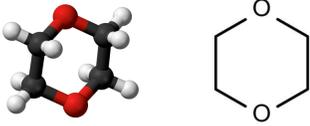


NC STATE UNIVERSITY

1,4-Dioxane Occurrence in the Haw River and in Pittsboro Drinking Water

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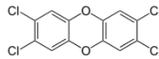
Pittsboro, NC, September 28, 2015

Presentation Overview

- What is 1,4-dioxane?
- 1,4-dioxane occurrence in
 - Pittsboro source water (Haw River at Bynum)
 - Pittsboro drinking water
- 1,4-dioxane sources
- Conclusions

What is 1,4-dioxane?

- 1,4-dioxane \neq dioxin

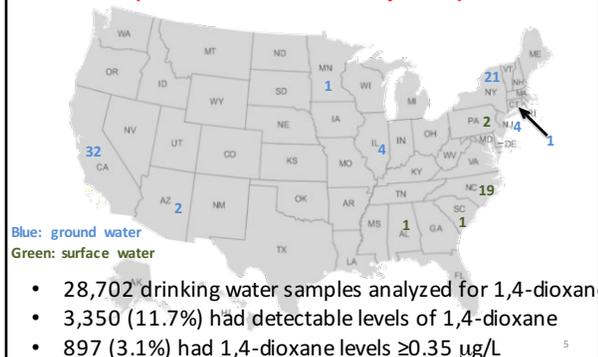


- Uses and potential sources of 1,4-dioxane
 - Solvent stabilizer (phased out)
 - Industrial solvent (textile, paper, specialty chemicals)
 - By-product of manufacturing processes involving ethylene oxide (polyester, PET, detergents, cosmetics)

1,4-Dioxane – Background Information

- Miscible in water
- Very difficult to remove from water
- Monitored nationwide in drinking water as part of EPA's 3rd Unregulated Contaminant Monitoring Rule (UCMR3)
 - Finished drinking water samples only
 - Public water systems serving >10,000 people

Drinking water samples with 1,4-dioxane $\geq 3.5 \mu\text{g/L}$ (UCMR3 data as of May 2015)



1,4-dioxane cancer risk

- Likely human carcinogen; one in a million excess cancer risk associated with lifetime consumption of water containing a 1,4-dioxane concentration of $0.35 \mu\text{g/L}$ (EPA IRIS database)
 - $0.35 \mu\text{g/L} = 1:1,000,000$ risk
 - $3.5 \mu\text{g/L} = 1:100,000$ risk
 - $35 \mu\text{g/L} = 1:10,000$ risk
- Comparison with disinfection by-products
 - Bromodichloromethane: $0.6 \mu\text{g/L} = 1:1,000,000$ risk
 - Dibromochloromethane: $0.4 \mu\text{g/L} = 1:1,000,000$ risk

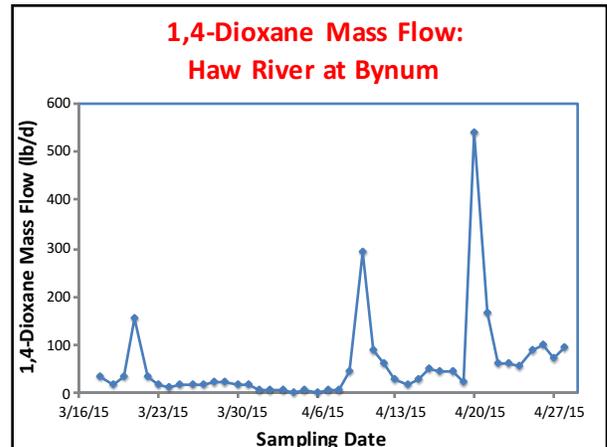
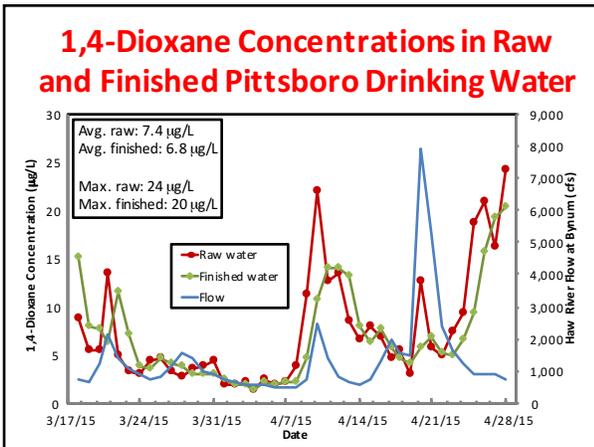
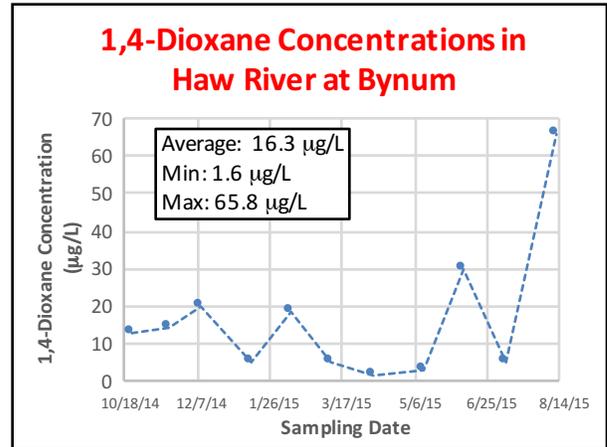
Field Sample Collection





