Fairfax Water's Current Perspective on EDC and PPCP's

(Endocrine Disrupting Compounds and Pharmaceuticals and Personal Care Products)

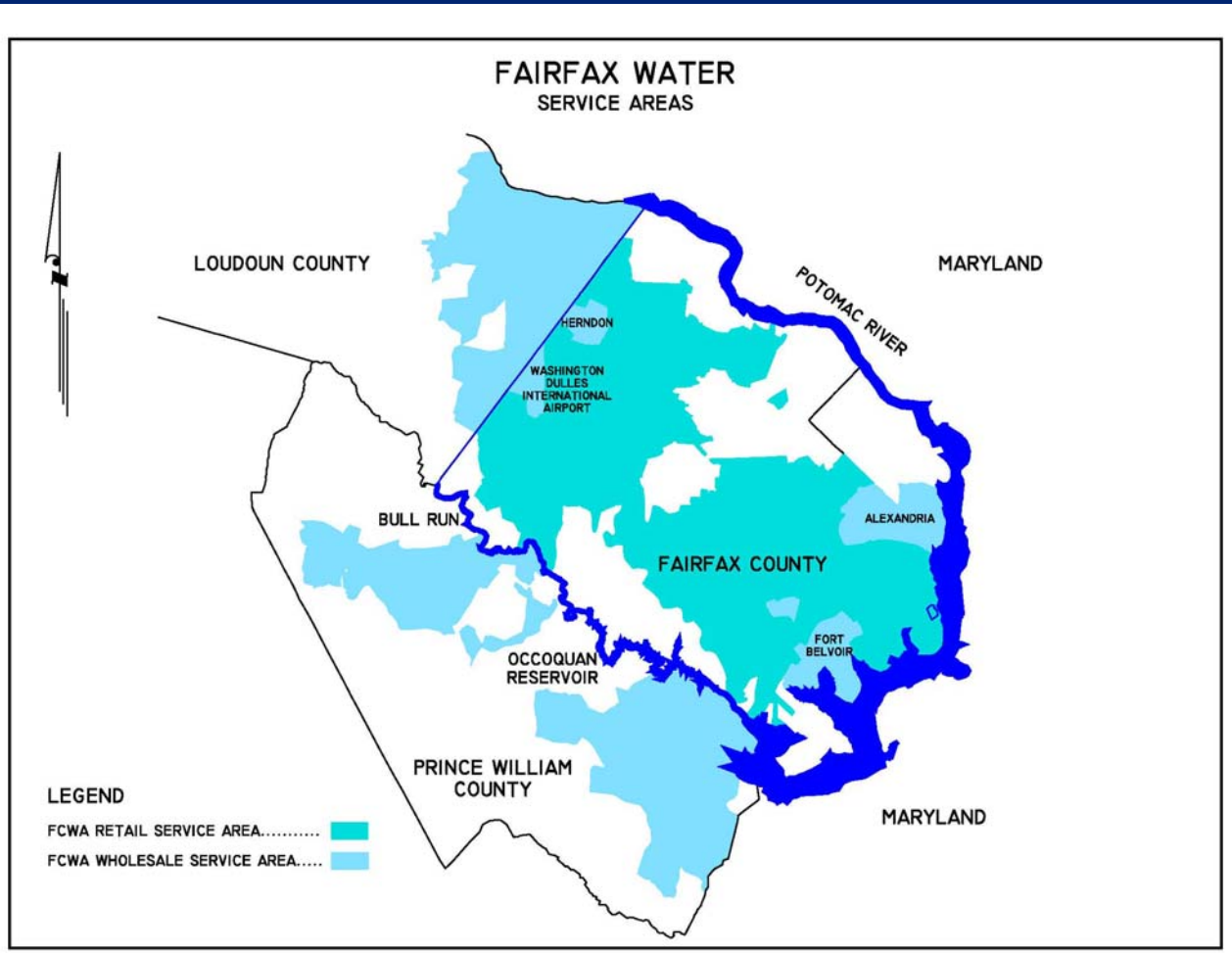
October 28, 2010

State Water Commission Meeting

Fairfax Water

Who is Fairfax Water ? – the Basics

- Drinking water only utility
- ~50-50 split retail/wholesale



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Who is Fairfax Water?

