Georgia Adopt-A-Stream

BACTERIAL MONITORING WORKSHOP

Georgia
Adopt-A-Stream
Volunteer Water Quality Monitoring

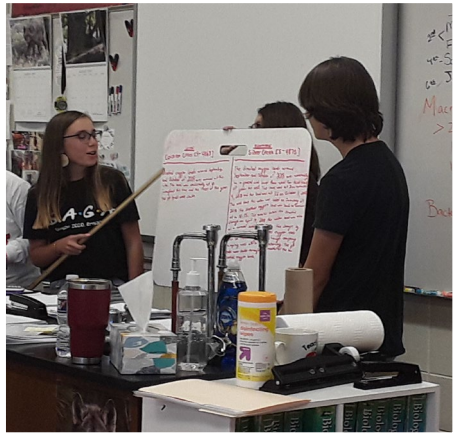
GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Georgia Adopt-A-Stream

A citizen science water quality monitoring program encouraging all Georgians to get familiar with their watersheds, monitor impacts, improve streams, rivers, wetlands, lakes, and estuaries, and inform others about their effect on water quality.

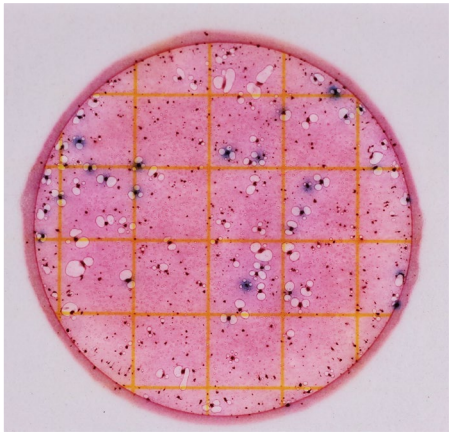
Georgia Adopt-A-Stream
Volunteer Water Quality Monitoring

A
Awareness



Increase public **awareness** of nonpoint source pollution & water quality issues

D
Data



Collect baseline water quality **data** according to Adopt-A-Stream protocols

O
Observations

Take **observations** of sites to note water quality conditions

P
Partnerships

Seek **partnerships** with local gov'ts, nonprofits, & other organizations to share results & resources

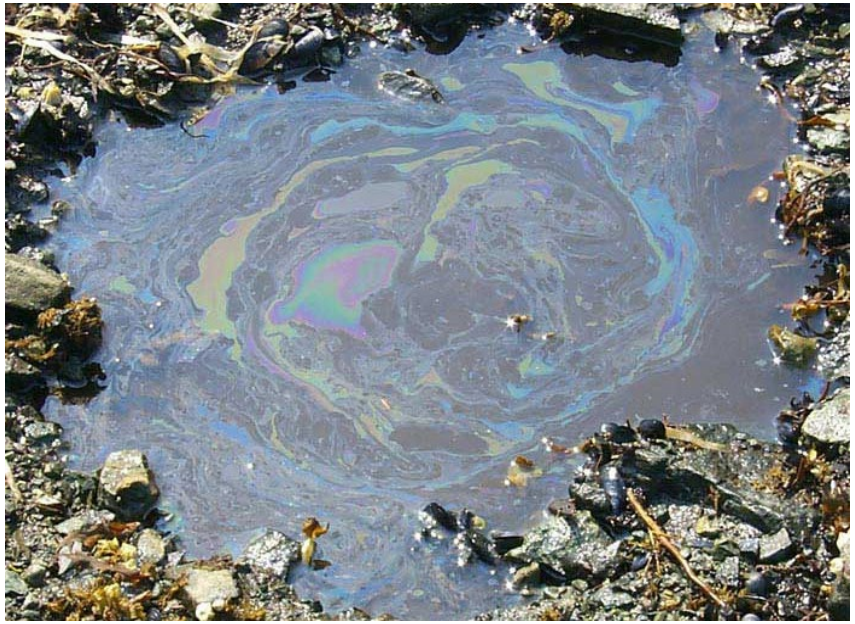
T
Tools & Training

Utilize **tools & training** provided by staff & local coordinators

TYPES OF POLLUTION

POINT SOURCE POLLUTION

- Easily identifiable pollutant source
- Regulated by GA EPD through NPDES permitting process