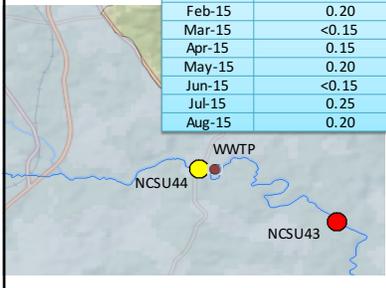
Preservatives:
50 mg/L sodium sulfite
1 g/L sodium bisulfate
Added sequentially in the field

Brown glass bottles 500 mL with PTFE Caps

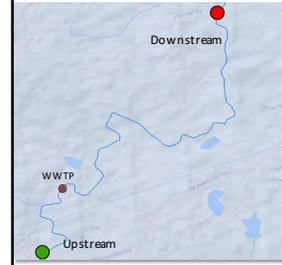


Source Identification: Haw River

Date	Upstream Concentration (µg/L)	Downstream Concentration (µg/L)
Oct-14	0.60	77
Dec-14	0.16	123
Jan-15	0.20	1.0
Feb-15	0.20	76
Mar-15	<0.15	3.8
Apr-15	0.15	27
May-15	0.20	26
Jun-15	<0.15	40
Jul-15	0.25	270
Aug-15	0.20	86



Source Identification: S. Buffalo Creek



Date	Upstream Concentration (µg/L)	Downstream Concentration (µg/L)
Oct-14	0.2	4.8
Dec-14	2.0	38
Jan-15	0.9	226
Feb-15	3.7	11
Mar-15	1.8	436
Apr-15	1.9	30
May-15	3.8	20
Jun-15	3.6	62
Jul-15	0.43	22
Aug-15	0.45	14

Regulatory Framework

- No federal drinking water standard
- No NC drinking water standard
- NC groundwater standard: 3 µg/L
- Surface water quality (in-stream) standard:
 - 0.35 µg/L for streams classified as water supplies (WS-I through WS-IV)
 - 80 µg/L for other stream classifications

15ANCAC 02B .0208 STANDARDS FOR TOXIC SUBSTANCES AND TEMPERATURE
 For carcinogens, the concentrations of toxic substances shall not result in unacceptable health risks and shall be based on a Carcinogenic Potency Factor (CPF). An unacceptable health risk for cancer shall be considered to be more than one case of cancer per one million people exposed (10-6 risk level).

CONCLUSIONS

- In the Cape Fear River watershed, multiple sources of 1,4-dioxane exist in the uppermost reaches of the watershed
- 1,4-dioxane concentrations at Pittsboro:
 - Source water (Oct. 14 – Aug. 15): 16.3 µg/L (avg.), 66 µg/L (max.)
 - Finished water (March 15 – April 15): 6.8 µg/L (avg.), 20 µg/L (max.)
 - No measurable removal of 1,4-dioxane in water treatment plant (March 15 – April 15)
- NC surface water quality standard of 0.35 µg/L greatly exceeded at Pittsboro water intake

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