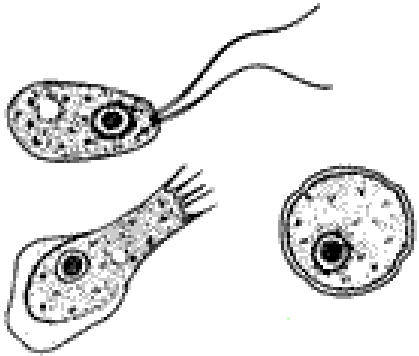
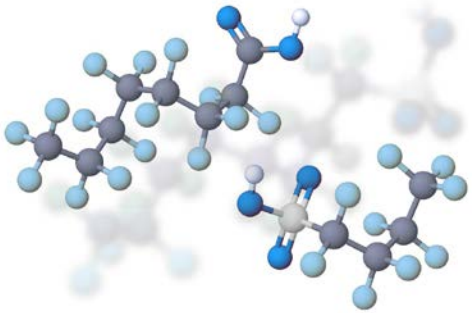




Emerging Contaminants

Gregg Baird, REHS
OHA-Drinking Water Services

Oregon Health Authority

Overview

- What are Emerging Contaminants
- How do we get data on Emerging Contaminants
- What are health advisory levels
- Emerging Contaminants of concern in Oregon
- Emerging Contaminants of concern nationally/globally

Emerging contaminants (ECs)

- Contaminants in drinking water that are not regulated under the Safe Drinking Water Act (SDWA)
- Human health effects may or may not be well understood
- Examples of ECs in the news a lot lately: PFAS, cyanotoxins

How do we get data on ECs?

- Process for creating new drinking water regulations:
  1. Contaminant Candidate List (CCL)
  2. Unregulated Contaminant Monitoring Rule (UCMR)
  3. Regulatory Determination (RD)
  4. 6YR Review
- EC data mostly from **CCL *I* UCMR** part of above process (est. 1996)
- *Interesting note: this process has not yet produced any new regulated contaminants*
  - Not necessarily a bad thing, but…
  - Does not meet public's expectations
  - Some states choosing to take their own action (Oregon = cyanotoxins)

What to do with contaminants EPA decides not to regulate?

- That's the question!
- Occurrence data from UCMR monitoring + Health effects info = human exposure to potentially harmful, unregulated contaminants in DW
- EPA develops Heath Advisory Levels (HALs) for some contaminants of concern

What are Health Advisory Levels?

- HALs provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water
- EPAs HALs are non-enforceable and provide technical guidance to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination
- The EPA tables contain HAL values for certain contaminants based on non-cancer health effects for different durations of exposure (for example, one-day, ten-day, and lifetime)
- Not all unregulated contaminants have HALs. Some regulated contaminants have HALs

ECs of concern in Oregon

- Cyanotoxins
- Manganese

Cyanotoxins

- Characteristics and health effects of cyanotoxins
- Temporary cyanotoxin monitoring rules & results
- Permanent cyanotoxin monitoring rules

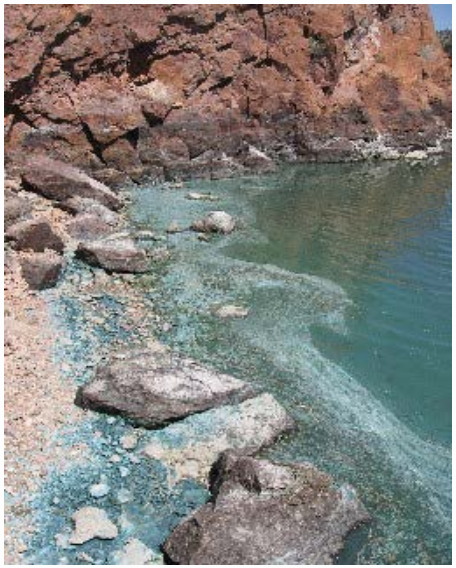
Characteristics of cyanobacteria

- It’s not an algae but needs sunlight, nutrients to live
- Much of Earth’s atmosphere oxygen can be attributed to algae and cyanobacteria: oxygen is a by-product of photosynthesis.
- Can be found almost everywhere in our environment; oceans, fresh water, damp soil, bare rock and soil, Antarctic rocks.
- Can reproduce explosively under certain conditions.
- Some can produce toxins.

