Coliform & Coffee

KENT COUNTY
Health
Department

What is a non-community water supply?

Non-community Water Supply (Type II)

- Provides water to 25 or more people at least 60 days per year
- Must meet Michigan Safe Drinking Water Act (Act 399) requirements and standards
- Must complete routine water sampling requirements
  - Dependent upon use, size, and vulnerability

What rules are followed?

Revised Total Coliform Rule (RTCR)

- Federal rule instituted in 2016 to reduce potential for fecal and microbial contamination in public water supplies
- Specifies bacteriological sampling requirements based on population
- Determines monitoring of water according to schedule and sample siting plan
  - Focuses on sampling water people are drinking
- Requires an assessment (triggered inspection) and corrective action for potentially vulnerable water supplies
  - Includes a schedule for repeat and additional water sampling

What type of facility?

Grocery Store with Retail Food Establishment

What is the water supply?

Water Supply Background

- Non-transient, non-community water supply
  - Daily population around 1600 people (potential users)
  - Approximately 40 employees per day
- Supplied by a 4” steel well
  - Constructed in 1982
  - 108’ deep
  - Protective clay layer from 4’ to 93’
- Two areas served
  - Grocery Store: Bakery, Meat Counter, Deli, Pharmacy, Restrooms, Employee Breakroom
  - Food Establishment: Hand sink, Wash sinks, and Drink sinks, Specialty fixtures

What samples are collected?

RTCR Sampling Requirements

- Routine coliform sampling requirements: 2 per month
  - Food establishment 3-comp sink
  - Breakroom sink

  (prior to July 2022)

- Requires an assessment (triggered inspection) and corrective action for potentially vulnerable water supplies
  - Includes a schedule for repeat and additional water sampling

What analytes are tested?

Bacteriological Analysis

- Coliform bacteria
  - Common group of bacteria found throughout the environment
  - Most are harmless "indicator organisms"
- E. coli is a type of coliform

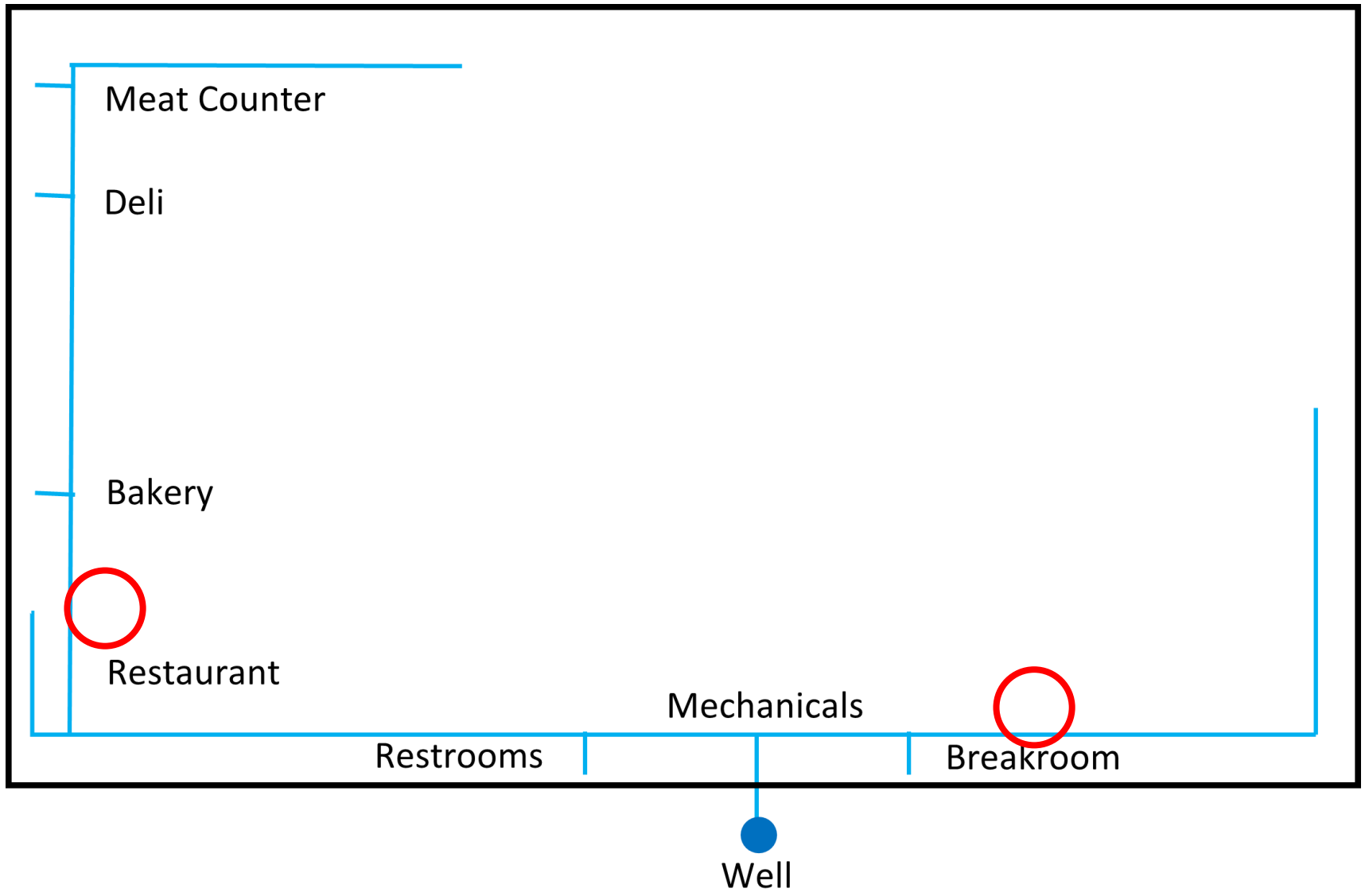
Penn State Extension: https://extension.psu.edu/coliform-bacteria

Where are samples collected?