- Largest water utility in Virginia
- One of the 25 largest in the United States
- Serve 1.7 million customers
- Serve one out of every five Virginian's using public water
- Average Daily Production = 167 MGD (million gallons per day)

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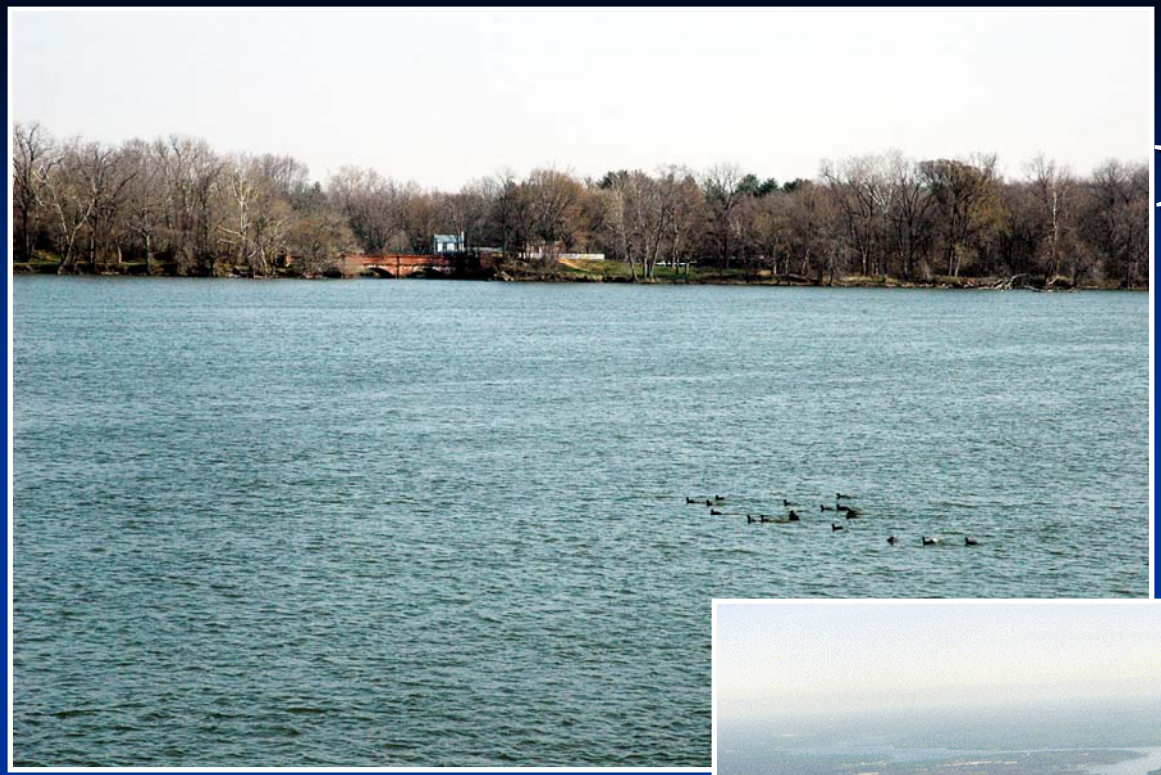

Potomac River source water

Occoquan Reservoir source water

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James J. Corbalis, Jr. Water Treatment Plant

Frederick P. Griffith Jr. Water Treatment Plant

7. Low Southwest view of Griffith WTP 10-21-06 Patrick J. Hendrickson / Highcamera.com

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Five Steps of Conventional Water Treatment

1. Coagulation
2. Flocculation
3. Sedimentation
4. Filtration (deep bed GAC)
5. Disinfection

…with an additional treatment…

Ozonation

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Emerging Contaminant Definitions

- **Endocrine Disrupting Compounds (EDCs)/**
  - Chemicals that interfere with the action of natural hormones responsible for reproduction, development, and/or behavior of an organism.
    - Examples – pesticides; and natural & synthetic hormones
- **Pharmaceuticals (P)**
  - Simply put - Medications
    - Encompasses some of the hormone-based compounds already noted as EDCs
    - Examples – antibiotics; heart, cancer, and anti-epileptic medications; livestock food additives
- **Personal Care Products (PCPs)**
  - Common anthropogenic compounds
    - Examples – shampoos, bug spray, OTC meds