NONPOINT SOURCE POLLUTION

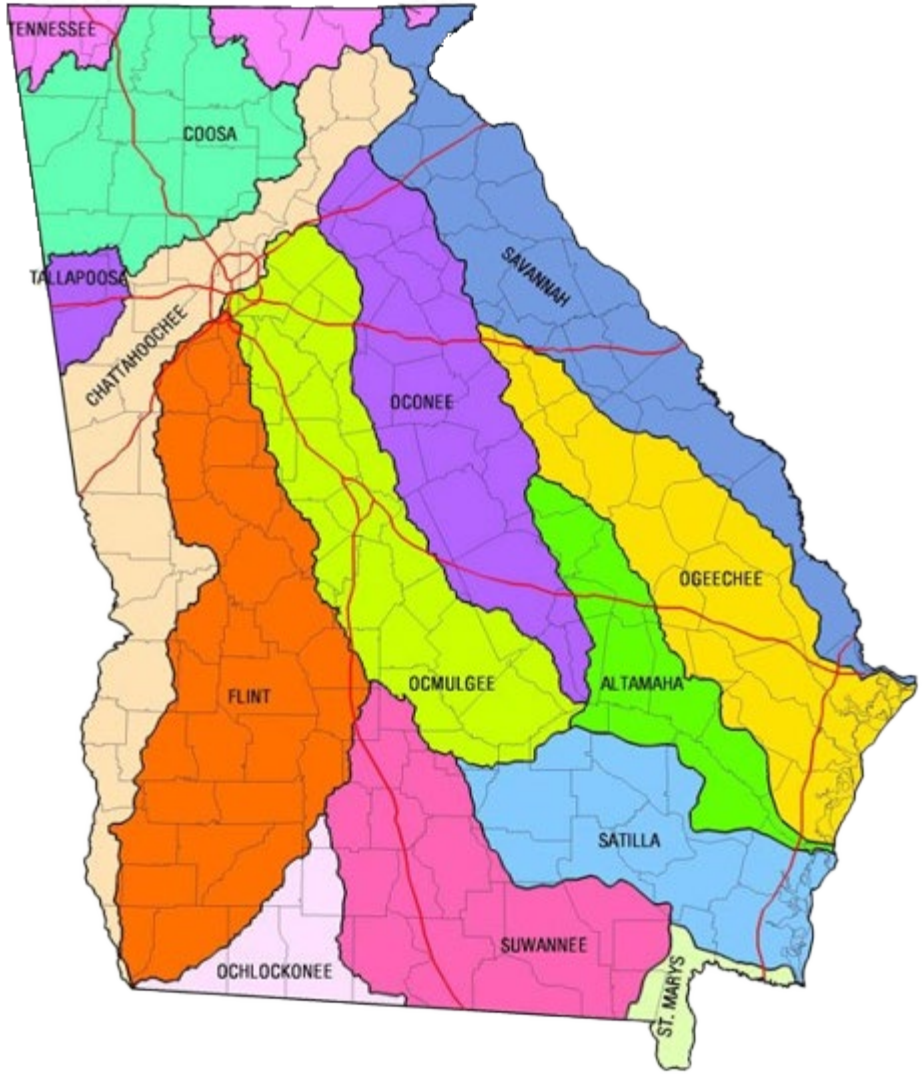
- Sources not easily distinguished/identified
- Everyone contributes
- Main cause of water quality problems in GA