Sampling Siting Plan

- Supply contracted with new Certified Water Operator in June 2022
- Beginning in July one routine sample to be collected from food establishment **glass fill**
  - Replaced sink sampling site
  - Water consumers are drinking

Water Distribution Layout



Sample Locations

RTCR Sample Results

Routine Samples

- Two (2) routine coliform samples collected July 13, 2022
  - Breakroom sink: Non-detect
  - Glass fill: **Positive** (Non-detect for E. coli)

RTCR Sample Results

Repeat Samples

- Automatically triggered by RTCR
- Four (4) repeat samples collected July 15, 2022
  - Breakroom sink: Non-detect
  - Drinking fountain: Non-detect
  - Glass fill: **Positive**
  - Pressure tank (raw): Non-detect

Coliform positive samples… what do we do?

Initial RTCR Response

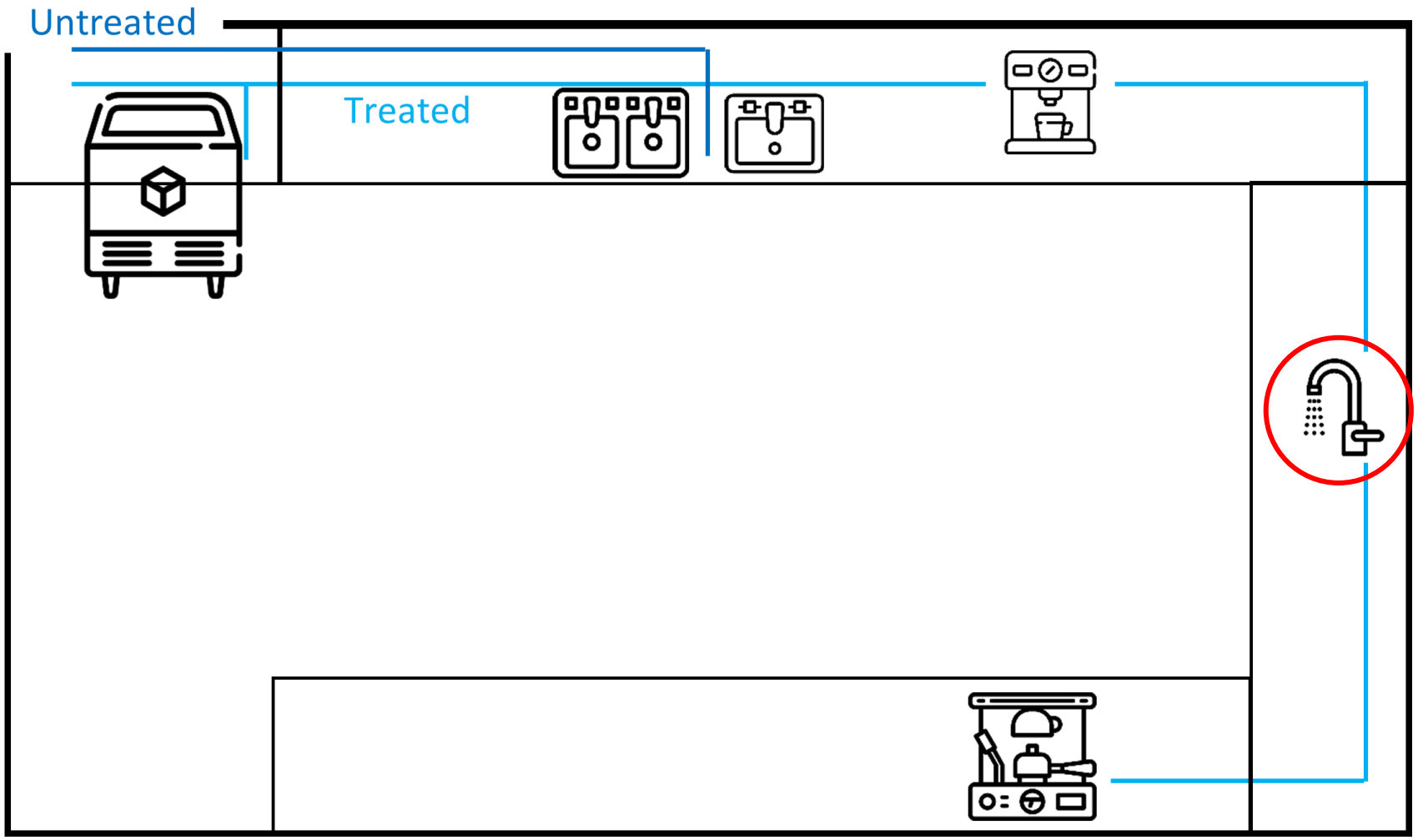
- Level 1 Assessment triggered
  - Issued July 18, 2022, by KCHD
- Operator made site visit and talked to Facilities/ Maintenance staff
- L1A returned to KCHD same day

What does the Level 1 Assessment tell us?

Level 1 Assessment Details

- Store performed some remodeling in May and June 2022
  - Restroom fixtures replaced
  - Drinking fountain not in service
- Glass fill supplied by treated water
  - Drinking locations at RFE supplied with treated water (reverse osmosis)