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Emerging Contaminants-EDC/PPCP's
What is FW doing? Nationally, Regionally, Locally

- Fairfax Water involvement
  - **Nationally**
    - Water Research Foundation (WRF)
  - Regionally
    - MWCOG (Metropolitan Washington Council of Governments)
    - Potomac River DWSPP (Drinking Water Source Protection Partnership)
    - Public access to data via website www.mwcog.org/environment/water/watersupply/tracecompounds.asp
  - Locally
    - Research studies (2007 and 2010) performed to determine what specific compounds to monitor
    - Monitoring the source and finished waters
    - Public access to data via website www.fairfaxwater.org

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A Closer Look at the National level – Water Research Foundation, WRF

- The WRF is the nation's largest and most well established research foundations devoted solely to drinking water.

- Strategic Initiative: *Provide research into understanding the sources, occurrence, nature, fate, possible health effects, and treatment options for EDCs, PhACs, and PCPs.*

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A Closer Look at the National level – Water Research Foundation

- 47 funded projects since 1999 to address emerging contaminant issues
  - Total budget amount of $16,485,402 (funded and in-kind)
- 21 reports have been finalized and published
- Current funding for 26 on-going projects
  - (info updated Oct '10)

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WATER RESEARCH FOUNDATION
ADVANCING THE SCIENCE OF WATER

Relevant research findings for FW

- Project: #2758 "Removal of EDCs and Pharmaceuticals in Drinking and Reuse Treatment Processes"
  - Conclusions
    - 5. Conventional coagulation, flocculation, and sedimentation are ineffective for removing the majority of target EDCs and PPCPs
    - 8. Ozone is much more effective than chlorine and is able to significantly remove the majority of target analytes.
    - 11. Activated carbon is highly effective for removal of target analytes…

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WATER RESEARCH FOUNDATION
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Relevant research findings for FW

- Project # 3085: Toxicological Relevance of Endocrine Disruptors and Pharmaceuticals in Drinking Water
  - Conclusions
    - Although some EDC's and PPCPs were detected…there is no evidence of human health risks from consumption of these waters.
    - Exposure to estrogenic chemicals in diet is far greater than in drinking water

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Quote to note from Water Research Foundation's State of Knowledge of EDC and Pharms in Drinking Water, 2008

- "Screening-level risk assessments conducted to date have not indicated that the trace concentrations of Pharms detected in drinking water pose a risk to consumers, and likewise, there is no convincing evidence that EDCs at levels occurring in drinking water have caused adverse effects in humans."

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Emerging Contaminants-EDC/PPCP's
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- Fairfax Water involvement
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A Closer Look at Regional level

- Regional = National Capitol Region
  - Fairfax Water
  - Washington Aqueduct
  - Washington Suburban Sanitary Commission

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www.mwcog.org/environment/water/watersupply/tracecompounds.asp

Metropolitan Washington Council of Governments

Serving the National Capital Region

Environment

Trace Compounds Research

Overview

Fairfax Water, the Washington Aqueduct, and the Washington Suburban Sanitary Commission, suppliers of over 90 percent of the COG region's drinking water, have taken regional efforts to monitor for the presence of trace compounds (often referred to as emerging contaminants) in source water (stream water collected at a surface-water intake) and finished water (water that has gone through the treatment process, but has not been distributed). Working with national partners, these three major drinking water suppliers tested the Potomac, Patuxent, and Occoquan source waters for emerging contaminants. Emerging contaminants, such as endocrine disrupting compounds (EDCs), pharmaceuticals, and personal care products (PPCPs), are commonly described as chemicals or materials that have a real or perceived threat to human health or the environment.

The utilities tested for nineteen (19) compounds in the source and treated waters. Water samples were sent to a laboratory certified for this type of analysis.

Out of nineteen compounds tested for, the results showed the presence of very, very small amounts of a total of four compounds—Atrazine, Carbamazepine, estrone and Sulfamethoxazole—in the three rivers and in some of the treated drinking water, confirming the results of earlier monitoring studies. The compounds detected were found at the part per billion and part per trillion levels. A part per billion is equal to one gallon of water in 1,514 Olympic-size swimming pools. A part per trillion is equal to one gallon of water in 1,514,570 Olympic-size swimming pools. Research to date shows that there is no indication of human health concern at these levels.

