

University of
Massachusetts
Amherst

What's Up with Water Testing?

January 5, 2024

Lisa McKeag

607th NEVBGA Growers'
Meeting





- Where is poop in the landscape?
- How could it get in the water?
- How do you stop it getting in the water?

The Big Picture

Thanks, Phil Tocco!

OUTLINE



The Rules – FSMA and audit programs



Water Testing – When, how, and why



The Big Picture – Assessing and addressing water risks

The Rules



What
YOU
need to
know

What **state** do
you farm in?



Is your farm
COVERED
under the
FSMA Produce
Safety Rule?



Do you participate
in a voluntary
certification
program?

- ◇ CT: CGAP
- ◇ ME: USDA-GAP
- ◇ MA: CQP
- ◇ NH: USDA-GAP
- ◇ RI: RI GAP
- ◇ VT: CAPS

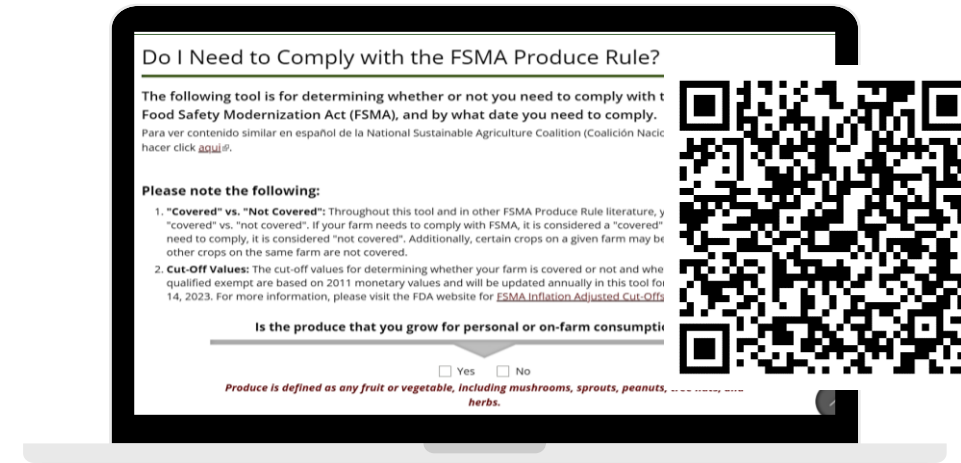
The Rules - FSMA



Is your farm
COVERED
under the
FSMA
Produce
Safety Rule?

Don't know?

- Use UMass Tool as a Guide →
- Contact your state agency to determine/confirm coverage



<https://ag.umass.edu/resources/food-safety/for-farmers/fsma-produce-rule>

If covered, what **SIZE** is your farm

- Very small: <\$250K annual produce sales
- Small: \$250K to \$500K annual produce sales
- Large: >\$500K annual produce sales



Determines *when* you have to comply with water requirements

The Rules – FSMA Produce Safety Rule



All water	Preharvest	Microbial Threshold	Postharvest	Microbial Threshold	Business Size	Enforcement date	Will start asking for tests, assessing compliance
Annual agricultural water system inspection	New rule pending - no testing requirement now Ag Water Assessment pending	None	Surface – not allowed at all unless treated Ground – 4 tests in first year, 1 test every year after Municipal – no test; compliance cert. from town	0 CFU/100 ml generic E. coli	All other >\$500K annual produce sales	January 26, 2023	January 26, 2024
			Small \$250K to \$500K annual produce sales		January 26, 2024	January 26, 2025	
			Very small <\$250K annual produce sales		January 26, 2025	January 26, 2026	

The Rules



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The Rules – Audit Programs



Do you
participate in a
voluntary
certification
program?