Food Establishment Water Distribution Layout



Treated Water Distribution Layout

Reverse Osmosis

Water In

Coffee Maker

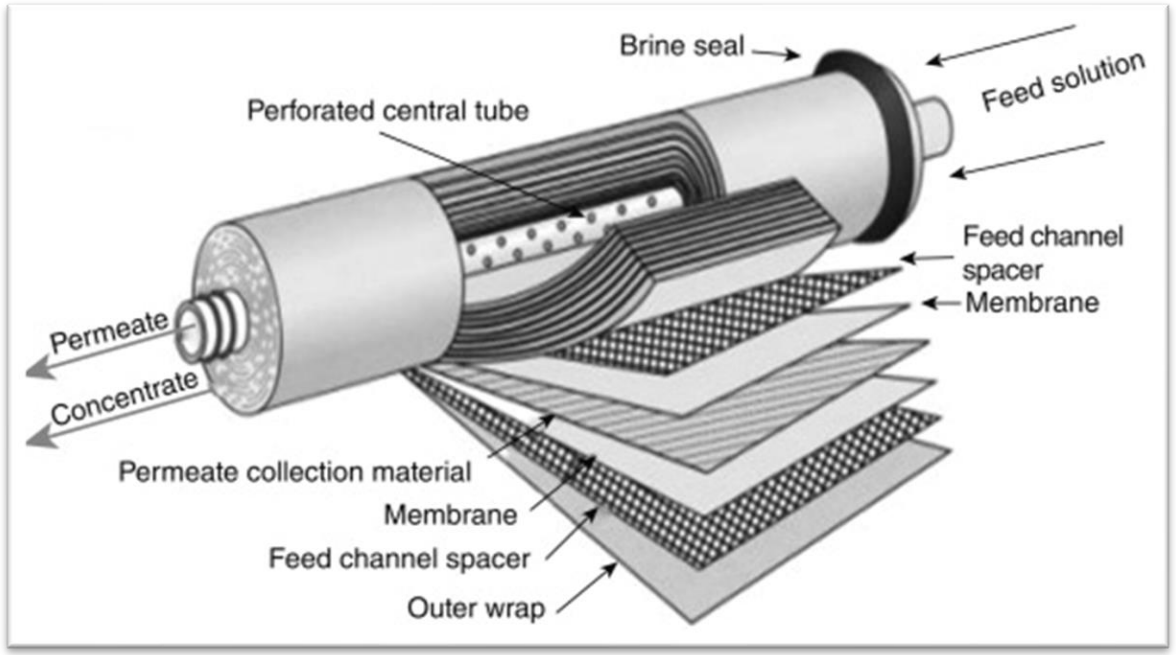
Glass Fill

Espresso Machine

Membrane Filter

Inner Workings of RO

- Reverse osmosis is completed by a filter containing various composite semipermeable membranes
- Pressure is applied to force water through the membranes leaving contaminants behind in a concentrate



How can we fix this?

Corrective Actions

- Operator submitted Corrective Action Plan
  - Replaced filters at reverse osmosis unit on July 19, 2022
  - Installed a new glass fill unit on July 25, 2022

Did the replaced fixtures resolve the bacteria issues?

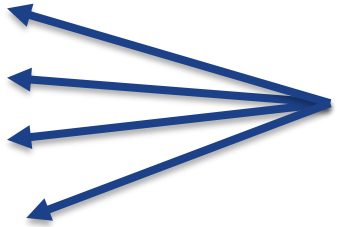
Water Samples

- Construction sample collected July 25, 2022
  - Glass fill: **Positive**

Sample Results

Date	Location	Result
07/13/2022	Glass Fill	POS
07/13/2022	Breakroom Sink	ND
07/15/2022	Breakroom Sink	ND
07/15/2022	Drinking Fountain	ND
07/15/2022	Pressure Tank (Raw)	ND
07/15/2022	Glass Fill	POS
07/25/2022	Glass Fill	POS

Routine Samples



Repeat Samples

Did the replaced fixtures resolve the bacteria issues?

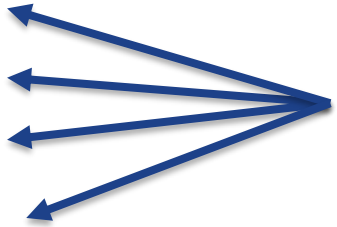
Water Samples

- Four (4) construction samples collected July 27, 2022
  - Food facility hand sink: Non-detect
  - Store bakery hand sink: Non-detect
  - Glass fill: **Positive**
  - Coffee machine: Non-detect
    - Treated water at near-boiling temperature

Sample Results

Date	Location	Result
07/13/2022	Glass Fill	POS
07/13/2022	Breakroom Sink	ND
07/15/2022	Breakroom Sink	ND
07/15/2022	Drinking Fountain	ND
07/15/2022	Pressure Tank (Raw)	ND
07/15/2022	Glass Fill	POS
07/25/2022	Glass Fill	POS
07/27/2022	3-Comp Sink	ND
07/27/2022	Glass Fill	POS
07/27/2022	Bakery Hand Sink	ND
07/27/2022	Coffee Maker	ND

Routine Samples



Repeat Samples

How can we fix this (continued)?

Corrective Actions

- Operator worked with water supply staff to identify other potential sources of contamination
  - Replaced shut-off valves

Did the plumbing repairs resolve the bacteria issues?

Additional Samples

- Construction sample collected August 5, 2022
  - Glass fill: **Positive**

How can we fix this (continued)?

Corrective Actions

- Operator worked with water supply staff to identify other potential sources of contamination
  - Replaced supply lines to all treated fixtures

Did the plumbing repairs resolve the bacteria issues?

Additional Samples

- Construction sample collected August 9, 2022
  - Glass fill: **Positive**

How can we fix this (continued)?

Corrective Actions

- Operator worked with water supply staff to identify other potential sources of contamination
  - Replaced pre-filters on reverse osmosis unit
  - Replaced supply lines to all treated fixtures

Did the plumbing repairs resolve the bacteria issues?

Additional Samples

- Two (2) construction samples were collected August 11, 2022
  - After the RO: **Positive**
  - Glass fill: **Positive**

Reverse Osmosis Treatment System

Sample Results

Date	Location	Result
07/13/2022	Glass Fill	POS
07/13/2022	Breakroom Sink	ND
07/15/2022	Breakroom Sink	ND
07/15/2022	Drinking Fountain	ND
07/15/2022	Pressure Tank (Raw)	ND
07/15/2022	Glass Fill	POS
07/25/2022	Glass Fill	POS
07/27/2022	3-Comp Sink	ND
07/27/2022	Glass Fill	POS
07/27/2022	Bakery Hand Sink	ND
07/27/2022	Coffee Maker	ND

Date	Location	Result
08/05/2022	Glass Fill	POS
08/09/2022	Glass Fill	POS
08/11/2022	Glass Fill	POS
08/11/2022	Post RO	POS