The regional drinking water utilities, along with other water utilities nationally, are working to advance the science in the area of understanding and treating these emerging contaminants in water. The Potomac Drinking Water Source Partnership, founded by Fairfax Water, the Washington Suburban Sanitary Commission and the

WATER USE IT WISELY

Emerging Contaminants-EDC/PPCP's
What is FW doing? Nationally, Regionally, Locally

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    - Water Research Foundation
  - Regionally
    - MWCOG (Metropolitan Washington Council of Governments)
    - Potomac River DWSPP (Drinking Water Source Protection Partnership)
    - Public access to data via website
  - **Locally**
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www.fairfaxwater.org

Fairfax Water- Monitoring Program - Windows Internet Explorer provided by Fairfax Water

http://www.fairfaxwater.org/current/monitoring_program.htm

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Fairfax Water- Monitoring Program

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Emerging Water Quality Issues

Fairfax Water's Monitoring Program

While Fairfax Water does not have all of the answers about how and why certain compounds are in the source waters (the Potomac River and Occoquan Reservoir), we do try to answer some of the questions about what we have found, what we have not found, and what we are doing about it. Working with regional and national partners, Fairfax Water has developed a testing plan for emerging contaminants such as Endocrine Disrupting Compounds (EDCs), Pharmaceuticals, and Personal Care Products (PPCPs) in source and treated waters. We hope you find the discussion below helpful.

What are EDCs and PPCPs?

Endocrine Disrupting Compounds (EDCs) are chemicals that interfere with the action of natural hormones responsible for reproduction, development, and/or behavior of an organism.

- Examples – pesticides; and natural and synthetic hormones

Pharmaceuticals (P), simply put, are medications.

- Examples – antibiotics; heart, cancer, and anti-epileptic medications; livestock food additives

Personal Care Products (PCPs) are common household compounds.

RELATED LINKS

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Fairfax Water on-going actions

- Research
- Assess
- Monitor
- Report
- Repeat
  - To date, as of October 2010, FW has compiled 10 quarterly sets of EDC/PPCP data through it's Emerging Compound Periodic Testing Efforts

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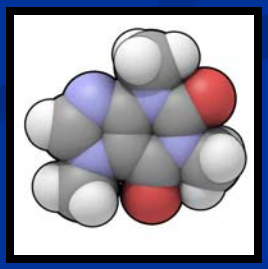
FW List of Compounds for Analysis

- Atrazine
- Bisphenol A
- Butylbenzyl phthalate
- DEHP [di(2-ethylhexyl)phthalate]
- Dibutyl phthalate
- 17b-estradiol
- Estrone
- Caffeine
- Carbamazepine
- Ethynyl estradiol
- Lindane (BHC-gamma)
- Linuron
- Methoxychlor
- Nonylphenol
- Octylphenol
- Monensin
- Naproxen
- Sulfamethoxazole
- Ibuprofen
- Progesterone



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FW List of Compounds with detectable levels in Source Waters

- Atrazine (Occoquan and Potomac)
- Bisphenol A (Occoquan)
- Butylbenzyl phthalate
- DEHP [di(2-ethylhexyl)phthalate]
- Dibutyl phthalate
- 17b-estradiol
- Estrone (Potomac)
- Caffeine (Potomac)
- Carbamazepine (Occ and Potomac)
- Ethynyl estradiol
- Lindane (BHC-gamma)
- Linuron
- Methoxychlor
- Nonylphenol
- Octylphenol
- Monensin
- Naproxen (Potomac)
- Sulfamethoxazole (Occ and Potomac)
- Ibuprofen
- Progesterone (Occ and Potomac)

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Atrazine

- <0.1 - 0.9 ppb detected in both source waters (7 detects out of 18)
- Lowest level of detection = 0.1 ppb
- EPA Maximum Contaminant Level (MCL) of 3.0 ppb in Finished waters
- Seasonally detected in FW source waters
- Limited detections in FW finished waters (historical data)
- Commonly used herbicide for maize crops
- Watersheds contain agricultural uses
- Adequately removed by GAC and Ozone