Health Effects

- Cyanobacteria can produce toxins
- Can cause a red, raised rash or irritation from skin exposure.
- Symptoms from ingesting: headaches, cramps, diarrhea, nausea and vomiting, numbness, dizziness, fever.
- Can have long-term effects on liver and kidneys
- Children, pets, livestock, wildlife are at increased risk because of their size

Cyanobacteria Blooms



Regulations for drinking water - Federal

US Environmental Protection Agency (EPA) currently has no regulations for cyanotoxins.

- Health Advisory Levels for two cyanotoxins (Total Microcystin and Cylindrospermopsin)
- Testing occurring with Unregulated Contaminant Monitoring Rule (UCMR4)
- Currently each state is implementing individual programs. Regulations in Ohio, Rhode Island, and now Oregon.

Advisory Levels

- Drinking water (OR regulations):

Cyanotoxin	For Vulnerable People (ppb)	For Age 6 and Above (ppb)
Total Microcystins	0.3	1.6
Cylindrospermopsin	0.7	3

- Recreational waters (OR guidance):

Table 2. Health advisory RUVs for cyanotoxins in Oregon recreational waters (µg/L)

*RUVs**	*Microcystin*	*Anatoxin-a*	*Saxitoxin*	*Cylindrospermopsin*
	4	8	4	8

Until July 2018, Public Water Systems voluntarily monitoring for toxins in Oregon

- Salem conducting aggressive toxin monitoring in Detroit reservoir, downstream of reservoir and at their treatment plant.
- Beginning in May 2018, Salem starts detecting a bloom on Detroit reservoir, recreational advisory posted on May 23rd.
- Toxins being detected downstream of Detroit reservoir including Salem's raw water intake
- Salem detects toxins in finished water!

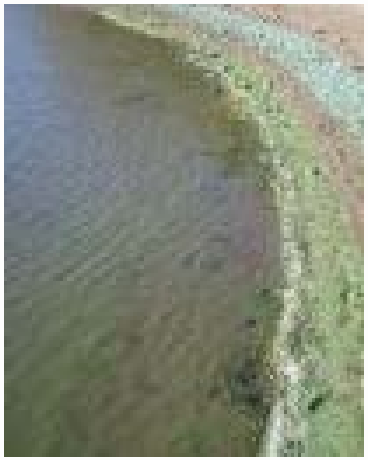
Salem Cyanotoxin Incident

Quick Facts:

- 33 days of Do Not Drink Advisory for vulnerable population.
- 5 days with exceedances of HALs, no 10 day exceedance.
- Local emergency response with State support.
  - Marion County EOC
  - State EOC
  - PHD AOC
  - Joint Information Center
- Assistance from other water systems received through ORWARN.
- City, County and National Guard operated bulk water distribution sites, some operated 24/7.
- Salem installed PAC pre-treatment within weeks.
- OHA adopted temporary cyanotoxin rules within 3 weeks.