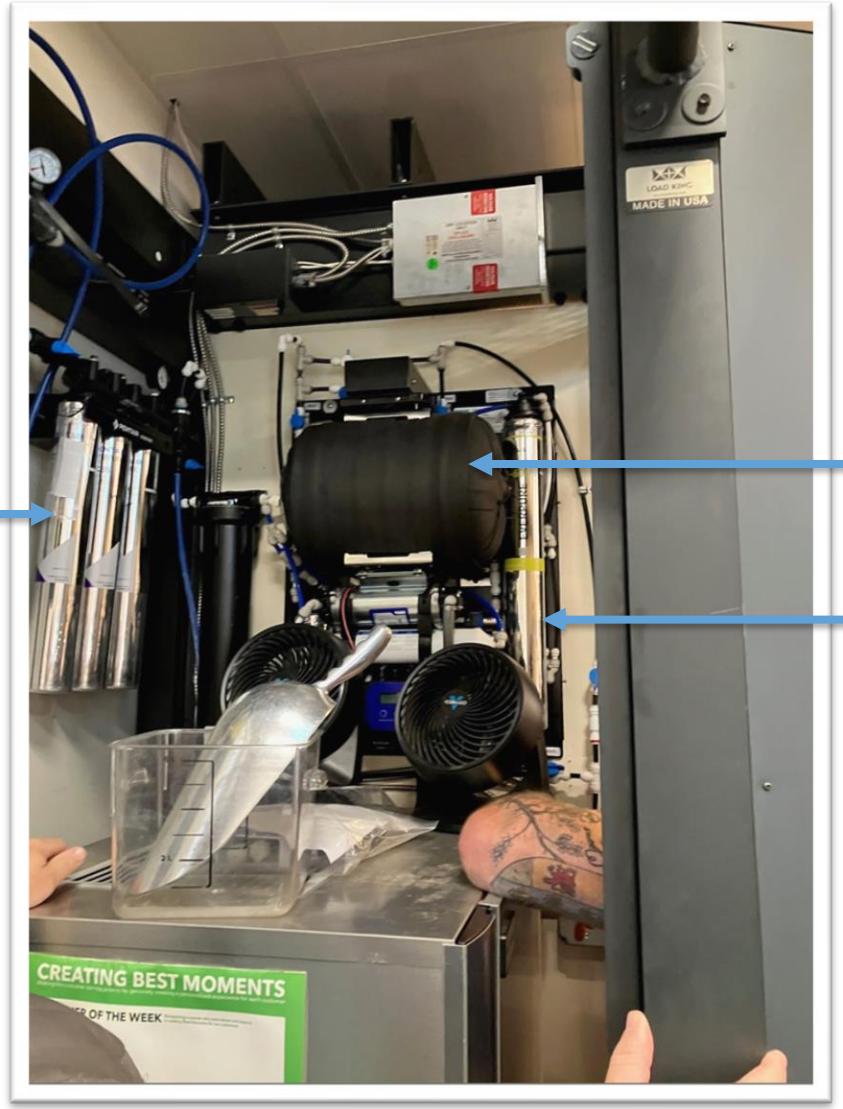
- Construction samples collected as plumbing replaced.

What makes a great breeding ground for bacteria?

Heat, Moisture, and Stagnation

- Operator discovered exhaust from the ice machine warming the RO tank
  - Treatment unit and ice machine in small “closet”
  - Almost 100°F in closet

Reverse Osmosis Treatment System



Pre-Filters

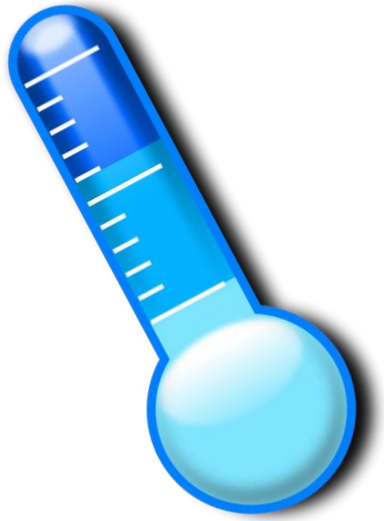
Storage Tank

Membrane Cartridge

How can the closet be cooled down?

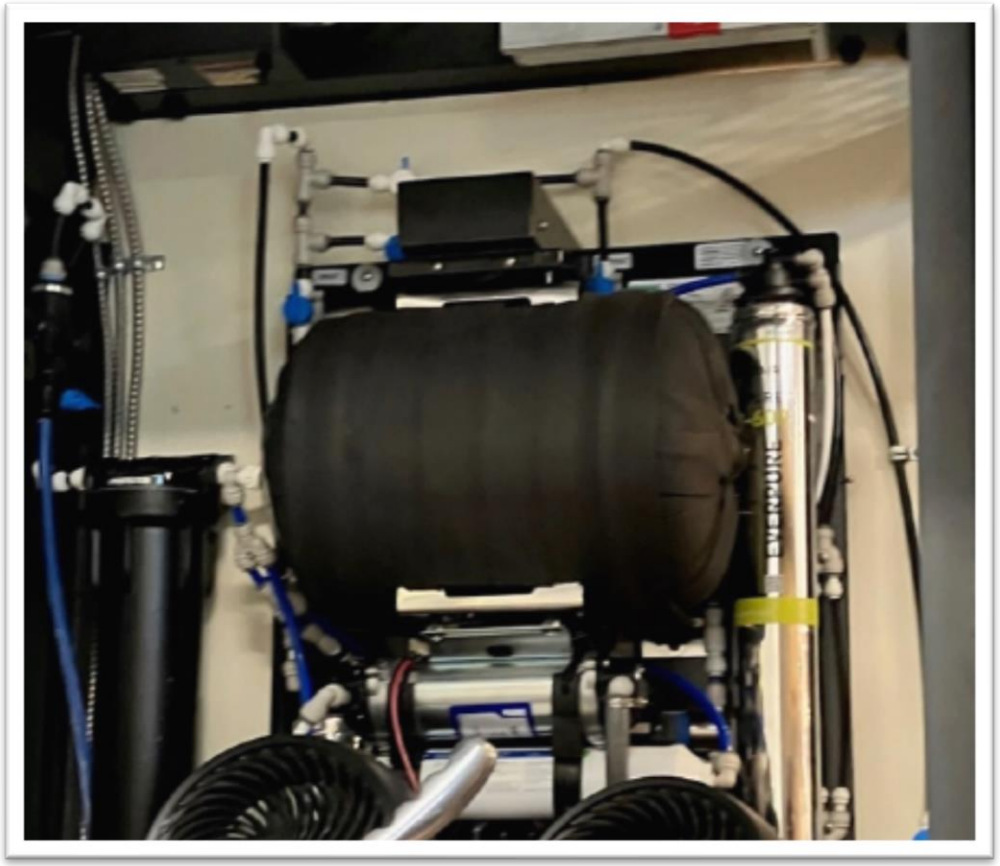
Cooling Measures

- Redirected exhaust from the ice machine
  - Installed vent in door
  - Installed a fan to circulate air flow
  - Insulated the RO storage tank