- ◇ CT: CGAP
- ◇ ME: USDA-GAP
- ◇ MA: CQP
- ◇ NH: USDA-GAP
- ◇ RI: RI GAP
- ◇ VT: CAPS

- What's that?
 - Market access program
 - Get a certificate you can show to buyers, customers
 - No legal requirement to participate
- Might be same people as FSMA inspectors, or different departments at same agency – *VT run by VVBGA*
 - Contact your audit authority to determine status
- You might be a COVERED farm *and* be in an Audit program
- DIFFERENT RULES for water testing

The Rules – Audit Programs



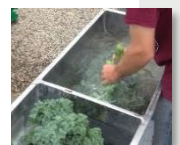
State	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont
Audit program	CGAP	USDA-GAP (Basic, Harmonized,+)	Commonwealth Quality Program (CQP)	USDA-GAP (Basic GAP only)	RI GAP	CAPS
All water	<ul style="list-style-type: none"> System map Annual water systems risk assessment 	<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> System map Annual water systems risk assessment 	<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> System map Annual water systems risk assessment 	<ul style="list-style-type: none"> n/a
Preharvest	<ul style="list-style-type: none"> Surface - 4x/year Ground - 1x/year Municipal - certificate 	<ul style="list-style-type: none"> Surface - 3x/year Ground - 1x/year Municipal - certificate Water quality assessment for water used for irrigation and chemical applications 	<ul style="list-style-type: none"> Surface - 3x/year Ground - 2x/year Municipal - certificate <i>Must use method/labs specified by MDAR</i> 	<ul style="list-style-type: none"> Surface - 3x/year Ground - 1x/year Municipal - certificate Water quality assessment for water used for irrigation and chemical applications 	<ul style="list-style-type: none"> Surface - 3x/season Ground - 2x/year Municipal – certificate <i>Must use state certified lab</i> 	<ul style="list-style-type: none"> No testing required Description of irrigation system, water source & Plan to reduce risk <i>CAPS+LGS only: irrigation system map</i>
Microbial Threshold	<ul style="list-style-type: none"> GM 126 CFU/100 ml STV 410 CFU/100 ml <i>for 4 annual tests</i> 	<ul style="list-style-type: none"> Grower sets threshold 	<ul style="list-style-type: none"> 126 CFU/100 ml 	<ul style="list-style-type: none"> Grower sets threshold 	<ul style="list-style-type: none"> 126 CFU/100 ml 	<ul style="list-style-type: none"> None
Postharvest	<ul style="list-style-type: none"> Ground - 1x/year Municipal - certificate 	<ul style="list-style-type: none"> Number of tests not specified <i>Lab must be GLP certified</i> <i>Testing for chemical contaminants if risk</i> 	<ul style="list-style-type: none"> Ground - 2x/year Municipal - certificate 	<ul style="list-style-type: none"> Number of tests not specified <i>Lab must be GLP certified</i> <i>Testing for chemical contaminants if risk</i> 	<ul style="list-style-type: none"> Number of tests not specified 	<ul style="list-style-type: none"> Ground - 1x/year Municipal – certificate <i>CAPS+LGS only: Description, risk assessment & map of post-harvest system</i>
Microbial Threshold	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml



The Rules – Summary



State	Connecticut	Maine	Massachusetts	New Hampshire	Rhode Island	Vermont	FSMA
Audit program	CGAP	USDA-GAP	CQP	USDA-GAP	RI GAP	CAPS	PSR
All water	<ul style="list-style-type: none"> System map Annual risk assessment 	<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> System map Annual risk assessment 	<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> System map Annual risk assessment 	<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> Annual agricultural water system inspection
Preharvest	<ul style="list-style-type: none"> Surface - 4x/year Ground - 1x/year Municipal - cert 	<ul style="list-style-type: none"> Surface - 3x/year Ground - 1x/year Municipal - cert Water quality assessment 	<ul style="list-style-type: none"> Surface - 3x/year Ground - 2x/year Municipal - cert <i>Must use method/labs specified by MDAR</i> 	<ul style="list-style-type: none"> Surface - 3x/year Ground - 1x/year Municipal - cert Water quality assessment 	<ul style="list-style-type: none"> Surface - 3x/season Ground - 2x/year Municipal – cert <i>Must use state certified lab</i> 	<ul style="list-style-type: none"> No testing required Description of system & Plan to reduce risk <i>CAPS+LGS only: irrigation system map</i> 	<ul style="list-style-type: none"> No testing required Ag Water Assessment pending
Microbial Threshold	<ul style="list-style-type: none"> GM 126, STV 410 CFU/100 ml 	<ul style="list-style-type: none"> Grower sets threshold 	<ul style="list-style-type: none"> 126 CFU/100 ml 	<ul style="list-style-type: none"> Grower sets threshold 	<ul style="list-style-type: none"> 126 CFU/100 ml 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Postharvest	<ul style="list-style-type: none"> Ground - 1x/year Municipal - cert 	<ul style="list-style-type: none"> Number not specified <i>Lab GLP certified</i> <i>Testing for chemical contaminants if risk</i> 	<ul style="list-style-type: none"> Ground - 2x/year Municipal - cert 	<ul style="list-style-type: none"> Number of tests not specified <i>Lab GLP certified</i> <i>Testing for chemical contaminants if risk</i> 	<ul style="list-style-type: none"> Number not specified 	<ul style="list-style-type: none"> Ground - 1x/year Municipal – cert <i>CAPS+LGS only: Post-harvest system assessment</i> 	<ul style="list-style-type: none"> Surface -not allowed Ground water 4 tests first year 1 test/year after Municipal – cert
Microbial Threshold	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml 	<ul style="list-style-type: none"> 0 CFU/100 ml



The Rules – Massachusetts Summary



State	Massachusetts	FSMA
Audit program	CQP	PSR
All water	System map Annual risk assessment	Annual agricultural water system inspection
Preharvest	Surface - 3x/year Ground - 2x/year Municipal - certificate <i>Must use method/labs specified by MDAR</i>	No testing required Ag Water Assessment pending
Threshold	126 CFU/100 ml	None
Postharvest	Ground - 2x/year Municipal - cert	Surface -not allowed Ground water 4 tests first year 1 test/year after Municipal – cert
Threshold	0 CFU/100 ml	0 CFU/100 ml



The Rules



State Agencies and Contacts

Connecticut Dept. of Agriculture

MacKenzie White

MacKenzie.White@ct.gov

860-713-2562

Maine Department of Agriculture, Conservation and Forestry

Lindsay Werner

Lindsay.Werner@maine.gov

207-592-2687

Massachusetts Department of Agricultural Resources

Michael Botelho

Michael.Botelho@mass.gov

508-985-8751

NH Department of Agriculture, Markets and Food

Vickie Smith

victoria.m.smith@agr.nh.gov

603-848-4781

Rhode Island Department of Environmental Management

Ananda Fraser

ananda.fraser@dem.ri.gov

401-537-4272

Vermont Agency of Agriculture

Tucker Diego

AGR.Produce@vermont.gov

802-828-2433

For VT CAPS Program:

Hans Estrin

hestrin@uvm.edu

802-380-2109



The Rules – final FSMA Subpart E

- **FSMA Proposed Rule for Preharvest water** – expected to be finalized in 2024
- Requires an annual **Agricultural Water Assessment**
- **No testing for preharvest water *required*** in proposed version –
 - not sure what will happen with final rule
- Testing **CAN** be used as part of assessment
- States **CAN** have stricter regulatory requirements – may require some testing

The Rules – *proposed* FSMA Subpart E



Written Agricultural Water Assessment

Ag Water system	<ul style="list-style-type: none">• Source and location (surface, ground, municipal)• Water distribution system (open or closed)• Degree of protection from possible contamination including other users, animal impacts, and adjacent land uses	Mitigation measures (in 2021 Proposed Subpart E) <ul style="list-style-type: none">• Increasing time interval: <u>minimum</u> 4 days between last direct application → harvest (microbial die-off)• Increasing time interval for harvest → storage (microbial die-off)• Other activities such as: Commercial washing• Making necessary changes, repairs• Changing water application method• Treat the Water (PSR standards)• Taking alternative mitigation measures supported by scientific information
Ag Water practices	<ul style="list-style-type: none">• Type of application method (overhead, drip, furrow, flood)• Time interval between last direct application and harvest	
Crop characteristics	<ul style="list-style-type: none">• Crop susceptibility to surface adhesion or internalization	
Environmental Conditions	<ul style="list-style-type: none">• Frequency of rain or extreme weather that might impact the agricultural water system or might damage produce• Air temperatures• Sun (UV) exposure	
Other factors	<ul style="list-style-type: none">• Includes results of testing	



The Rules - Records

What do you need to show an auditor and/or inspector?