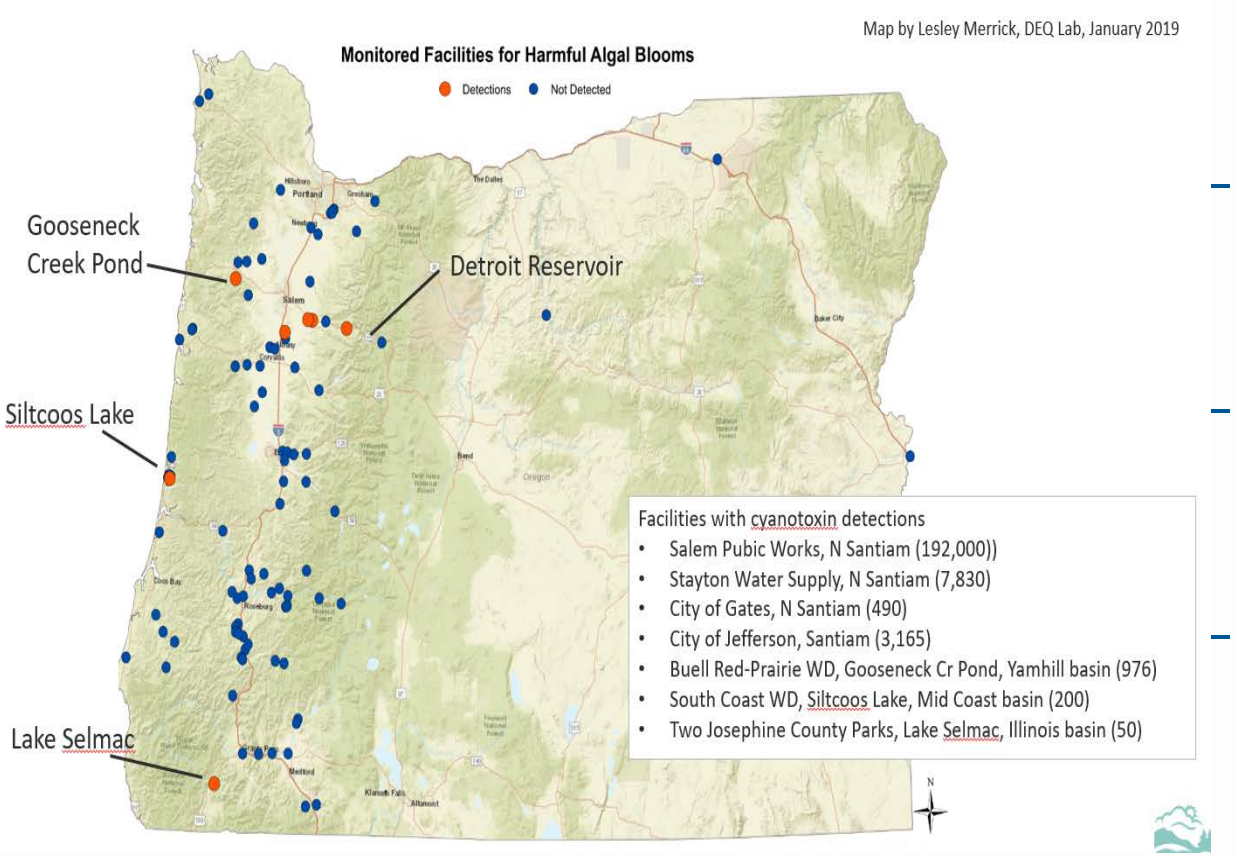
Salem Cyanotoxin Incident--After Action

- Legislature's Emergency Board action:
  - New permanent NRS 4 Emerging Contaminants Coordinator
    - Cyanotoxins, Legionella, Manganese, PFAS, etc
    - Engage in UCMR process
  - New limited duration NRS 3 Emergency Preparedness
  - Request to fund 5 FTEs proposed for 2019



- State Drinking Water Response protocol:
  - Working with OHA/PHD Health, Security, Preparedness and Response section staff