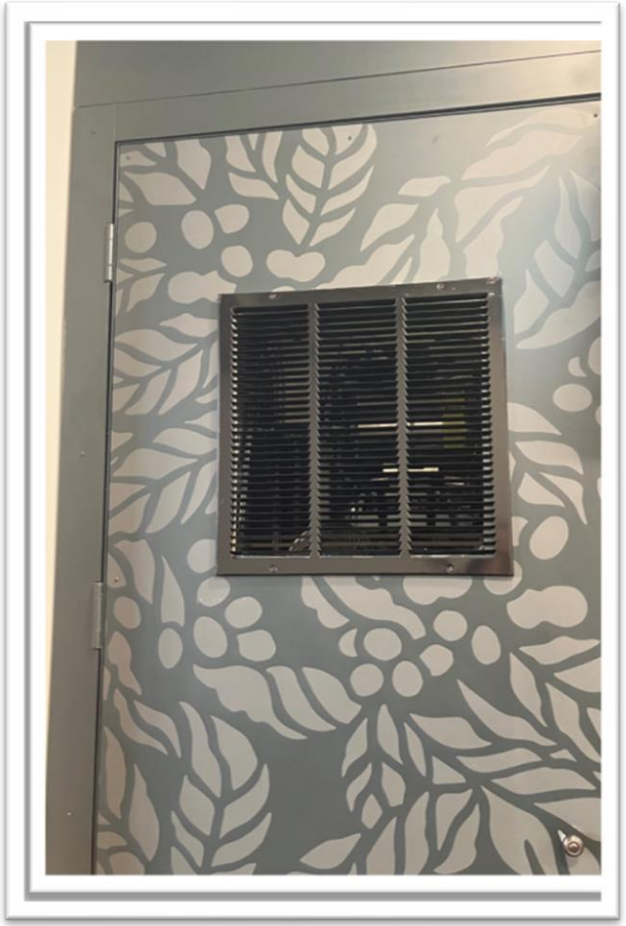
Corrective Actions

Insulated the RO tank



Added a fan

Added vent in door



Is the coliform in the pre-filters?

Additional Samples

- Two (2) other construction samples were collected August 11, 2022
  - After the sediment filter: Non-detect
  - After the pre-filter: Non-detect

Sample Results

Date	Location	Result
07/13/2022	Glass Fill	POS
07/13/2022	Breakroom Sink	ND
07/15/2022	Breakroom Sink	ND
07/15/2022	Drinking Fountain	ND
07/15/2022	Pressure Tank (Raw)	ND
07/15/2022	Glass Fill	POS
07/25/2022	Glass Fill	POS
07/27/2022	3-Comp Sink	ND
07/27/2022	Glass Fill	POS
07/27/2022	Bakery Hand Sink	ND
07/27/2022	Coffee Maker	ND

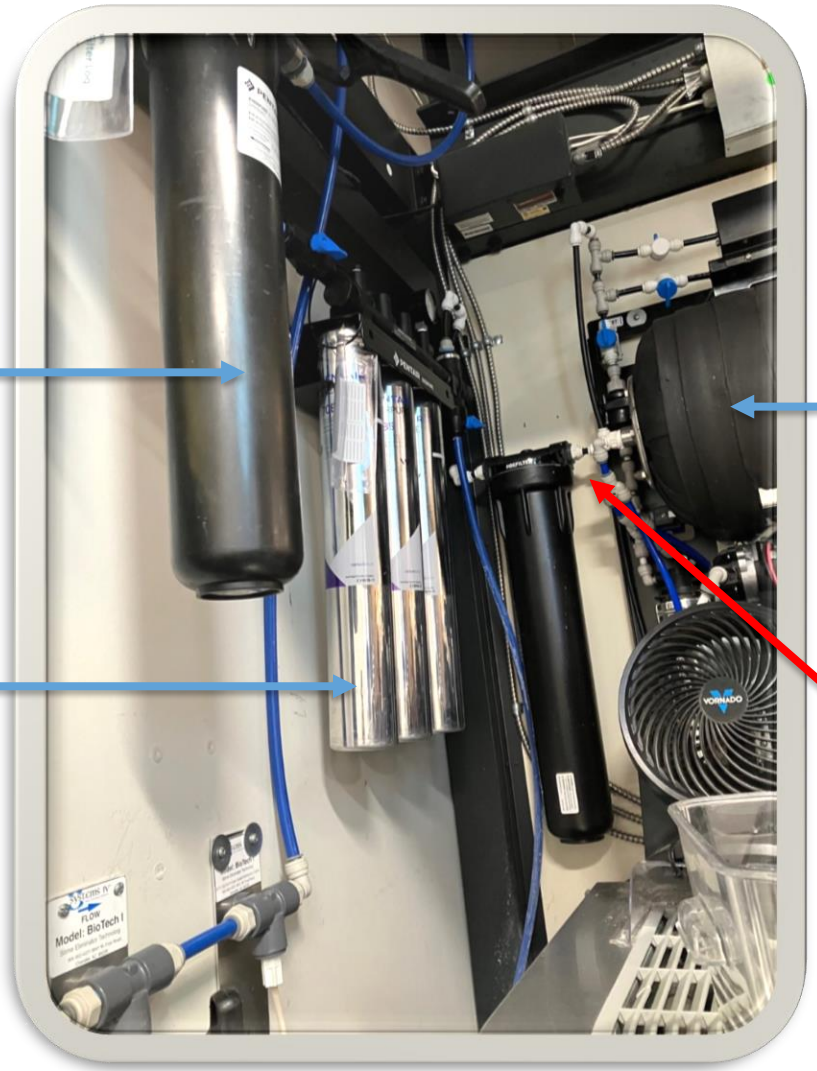
Date	Location	Result
08/05/2022	Glass Fill	POS
08/09/2022	Glass Fill	POS
08/11/2022	Glass Fill	POS
08/11/2022	Post RO	POS
08/11/2022	Post Sediment Filter - Pre RO	ND
08/11/2022	Post Pre-Filter - Pre RO	ND

What else can be fixed or replaced?