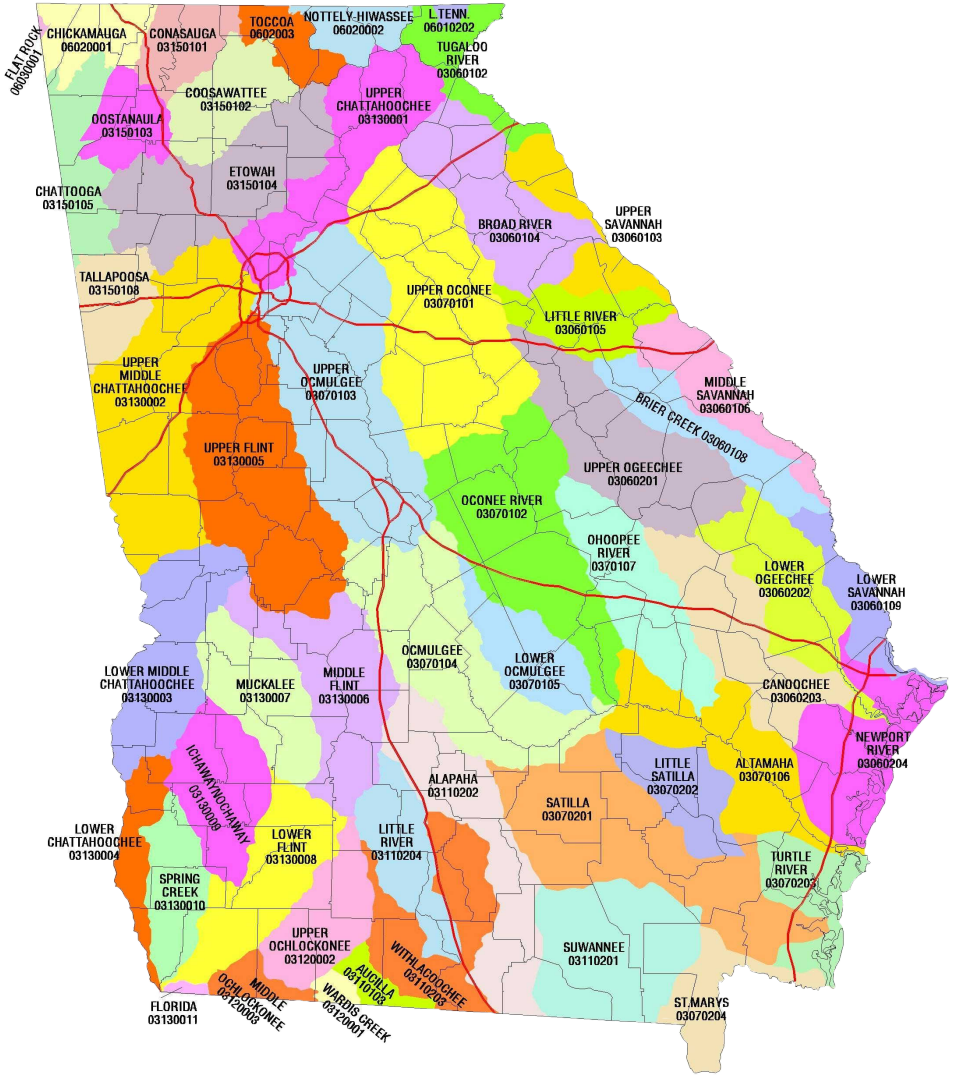
WHAT IS A WATERSHED?

- **A land area from which water, sediment, and dissolved materials drain to a common point along a stream, wetland, lake, or river.**
- Its boundaries are defined by the highest points of land around the waterbody.

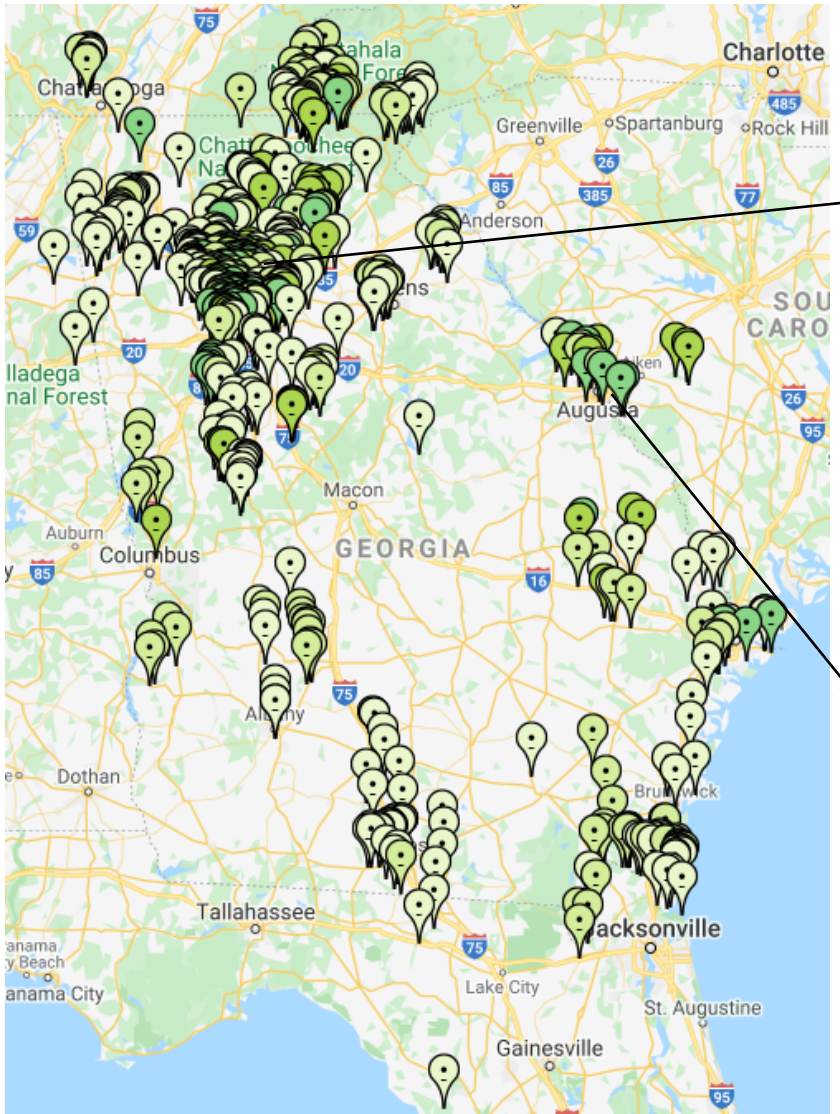
There is an unbreakable link between human health and wellbeing and ecosystems. -Walter Reid

WHERE IS YOUR WATERSHED?