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Atrazine

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

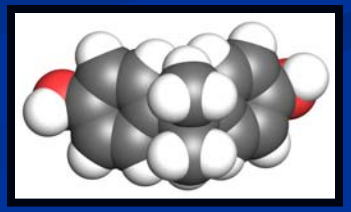
25 8oz. glasses of water per Day*

*water which contained 1.0 ppb Atrazine
(FW project data reflects non-detect for drinking waters)

Fairfax Water

Bisphenol A

- <0.010 - 0.027 ppb detected in Occoquan source (one detected occurrence out of 18)
  - Lowest level of detection = 0.010 ppb
- No EPA MCL
- Intermediate used in production of epoxy and polycarbonate resins and plastics
- Commonly found in food and various consumer products
- **Effectively removed by GAC and Ozone**



Fairfax Water

Bisphenol A

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

60,000 8oz. glasses of water per Day*

*water which contained 0.025 ppb Bisphenol A

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Carbamazepine

- Antiepileptic drug use
- 0.001 to 0.012 ppb detected in both source waters (18/18)
  - Lowest level of detection = 0.001 ppb
- No EPA MCL
- WWTP are potential point source contributors
- One of the most commonly found pharms in WWTP's
- Watersheds contain WWTPs
- **Excellent removal capability by GAC and Ozone**

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Carbamazepine

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

5,600 8oz. glasses of water per Day*

*water which contained 0.018 ppb Carbamazepine

(FW project data reflects non-detect for drinking waters)

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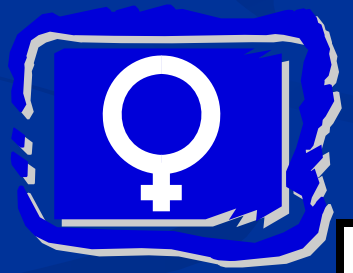
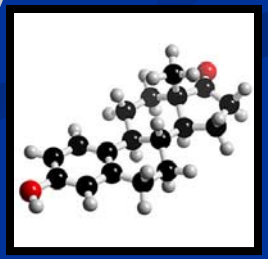
Estrone

- Natural hormone
- <0.5 to 0.9 ppt detected in Potomac source water only (2/18)
  - Lowest level of detection = 0.5 ppt
- No EPA MCL
- WWTP are potential point source contributors
- Watersheds contain WWTPs
- **Excellent removal capability by GAC and Ozone**





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Estrone

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

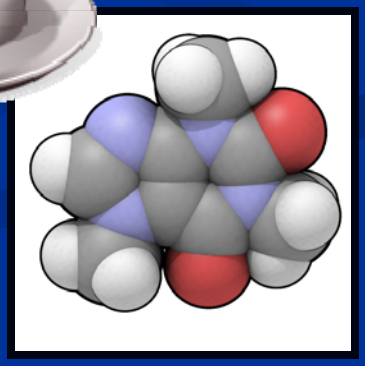
4,300 8oz. glasses of water per Day*

*water which contained 0.9 ppt Estrone
(FW project data reflects non-detect for drinking waters)

Fairfax Water

Caffeine

- Stimulant
- <0.05 to 0.07 ppb detected in Potomac source water only (2/18)
  - Lowest level of detection = 0.05 ppb
- WWTP are potential point source contributors
- Watersheds contain WWTPs
- No EPA MCL
- **Excellent removal capability by GAC and Ozone**



Fairfax Water

Caffeine

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

740,000 8oz. glasses of water per Day*

*water which contained 1.0 ppb Caffeine
(FW project data reflects non-detect for drinking waters)

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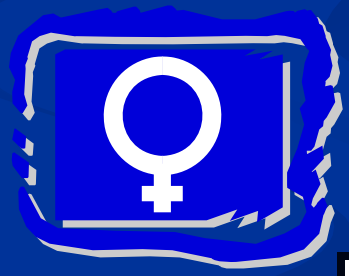
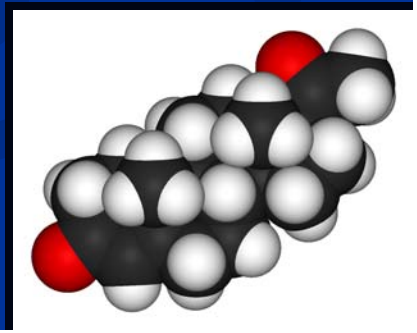
Progesterone