Corrective Actions

- At this point, the operator suspected coliform was coming from reverse osmosis unit (August 12, 2022)
- Replaced all pre-filters
  - Installed new chlorinated filters
- Disinfected the RO based on manufacturer recommendation

Reverse Osmosis Treatment System



Any luck resolving the bacteria issues?

Additional Samples

- Two (2) construction samples were collected August 25, 2022
  - Breakroom Sink: Non-detect
  - Glass fill: **Positive**

Any luck resolving the bacteria issues?

Additional Samples

- Two (2) construction samples were collected August 29, 2022
  - Glass fill: **Positive**
  - Post RO: **Positive**

Sample Results

Date	Location	Result
07/13/2022	Glass Fill	POS
07/13/2022	Breakroom Sink	ND
07/15/2022	Breakroom Sink	ND
07/15/2022	Drinking Fountain	ND
07/15/2022	Pressure Tank (Raw)	ND
07/15/2022	Glass Fill	POS
07/25/2022	Glass Fill	POS
07/27/2022	3-Comp Sink	ND
07/27/2022	Glass Fill	POS
07/27/2022	Bakery Hand Sink	ND
07/27/2022	Coffee Maker	ND

Date	Location	Result
08/05/2022	Glass Fill	POS
08/09/2022	Glass Fill	POS
08/11/2022	Glass Fill	POS
08/11/2022	Post Sediment Filter - Pre RO	ND
08/11/2022	Post Pre-Filter - Pre RO	ND
08/11/2022	Post RO	POS
08/25/2022	Glass Fill	POS
08/25/2022	Breakroom Sink	ND
08/29/2022	Post RO	POS
08/29/2022	Glass Fill	POS

Moving Forward

- After corrections and disinfection, all post-RO samples were still positive for coliform
- What else can we do?
  - Give up?

Corrective Action

Additional Repairs

- Changed analytical labs
- Replaced bladder tank for treatment unit
- Installed air gap on RO waste line
- Added chlorination upstream of all filtration and treatment
  - This would require permit through KCHD and EGLE
- Entire post-treatment distribution disinfected week of September 5, 2022

Air gap missing

Sample Results

Date	Location	Result
09/09/2022	Post RO	POS
09/13/2022	Glass Fill (RO Bypassed)	ND
09/28/2022	Glass Fill	POS
09/30/2022	Post Sediment Filter - Pre RO	ND
09/30/2022	Pre RO	ND
09/30/2022	Post RO	POS
09/30/2022	Glass Fill (RO Bypassed)	ND
09/30/2022	Glass Fill	POS
09/30/2022	Bakery (Post RO)	POS
09/30/2022	Breakroom Sink	ND

New Reverse Osmosis Unit

- Replaced entire reverse osmosis unit, pressure tank, and all filters on October 14, 2022
  - Unit delivered “prepackaged”
  - Plug water line upstream and downstream of unit with quick connects
- Continued coliform sampling

How many bacteria are present?

Heterotrophic Plate Count

- Heterotrophic plate count collected October 28, 2022
- Low-to-moderate number of bacteria colonies (360 CFU/100mL)

Can we get some help?

KCHD and EGLE Site Visit

- Onsite meeting took place October 28, 2022
  - Staff from KCHD, EGLE, Fleis & Vandenbrink, and store staff
- Minor cross connections were discovered
  - No major deficiencies
- Multiple reverse osmosis units were discovered in the store
  - Food service establishment
  - Bakery

Sample Results

Date	Location	Result
09/09/2022	Post RO	POS
09/13/2022	Glass Fill (RO Bypassed)	ND
09/28/2022	Glass Fill	POS
09/30/2022	Post Sediment Filter - Pre RO	ND
09/30/2022	Pre RO	ND
09/30/2022	Post RO	POS
09/30/2022	Glass Fill (RO Bypassed)	ND
09/30/2022	Glass Fill	POS
09/30/2022	Bakery (Post RO)	POS
09/30/2022	Breakroom Sink	ND

Sample collected from different RO unit within store

Is this the only RO unit with bacteria present?

Additional RO Units

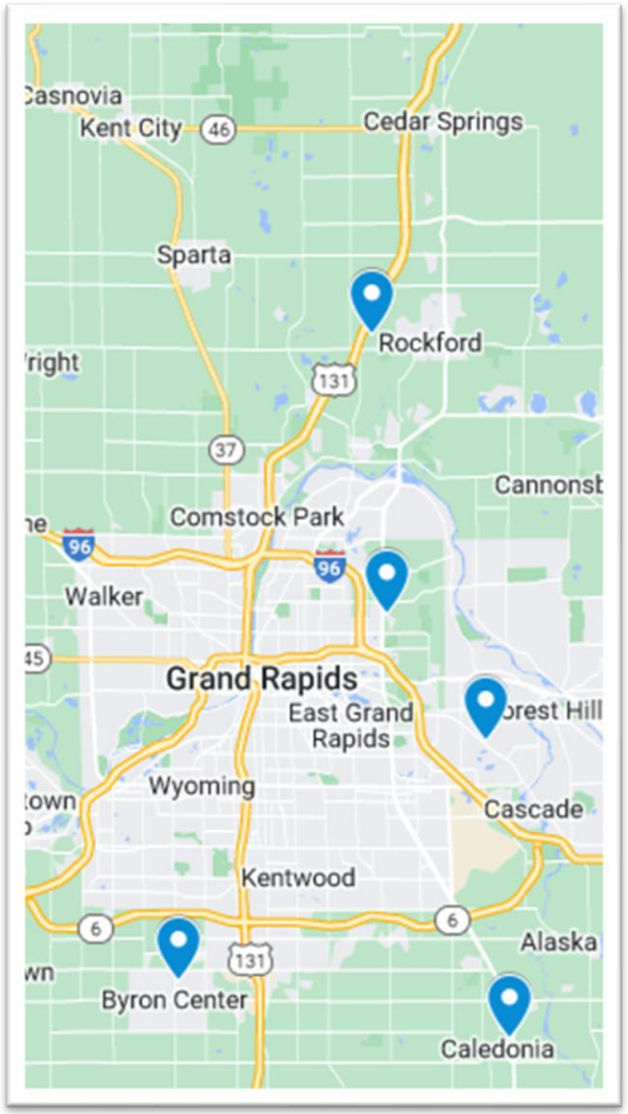
- Samples from two (2) separate reverse osmosis units in store were positive for coliform
  - RO units on separate supply lines
- After discussion with the operator and maintenance supervisor it turns out all stores are required to treat water to a certain standard
    - Most stores use the same RO unit to reach specified water quality parameters

Are We On To Something?