- **Water test results** - lab reports, spreadsheet of all results
- **Municipal certificate** – most probably won't ask for this but it's good to pay attention, e.g., boil water notices
- **Water system map** – whole system, pre- and post harvest; Show sources, pumps, mains and withdrawal points, including distribution (drip, overhead)
- **Annual risk assessment** - Describe water sources, crops, risk factors such as animals, etc., plans for reducing risk
- **Water system inspection log** – what you looked at, what you found, any changes or corrections made

Water Source
Water Source Type: Surface Water

Samples included in your MWQP calculation:

Date	Sample ID	Sample Location
2022-06-07	FD HF	Int
2022-07-05	FD HF	Int
2022-07-18	FD HF	Int
2022-08-01	FD HF	Int
2022-08-13	FD HF	Int
2022-09-13	FD HF	Int
2022-10-18	FD HF	Int
2023-04-03	FD HF	Int
2023-05-09	FD HF	Int
2023-05-23	FD HF	Int
2023-06-06	FD HF	Int
2023-06-20	FD HF	Int
2023-07-11	FD HF	Int
2023-08-01	FD HF	Int

Water System Inspection Record Template

Name and address of farm: _____

See farm policy for specific water distribution system inspection procedures.

Date	Time	Water Source and Distribution System	Observations	Corrective Actions Taken
4/22/16	7:00 AM	Well 1, north field	Well casing in good shape, but filter prevention device in place, no broken pipes	None
4/22/16	8:00 AM	Pond, south field	Significant grass presence	Eliminated grass through mowing

Reviewed by: _____ Title: _____ Date: _____

FSMA PSR reference § 112.50(b)(1) Confidential Record
Modified from On-Farm Decision Tree Project: Agriculture Water for Production—44 01172014
E.A. Bitts, M.A., Schramm, A.L., Plozinski, G.L. Weil, and S.K. Amundson, 2014 www.gov.com/afdc

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KEY

- Check valve □
- Sand filters ▩
- Pressure sensors ▲
- Frost free hydrant Y
- Hydrant cross connection ---
- Road =
- Centrifugal pump Ⓢ