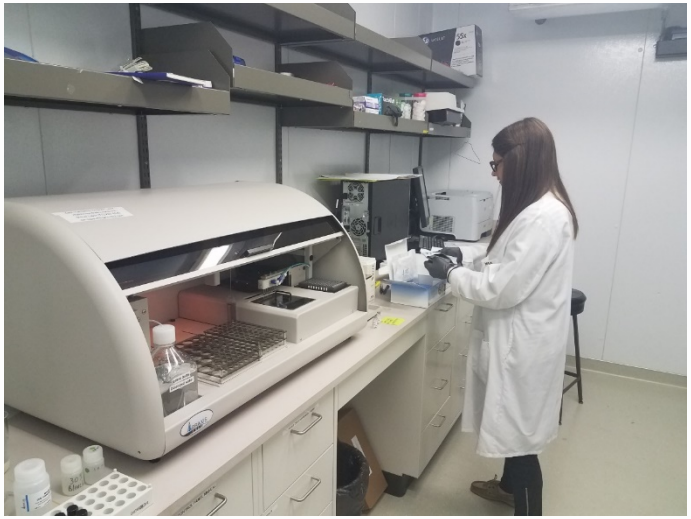
Results from Temporary cyanotoxin rule monitoring



- 8 systems (4 sources) detected total microcystins
- Other than Salem, 17 samples found Microcystins in source
- 1 system detected cylindrospermopsin in source
- **No detections at any entry point (finished water) samples**

Permanent cyanotoxin monitoring rules 2019 – Susceptible systems

- Approximately 58 PWS currently meet the rule criteria for conducting routine monitoring (“susceptible source”)
- List of susceptible systems posted on our website. Subject to change as new information becomes available
- Systems must use the DEQ lab or an ORELAP-accredited lab



ELISA: Enzyme Linked Immunosorbent Assay

LC MS/MS: Liquid Chromatography with tandem mass spectrometry

Permanent rules – Monitoring requirements

- Routine monitoring = test raw water for Total Microcystins and Cylindrospermopsin every two weeks from May to October.
- If either toxin ≥ 0.3 ppb or recreational HAB advisory upstream, weekly raw and finished water monitoring required.
- If toxins detected in the finished water, daily FW monitoring required.
  - *County EH & Ag will be notified*
- If finished water testing is confirmed above the Health Advisory Levels = issue a Do-Not-Drink advisory
- A flow chart of monitoring requirements is available on our website.

Perspective from a county person that's been through a cyanotoxins health advisory (and lived to talk about it)

Greg DeBlase, Marion County Environmental Health:

1. No drinking water rules in place made it a very frustrating situation to explain.
2. Initial panic prompted people to buy every last bottle of water from store shelves.
3. Constant phone calls from the public and licensed facilities.
4. Had to quickly put together an email list of all licensed facilities and send them information about the advisory. Later emailed the OHA notice for restaurants to post.
5. Private well owners calling and asking if they were affected.
6. Hysteric parents calling complaining their kids were sick from drinking the water.
7. Complaints from prison inmates saying they were being forced to drink contaminated water.
8. Common question was "is there a filter I can use to make the water safe to use?"

County perspective (continued)

Lessons learned:

1. Have email list of licensed facilities ready to go with consistent messaging (having rules in place now helps with this).
2. REHS's should be prepared to inspect water haulers and water distribution sites (multiple times as we had some complaints and had to develop guidelines for them)
3. Since the Salem advisory lasted for a month, we lost lots of time and got behind on our other work.

Manganese

- Health effects
- Health advisory levels
- Mn UCMR detections in OR
- Mn future activities

Photo credit: Alchemist-hp (talk) (www.pse-mendelejew.de) - Own work, FAL, https://commons.wikimedia.org/w/index.php?curid=11930318

Manganese health effects

- Manganese is a trace element and eating a small amount from food or water is needed to stay healthy
- Exposure to excess levels of manganese may occur from breathing air, particularly where manganese is used in manufacturing, and from drinking water and eating food
- Nervous system and reproductive effects have been observed in animals after high oral doses of manganese

Manganese health advisory levels

- 1- & 10-day HAL for adults and children older than 6 months = 1 mg/L (or 1000 µg/L).
- Lifetime HAL = 0.3 mg/L, or 300 µg/L.
- **10-day HAL for bottle-fed infants younger than 6 months is 0.3 mg/L (or 300 µg/L).**
  - Infants may be more susceptible than adults to adverse neurotoxic effects associated with high manganese exposures. For bottle-fed infants, a 10-day Health Advisory value of 0.3 mg/L is recommended.