- Natural hormone
- <0.1 to 0.3 ppt detected in both source waters (8/18)
  - Lowest level of detection = 0.1 ppt
- No EPA MCL
- WWTP are potential point source contributors
- Watersheds contain WWTPs
- **Excellent removal capability by GAC and Ozone**





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Progesterone

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

1,500 8oz. glasses of water per Day*

*water which contained 199 ppt Progesterone
(FW project data reflects non-detect for drinking waters)

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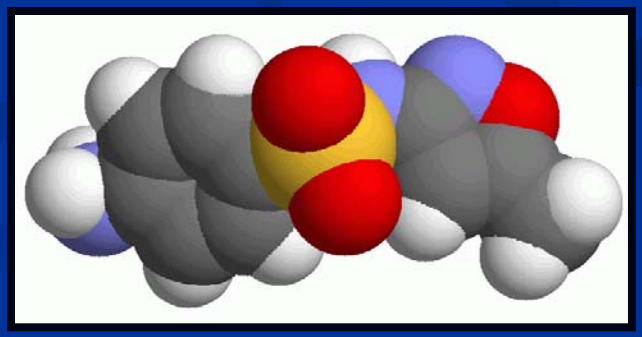
Sulfamethoxazole

- Antibacterial antibiotic
- <0.002 to 0.027 ppt detected in both source waters (7/18)
  - Lowest level of detection = 0.002 ppb
- No EPA MCL
- **Excellent removal capability by GAC and Ozone**



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Sulfamethoxazole

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

51,000,000 8oz. glasses of water per Day*

*water which contained 0.003 ppb Sulfamethoxazole
(FW project data reflects non-detect for drinking waters)

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FW List of Compounds with detectable levels in Finished Waters

- Atrazine
- Bisphenol A (Griffith)
- Butylbenzyl phthalate
- DEHP [di(2-ethylhexyl)phthalate]
- Dibutyl phthalate
- 17b-estradiol
- Estrone
- Caffeine
- Carbamazepine
- Ethynyl estradiol
- Lindane (BHC-gamma)
- Linuron
- Methoxychlor
- Nonylphenol
- Octylphenol
- Monensin
- Naproxen
- Sulfamethoxazole
- Ibuprofen
- Progesterone

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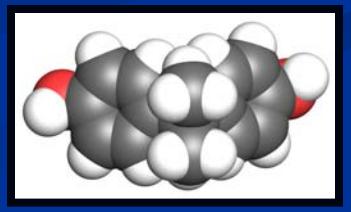
Bisphenol A

- <0.010 - 0.025 ppb detected in Griffith finished (1 detected occurrence out of 18)
  - Lowest level of detection = 0.010 ppb
- No EPA MCL
- Intermediate used in production of epoxy and polycarbonate resins and plastics
- Commonly found in food and various consumer products
- **Effectively removed by GAC and Ozone**



Fairfax Water

Bisphenol A

- To exceed the Acceptable Daily Intake levels as established through toxicity calculations….you would have to drink…

60,000 8oz. glasses of water per Day*

*water which contained 0.025 ppb Bisphenol A

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Bisphenol A - BPA

- Recent hit near detection level in Griffith Finished water - 1 out of 9 quarters
- Low level detection limit for this analyte depicts a lesser degree of confidence in quantitative results
- Extremely low detection level required for FW project based on the current science at the time (2007)
- New research since FW project inception shows that the current lower detection level is not needed to predict concentrations of health concerns
- The future detection level suggested by toxicological consultant is higher than recent hits….but will still give the needed health related information and produce a greater confidence in quantitative results

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The BPA Facts

- Extremely low level and very infrequent detects of BPA at FW
- Infrequent and/or low level detects provide analytical uncertainty
- GAC and Ozone are proven to be effective in removing BPA
- Conservative view of consumption
  - 60,000 8oz. glasses water/day to exceed the Acceptable Daily Intake at 0.025 ppb or 25 ppt

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Current Overall Conclusions

- Ozone and GAC are effective in removing the source water EDC/PPCP's as evidenced in the finished water results
- Very few detects, and if found at extremely low concentrations
- Further research needed

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Next steps, FW will continue…

- monitoring on a periodic basis for a more robust data set
- working with Regional and National organizations to bring more information to the drinking water industry and stakeholders
- researching the topic…..in order to keep current on new technology and findings

Fairfax Water

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