See audit programs for required docs, checklist questions

OUTLINE



The Rules – FSMA and audit programs



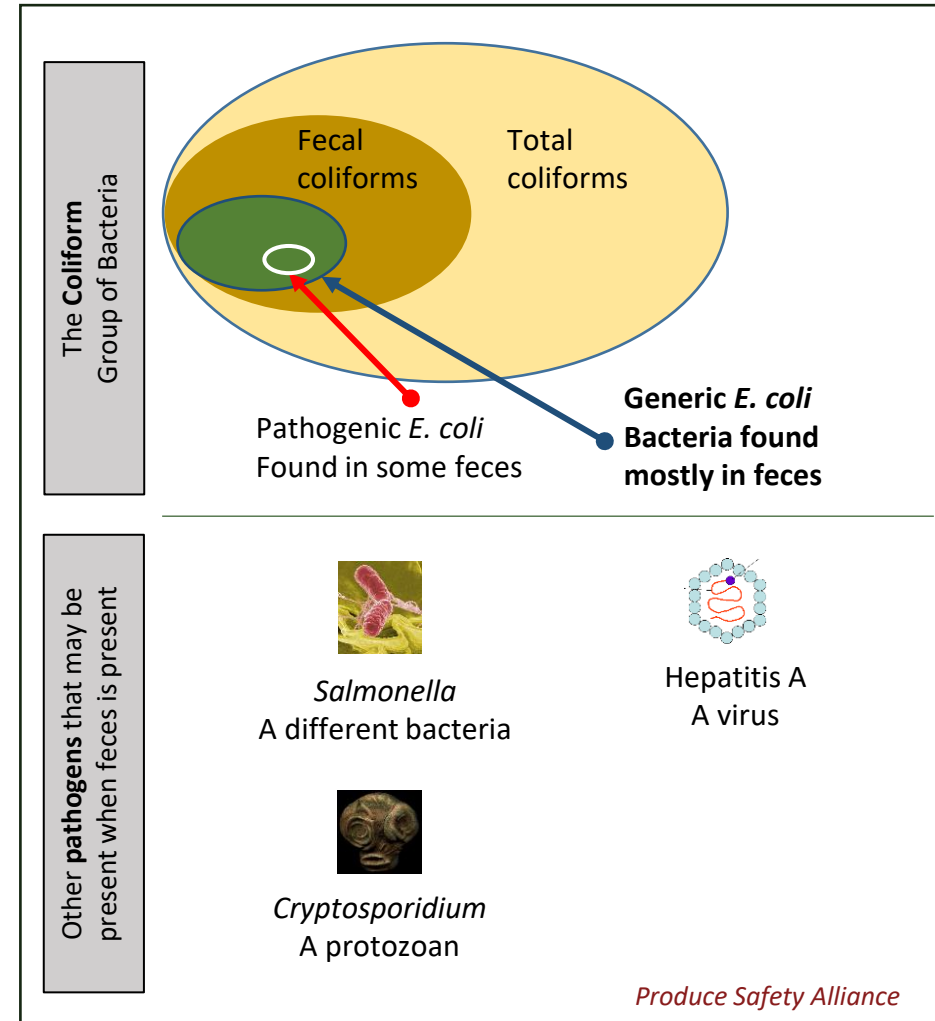
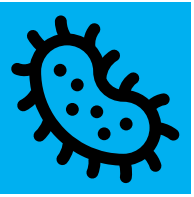
Water Testing – When, how, and why



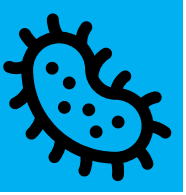
The Big Picture – Assessing and addressing water risks

Water Testing

- **What are you testing for?**
 - Generic *E. coli*
- Indicator of fecal contamination, not direct measure of pathogens
- Numeric measure of microbial quality
- Imperfect tool - hard to correlate number to risk
- Useful for finding trends, telling you to look for problems, checking risk assessments



Water Testing - Labs



- **How do you find a lab?**
 - NECAFS map of water labs
- **State DEP lists, databases** – search for analyte ‘E. coli’, avoid WTP labs
 - CT – *Environmental Laboratory Certification Program*
 - ME – *Laboratory accreditation*
 - MA – *MassDEP Online Searchable Laboratory Certification Listing*
 - NH – *Accredited Laboratory Search*
 - RI – *Certified Analytical Laboratories*
 - VT – *Certified Labs*
- **Google ‘water testing lab’**
- **CALL FIRST!**

Howard Laboratories, Inc.

What is your lab called?
Howard Laboratories, Inc.

Do you sell/provide sample bottles?
Yes

Can you perform any of the following quantitative generic E. coli tests in-house?
EPA Method 1603 (modified mTEC agar)

Can you perform any of the following presence/absence generic E. coli tests in-house?
IDEXX Colilert test kit

Which days of the week do you accept samples?
Monday, Tuesday, Wednesday, Thursday