Manganese UCMR detections in OR:

- 19 detects over 1- & 10-day HAL (1000 ug/L) in **Data Online archive**. Some PWSs inactive, some have treatment, some have subsequent tests below HAL, some are active with no treatment or subsequent results.
- 94 detects over lifetime/acute infant HAL (300 ug/L) in **Data Online archive**. Some PWSs inactive, some have treatment, some have subsequent tests below HAL, some are active with no treatment or subsequent results.
- 5 **UCMR3** detects above lifetime/acute infant (300 ug/L) HAL. All at one PWS: JLR 4194431. No subsequent testing. Has ion exchange treatment for IOC removal (As).
- 1 **UCMR4** detect above lifetime/acute infant HAL (300 ug/L). Sunrise Water Authority 4100635. Source is ASR well used only for injection at this time. PWS has been made aware of HAL.

Manganese future activities

- Develop Mn fact sheet that includes HALs, health effects, treatment options, info for private wells
- Send out letter to PWSs with historical detections over HALs informing them of HAL and recommend testing
- Develop Mn PN advisory template

Other ECs of concern nationally/globally (In Oregon?)

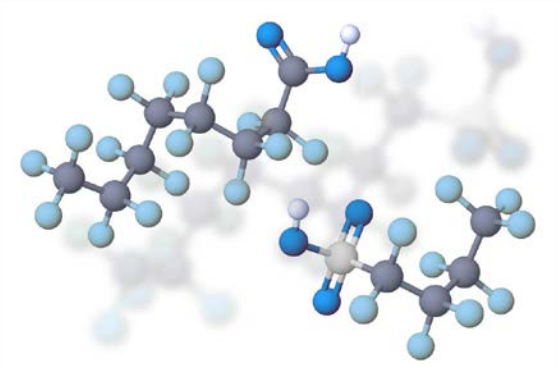
- PFAS
- Legionella
- Naegleria fowleri
- Microplastics

PFAS

- Per- and poly-fluorinated alkyl substances (PFAS) are a group of over 4,000 man-made chemicals including PFOA, PFOS, GenX, and many others
- PFAS are used in many products including stain- and water-repellent fabrics, nonstick products (e.g., Teflon), fast food containers/wrappers, microwave popcorn bags, pizza boxes, candy wrappers, waxes, sealants, cosmetics, and cleaning products
- They are also a major component in fire-fighting foams which have been a major source of groundwater contamination at airports and military bases where firefighting training occurs

Why do we care about PFAS

- PFAS compounds are resistant to breaking down in the environment, can travel long distances through soil and water, and can quickly contaminate groundwater supplies
- They can bioaccumulate in animals and humans
- Nationwide, PFAS have been found to have contaminated soil and groundwater where they are used or manufactured
- There is evidence that exposure to PFAS can lead to adverse health outcomes in humans.
- Testing & treatment for PFAS in drinking water can be expensive



People can be exposed to PFAS through:

- Drinking water contaminated with PFAS. Contamination typically localized & associated with:
  - Facilities where PFAS were produced or used to manufacture other products, or
  - Oil refineries, airfields, or other locations where PFAS used for firefighting
- Using consumer products containing PFAS
- Research suggests exposure to PFOA and PFOS from consumer products is lower compared to exposures from contaminated drinking water

Health effects of PFAS exposure

- Some studies in people show that exposure to certain PFAS compounds may:
  - Effect growth, learning and behavior of infants and older children,
  - Lower a woman's chance of getting pregnant,
  - Interfere with the body's natural hormones,
  - Increase cholesterol levels,
  - Effect the immune system, and
  - Increase the risk of certain types of cancer (such as kidney and testicular cancer)

PFAS regulation in the US

- EPA established a lifetime health advisory level for PFOS and PFOA, at 70 parts per trillion (PPT) individually or combined in 2016

