinking Water Consumed in Early Pregnancy," *Epidemiology*, vol. 9, no. 2, pp. 126-133 (March 1998); K. Waller, S. H. Swan, et al. (1998). "Trihalomethanes in Drinking Water and Spontaneous Abortion," *Epidemiology*, vol. 9, no. 2, pp. 134-40 (1998); F. J. Bove, et al. "Public Drinking Water Contamination and Birth Outcomes," *Amer. J. Epidemiol.*, vol. 141, no. 9, pp. 850-862 (1995); *see also*, NRDC, U.S. PIRG, and Clean Water Action, *Trouble on Tap: Arsenic, Radioactive Radon, and Trihalomethanes in Our Drinking Water* (1995).

Attachment #2 is a 1995 article that finds no strong link between TTHM levels and abortion or low birth rate. In doing a quick google scholar search, I found numerous articles that have been published since 1995, some of which make a correlation between exposure and birth defects, such as:

- S. Kumar, et al. "Total trihalomethanes in public drinking water supply and birth outcomes: a cross-sectional study," *Journal of Maternal and Child Health*, vol 18, no. 4, 996-1006 (2014). **This article notes a small increase in risk for low birthweight and pre-term births for chronic low maternal exposure to THMs.**

Attachment #3 (2003) is a Russian study that evaluates the efficacy of home filters in removing TTHMs. The authors of this article do not seek to determine whether or not TTHM levels can result in adverse health effects... instead, **the article states that adverse health effects are likely for pregnant women**

who are exposed to TTHM. The focus of the article is on finding an effective method for ridding water of the TTHM.

Attachment #4 (1999) from the EPA provides information on the importance of removing cryptosporidium from tap water, especially for people with compromised immune system. I'm not aware of previous or current test of the Flint river that detected cryptosporidium. That's the only reason I can think of for adding the topic to this discussion.

Attachment #5 (2006) This Water Research Journal article discusses the effect of boiling on the level of TTHM in the water. Depending on which trihalomethane is being measured, the level increases or decreases.

Attachment #6 Author unknown - perhaps this is a draft document to be included with the upcoming notification. This TTHM fact sheet suggests that the risk of adverse health effects after exposure to TTHMs is small, or that the number of people affected by TTHM is minimal. The statements made are vague and aren't supported by the other papers included in this email message.

Attachment #7 Again, author unknown. This document addresses the risks of cryptosporidium in drinking water, and casts doubt on the benefit of bottled water. The article states that THM is known to increase the risk of certain chronic diseases after long term exposure (without defining exactly what "long term" means), and that TTHMs can cause immediate adverse health effects in vulnerable people. The article notes that TTHMs have been associated with birth defects and premature births.

Attachment #8 discusses the options that people with compromised immune systems have for dealing with water that may have bacteria in it. Adding chlorine is not listed as an option.

After reading the attachments, I still felt unclear regarding the health effects of TTHM, and wanted to see if more recent research has been conducted and published. I searched and was able to find a number of literature citations. I am pasting here a list of articles I found, and attaching a document that contains the abstracts for the first 6 of the references. The full articles for references 7-10 are attached. I am a materials engineer, and not familiar with the academic literature on water research. For that reason, I may have missed pertinent literature published in the past 8 years. Still, it seems that the research I did find supports a correlation between TTHM exposure adverse health effects.

1. J. Lee, et al. "Occurrence of disinfection by-products in tap water distribution systems and their associated health risk." *Environmental Monitoring and Assessment* Vol. 185, no. 9, pp 7675-91 (Sept 2013).
2. E. Rincón-Bedoya, et al. "Mutagenicity and genotoxicity of water treated for human consumption induced by chlorination by-products," *Journal of Environmental Health*, Vol. 75, no. 6, pp 28-36 (Jan/Feb, 2013)
3. S. S. Tsai, et al. "Trihalomethanes in drinking water and the risk of death from esophageal cancer; does hardness in drinking water matter?," *Journal of Toxicology and Environmental Health*, Vol 76, no. 2, 120-30. (Jan/Feb, 2013)
4. S. Chowdhury, "Disinfection byproducts in Canadian provinces: associated cancer risks and medical expenses," *Journal of Hazardous Materials*, Vol 187, pp. 574-84 (March, 2011)
5. M. Basu, "Multi-route risk assessment from trihalomethanes in drinking water supplies," *Environmental Monitoring and Assessment*, Vol 178, pp. 121-34, (Jul, 2011)