Should growers call ahead?
No

Can you provide on-farm sample pickups?
No

Phone number
413-47-5533

Email address
howardlabs@gmail.com

Street address
62 Main Street

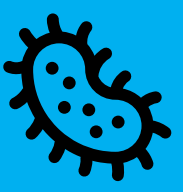
City
Hatfield

State
MA - Massachusetts

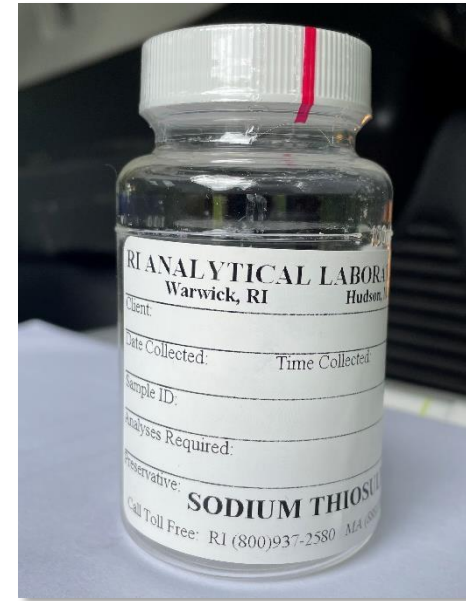
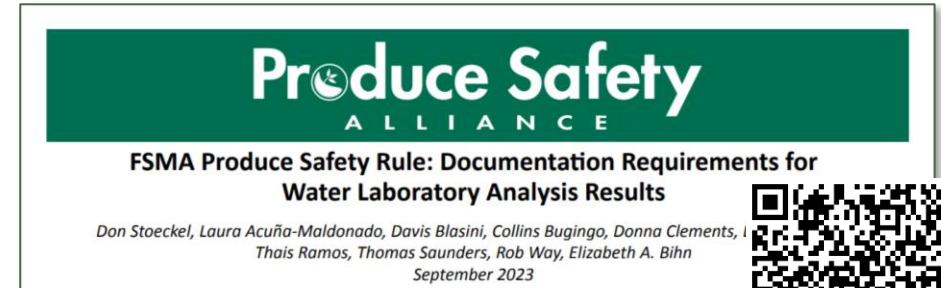
Zip code
01038

County
Hampshire

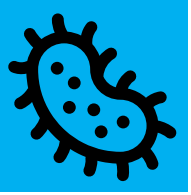
Water Testing - Labs



- **What to ask when talking to a lab?**
 - PSA Fact sheet
- Do you do one of the **approved methods**?
 - FDA list – **Equivalent Testing Methodology for Agricultural Water**
- Can you test surface water? Well water?
- How to get bottles?
- Cost per sample? – some places have a minimum
- Time between sample collection and drop-off?
- When can you drop off samples? e.g., not on Fridays...
- Courier service?
- How long for results?



Water Testing - Methods



Production or Postharvest Water

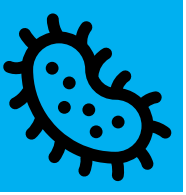
Membrane filtration methods (quantitative, CFU/100 mL)	
Cited method in FDA Fact Sheet	Shorthand method name
EPA Method 1603	Modified mTEC agar
EPA Method 1103.1, Standard Methods 9213 D, ASTM method D5392-93	mTEC agar
EPA Method 1604	MI agar
Standard Methods 9222 B followed by 9222 G	m-Endo followed by NA- MUG agar
Hach method 10029	m-ColiBlue 24 ampules
Most probable number methods (quantitative, MPN/100 mL)	
Product/medium named in FDA Fact Sheet	Method notes
IDEXX Colilert test kit, only if using Quanti-Tray/2000	There are several formats for Colilert, be sure the lab uses the FDA-named quantitative format. One reference protocol for this product is Standard Methods 9223B.
IDEXX Colilert-18 test kit, only if using Quanti-Tray/2000	

Postharvest Water Only

Presence/absence methods (in 100 mL)	
Product/medium named in FDA Fact Sheet	Manufacturer/source
TECTA™ EC/TC medium and instrument	Veolia Water Technologies
Modified Colitag, ATP D05-0035	CPI International
IDEXX Colilert test kit	IDEXX Laboratories, Inc.
IDEXX Colilert-18 test kit	IDEXX Laboratories, Inc.
IDEXX Colisure test kit	IDEXX Laboratories, Inc.
E*Colite Bag or Vial test	Charm Sciences
Readycult Coliforms 100	EMD Millipore, catalog 101298

- If you need to be under a certain number (e.g., 126 CFU/100 ml) ...
 - Get a *quantitative* test