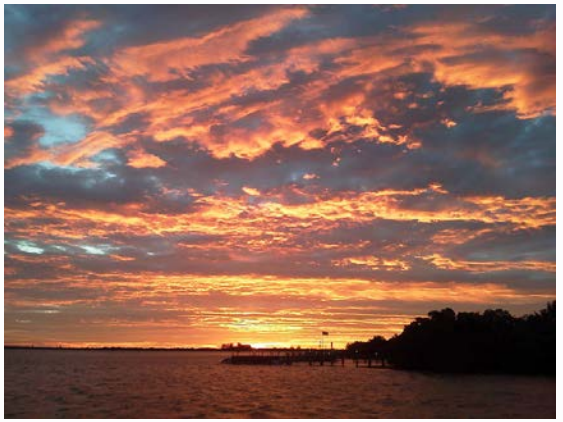
- 6 PFAS (including PFOS and PFOA) were monitored under UCMR3. In Oregon, 65 public water systems monitored for these contaminants and there were no detections

- In February 2019, EPA announced its PFAS Action Plan. Plan includes evaluating PFOA and PFOS for regulatory determination under the SDWA, and developing HALs for other PFAS

PFAS sites in Oregon

- Portland International Airport and Portland Air National Guard Base:
  - Significant concentrations of PFAS found at both sites
  - Both sites entered into cleanup agreement with DEQ; site assessment ongoing
- Portland Fire and Rescue Training Facility:
  - One of Portland's production wells is located at this known contamination site. Per the Portland Water Bureau, well was tested in 2018 and no PFAS detected. Tested again April 2019 (results pending)
- Kingsley Air Base in Klamath Falls:
  - Department of Defense is currently investigating if there is PFAS contamination at this site
- City of Mosier:
  - In 2018, DEQ tested groundwater at the site of the oil train derailment where firefighting foam was used. No detections of PFAS above the HAL for drinking water

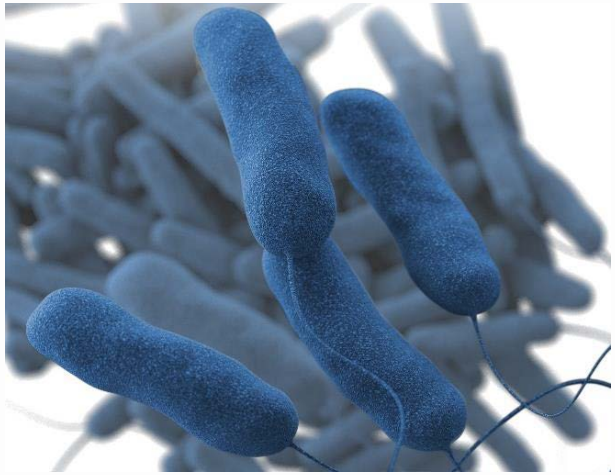
PFAS future activities



- Cross-agency coordination on PFAS issues
- Work with DEQ to map potential PFAS contamination sites, proximity to PWSs, assess risk
- Create OHA fact sheet on PFAS
- UCMR5 to include PFAS (2022-ish?). Monitoring may occur at more systems if Congress approves funding (>3,300 population)
- Provide technical support to PWSs on PFAS

Legionella

- Naturally occurring bacteria found in soil, surface and groundwater
- Causes Legionnaires' disease, a serious and often deadly lung infection (pneumonia)
- Mode of transmission is inhalation to susceptible host (+50 yrs, current/former smoker, chronic lung disease or weakened immune system most at risk)
- #1 cause of waterborne disease outbreaks in the US (per CDC 7,458 cases reported in 2017)