- KCHD asked the company to test glass fills at other stores in the area
- Two (2) other stores were sampled for coliform
  - Stores each connected to City of Grand Rapids municipal water supply
  - Both results were coliform positive

Date	Location	Result
10/31/2022	Cascade	POS
10/31/2022	Grand Rapids Township	POS

Where was additional testing completed?



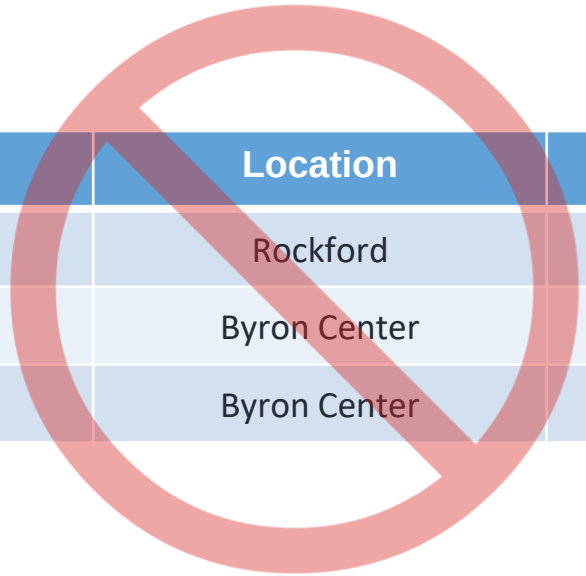
What if…?

- Could the reverse osmosis units be the source of bacteria?

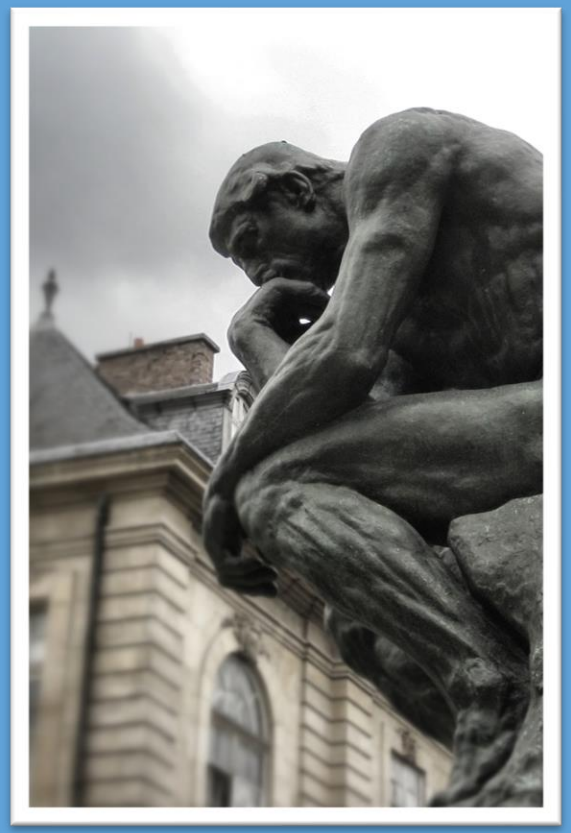
Are We On To Something?

- KCHD asked the company to test glass fills at additional stores
- Three (3) other stores were sampled for coliform
  - Stores each connected to Rockford and Wyoming municipal water supplies
  - All results were negative for coliform

Date	Location	Result
11/7/2022	Rockford	ND
11/7/2022	Byron Center	ND
11/7/2022	Byron Center	ND



More questions than answers…



- Did all stores tested use the same type of treatment/filter?
  - No. One of the stores with a non-detect sample was using a “new” style treatment system.
- Was the water from City of Grand Rapids to blame for the positive results?
  - Probably not. GR reported zero (0) positive samples and no known pressure losses in the area in recent months.
- Was there a certain batch of treatment units causing a problem?
  - No. Date codes from filters with detections were not consistent.

Who needs to be informed?

Other Interested Parties

- In early November EGLE and MDARD were informed of the potential situation
- Conversations were conducted with Pentair representatives
- Spoke to staff in the Global Food Safety, Quality, and Regulatory department from the company with the affected store