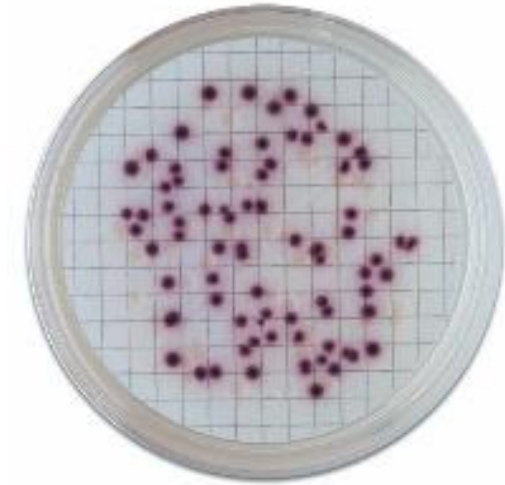
- If you need to be free of generic E. coli (0 CFU/100 ml) ...
 - Can get *quantitative* OR *presence/absence* test



Water Testing - FYI

- **CFU = Colony Forming Units**

- Filter 100 ml sample water through paper
- Put the paper on an agar plate
- Incubate, see how many colonies form in 24 hours
- Measure of colony-forming bacteria in 100 ml water

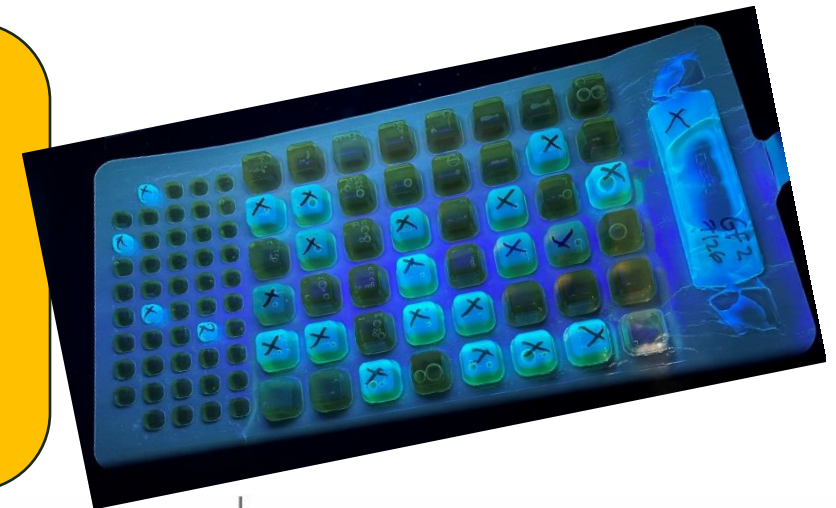


Some methods give results in **MPN/100 ml**.

MPN = Most Probable Number

You can use these results too.

~Equivalent, interchangeable



Water Testing

- **How do you take a sample?**

- Water should be representative of intended use
- As close as practicable to where the water gets pulled out
 - Sample pole, fishing pole, off a dock
- Test when using – early, mid, late season
- Not right after rain
- Don't rinse the bottle
- **Surface**
 - Don't disturb sediment with bottle or by wading into water
 - Don't touch bottle with fingers or to rocks or anything
- **Well/spigot**
 - Clean faucet with alcohol
 - Let water run ~ 1 minute



Water Testing



- **What do I do with the results?**

- Depends who's asking!

- Do they meet regulatory requirements?
 - Do they meet audit requirements?
 - Are they "high"?