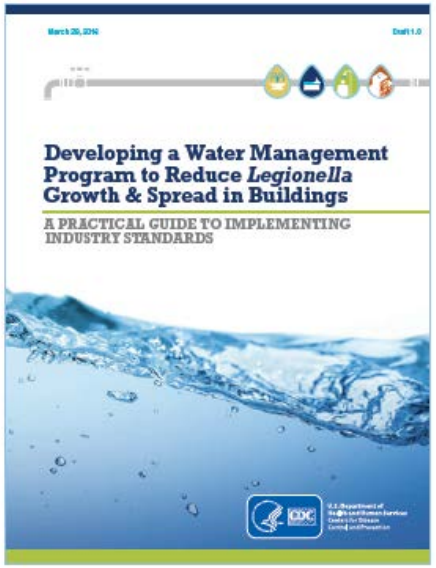


Legionella - Regulatory

- Surface water regulated at the treatment plant by the Safe Drinking Water Act (SDWA) under the Surface Water Treatment Rule (SWTR)
  - SWTR assumes if virus and Giardia limits are met, Legionella will be controlled
- Legionella introduced after treatment (main breaks?) can enter distribution system and under right conditions multiply (warm water, low chlorine residual)
- Large buildings with lots of plumbing most susceptible
- Building owners that add treatment for Legionella may become regulated PWSs under the SDWA

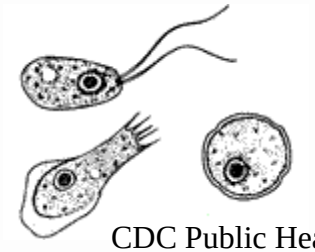
Legionella – OHA-DWS role

- Direct building owners to resources to help them create Legionella water management plans (CDC Toolkit / ASHRAE 188 standard)
- Work with building owners who install treatment to control Legionella and become regulated PWSs (none we know of yet)
- Cross-program coordination (Epi) in Legionnaires disease cases/outbreaks at PWSs



Naegleria fowleri

- NF is an ameba commonly found in warm freshwater and soil
- Infects people when ameba enters the nose and travels to the brain where it destroys tissue (usually fatal)
- Most infections associated with swimming/diving in lakes and rivers
- Very rarely deaths associated with irrigating sinuses with contaminated tap water
- **Cannot** be infected by drinking water contaminated with NF
- NF can grow in storage tanks, hot water heaters, distribution pipes and premise plumbing, esp. where little or no disinfectant is present
- NF confirmed in two Louisiana PWSs in 2013 (3 associated deaths). As result, state issued emergency rule requiring minimum disinfectant residual level (0.5 ppm) and increased residual monitoring



CDC Public Health Image Library

Microplastics (MPs)

- MPs are plastic particles under 5 mm in size
- Enter environment through human use
- Manufactured as MPs or larger plastics degrade into MPs over time
- Limited research on MPs in drinking water
- No standard methods exist for sampling and quantifying MPs, making it difficult to compare studies or reliably predict exposure, effects, hazards, or risks
- Lab analysis for different types of plastic materials requires advanced instrumentation that is not readily available

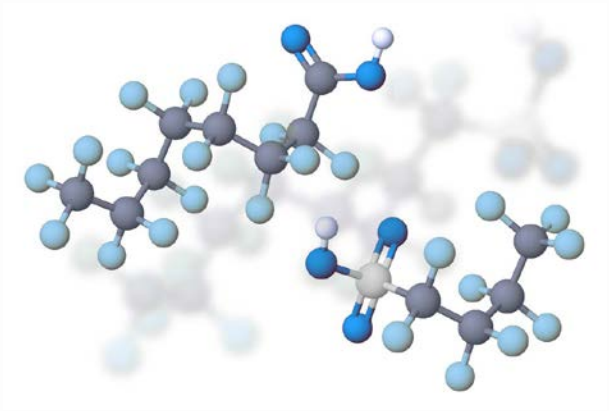
Emerging Contaminant Challenges

- How do states manage public demands for action on unregulated ECs vs mandated regulatory program work?
- Should states adopt standards? For which contaminants? At what levels?
- Confusion around 1 day, 10 day, Lifetime health advisory levels
- What is the role for states and PWSs for emerging contaminants in premise plumbing

What we know:

- Public demands to know if they are at risk, even in absence of a federal regulation

Questions?



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