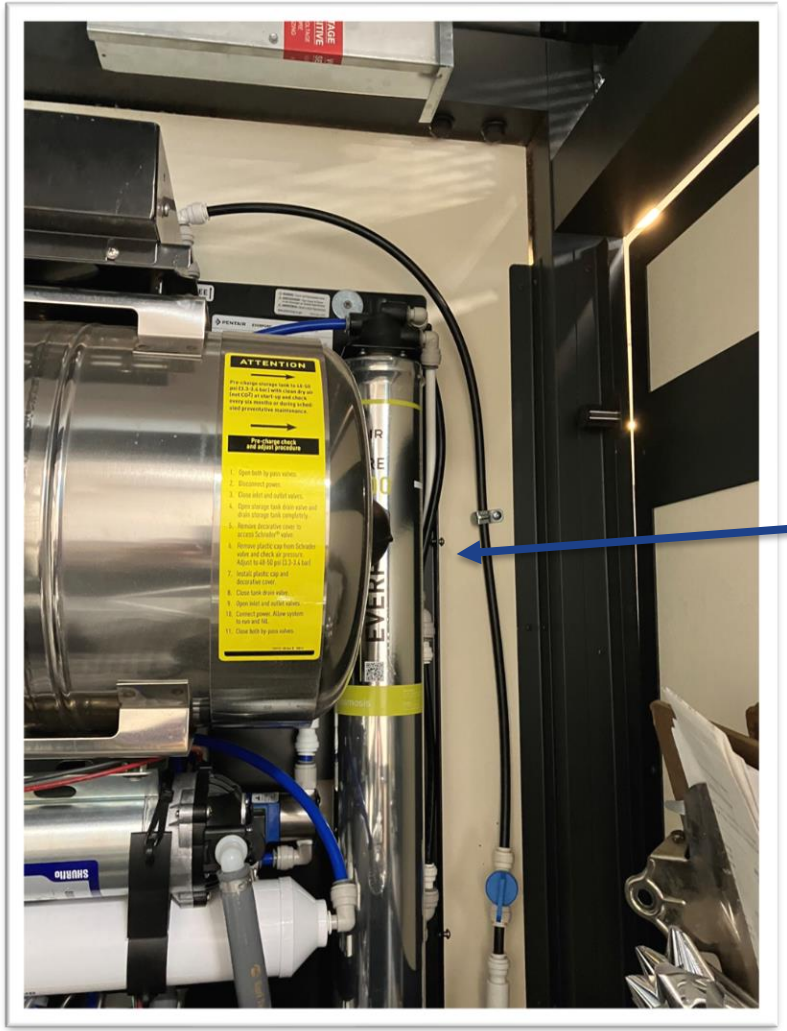
What information can the manufacturer provide?

Pentair

- Pentair is the only approved supplier of filtration devices for this company
- Franchises may install one of three different filtration system configurations
  - Reverse osmosis is commonly used by most stores
- The membrane filter comes two different ways
  - Standard
  - Pre-flushed
- Pentair sampled the store RO in December 2022
  - **Positive** for coliform

Which part is the membrane filter?

Everpure MR-600 cartridge



Why is the membrane flushed?

Membrane Flushing

- Membrane filters need to be flushed when installed to expel preservatives
- Flushing may take up to 36 hours
  - Downtime for treated water
  - Staff time
- Pentair allows select clients to purchase pre-flushed filters
  - Pre-flushed filters have a shelf life of six (6) months

Who received a pre-flushed filter?

- Pentair began an internal investigation to determine source of bacteria
  - Performed a food safety assessment of their own facility
  - Tested filter membranes in various stages of production
  - Contracted with external microbiologists
- Determined approximately 80% of filters are shipped unflushed
- Traced shipments of pre-flushed filters

What did Pentair determine?

Investigation Results

- **Found a statistically significant number of pre-flushed filters contained coliform**
  - Filters on the shelf
  - Filters recently flushed
  - Filters previously shipped
- Unflushed filters found to be unaffected
- Zero (0) samples were E. coli positive

How did Pentair respond?

Investigation Response

- Immediately stopped shipping pre-flushed filters
- “Recalled” pre-flushed filters which had been shipped but not yet installed

What about other stores using these units?

- Pentair’s records allowed for a high confidence level of customers and stores with pre-flushed filters
- Sent an “alert notification” to customers
    - Created a video with a specific customer to identify and replace affected filters

What about other stores using these units?

- Majority of customers contract preventative maintenance
  - Already on a schedule
  - Best way to track when affected filters are replaced
- A “high percentage” (80% or more) addressed by June 2023
  - Most are on a six (6) month maintenance schedule
- Pentair stopped offering pre-flushed filters
  - If offered in the future, they plan to build a clean room in their manufacturing facility

What was the result of installing the new reverse osmosis units?

NCWS Results

- Store replaced both reverse osmosis systems in early January 2023
- Two (2) construction coliform samples collected in January 2023
  - Glass fill (1/13/2023): Non-detect
  - Glass fill (1/16/2023): Non-detect
- All routine samples since have been non-detect!

What did we learn?

- Communicate with your partners
- Coliforms are “mostly harmless”
- Expensive!
  - Store spent between $20,000 and $30,000 finding solution
- **Test the water people are drinking!**
- **Follow your intuition!**

Water Samples

Date	Location	Result		Date	Location	Result
07/13/2022	Glass Fill	POS		07/13/2022	Breakroom Sink	ND
07/15/2022	Glass Fill	POS		07/15/2022	Breakroom Sink	ND
07/25/2022	Glass Fill	POS		07/15/2022	Drinking Fountain	ND
07/27/2022	Glass Fill	POS		07/15/2022	Pressure Tank (Raw)	ND
07/27/2022	Coffee Maker	ND		07/27/2022	3-Comp Sink	ND
08/05/2022	Glass Fill	POS		07/27/2022	Bakery Hand Sink	ND
08/09/2022	Glass Fill	POS		08/11/2022	Post Sediment Filter - Pre RO	ND
08/11/2022	Glass Fill	POS		08/11/2022	Post Pre-Filter - Pre RO	ND
08/11/2022	Post RO	POS		08/25/2022	Breakroom Sink	ND
08/25/2022	Glass Fill	POS		09/13/2022	Glass Fill (RO Bypassed)	ND
08/29/2022	Glass Fill	POS		09/30/2022	Post Sediment Filter - Pre RO	ND
08/29/2022	Post RO	POS		09/30/2022	Pre RO	ND
09/09/2022	Glass Fill	POS		09/30/2022	Glass Fill (RO Bypassed)	ND
09/09/2022	Post RO	POS		09/30/2022	Breakroom Sink	ND
09/28/2022	Glass Fill	POS			Untreated	
09/30/2022	Glass Fill	POS				
09/30/2022	Post RO	POS				
09/30/2022	Bakery (Post RO)	POS				
11/10/2022	Glass Fill	ND				
11/17/2022	Glass Fill	POS				
01/13/2023	Glass Fill	ND				
01/16/2023	Glass Fill	ND				
01/24/2023	Glass Fill	ND				

Treated

Questions??

Special thanks to:

- Barbara Brown, Kent County Health Department
- Kasey Swanson, Michigan Department of Environment, Great Lakes, and Energy
- Stephanie Kozal, Fleis & VandenBrink
- Leigh Ann Nicholson, Pentair
- Courtnay Viars, Pentair
- Nick Wagner, SpartanNash

Thank you!