- **Use to better understand your water quality**

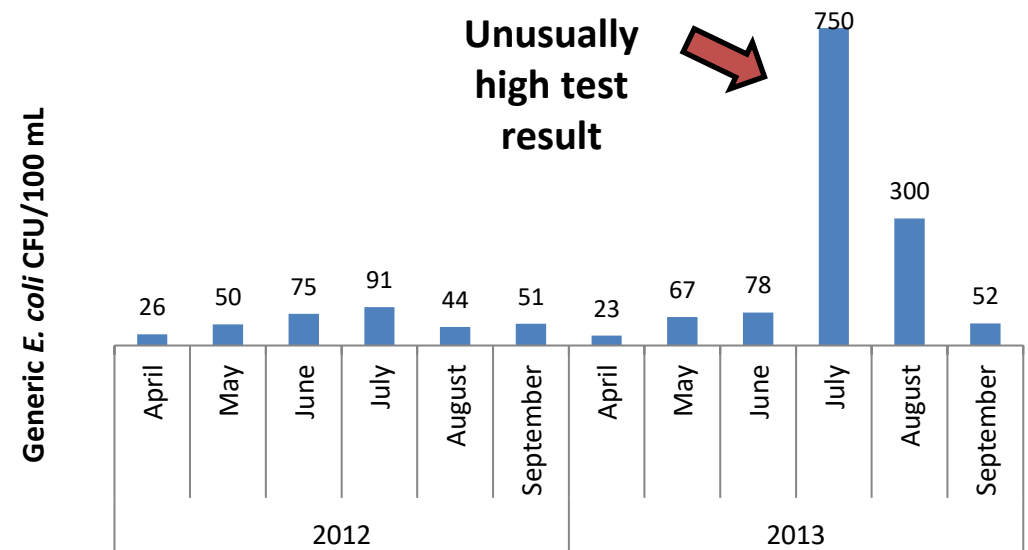
- More testing gives you a sense for what's "normal"
 - Look for trends
 - Look for things that might be impacting quality
 - Check mitigation efforts, assumptions about risks

Client:	Lisa McKeag	Date Sampled:	7-20-17
Sample ID:	██████████	Date Received:	7-20-17
Sampled By:	LM	Time Received:	1500

Sample Location	Time Sampled	E. Coli Present	Irrigation Water Limit
Pull Point CT River	1000	40 CFU*/100 ml	235 CFU/100 ml

Date: 7-21-17
Analyst: DH

* Colony Forming Unit



Produce Safety Alliance

OUTLINE



The Rules – FSMA and audit programs



Water Testing – When, how, and why



The Big Picture – Assessing and addressing water risks

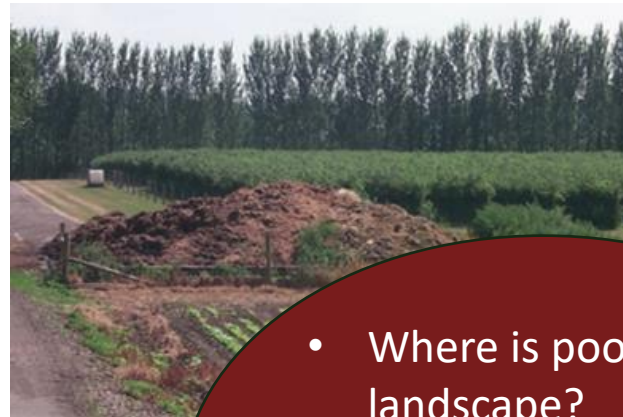
The Big Picture



- **Per FSMA...**

All agricultural water must be safe and of adequate sanitary quality for its intended use.

- Water contaminated with fecal pathogens can contaminate produce
- Can be contaminated at the source or somewhere within the system
- Risk from water needs to be assessed *somehow* ...



- Where is poop in the landscape?
- How could it get in the water?
- How do you stop it getting in the water?

The Big Picture

Thanks, Phil Tocco!



The Big Picture

- **Assess ...**
 - Can you move source of contamination – e.g., chicken house
 - Can you install barrier? – e.g., berm, veg buffer, fence
 - Repair infrastructure – wellheads, leaks, cracks



The Big Picture



- **Reduce risks from water ...**
 - Reduce contact with the crop
 - Increase time between application and harvest





Summary

- Map out the system and inspect regularly, at least annually
- Test water, review test results, look for trends
- If you have doubts or know/believe water is low quality – discontinue use, look for cause
- Use less risky application methods, e.g., drip instead of overhead
- Increase time between application and harvest

Thank You!
Questions?



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