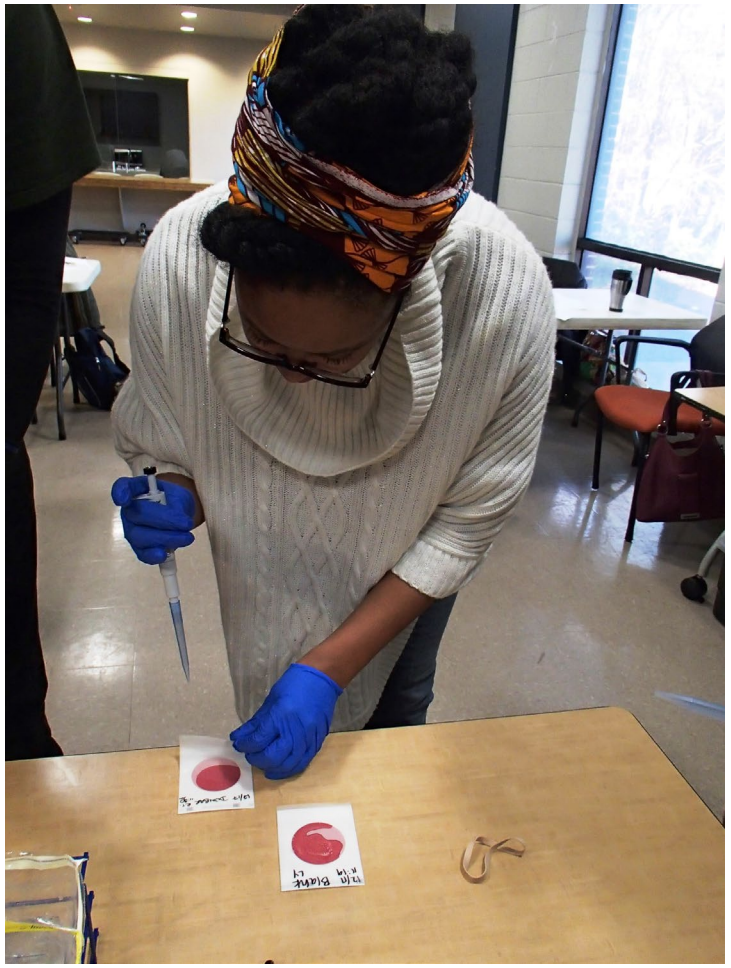
VOLUNTEER NETWORK AND SUPPORT



VOLUNTEER NETWORK AND SUPPORT

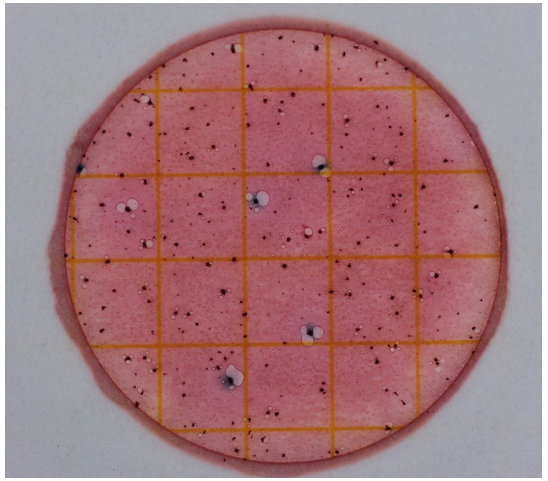
AAS VOLUNTEERS USE STANDARDIZED PROTOCOLS

- EPA Approved Quality Assurance Project Plan (QAPP)
- Quality Assurance/Quality Control (QA/QC)
  - Required to attend workshop(s) and pass certification test(s) to become certified
  - Only individuals are certified
  - Set monitoring protocol ensures all volunteers are collecting baseline data using standard methods
  - Only certified volunteers can enter data, but anyone can access the 20+ years of data in the online AAS database



EARNING YOUR QA/QC BACTERIAL CERTIFICATION

FIELD & LAB:
Volunteers must demonstrate how to properly collect and plate a sample



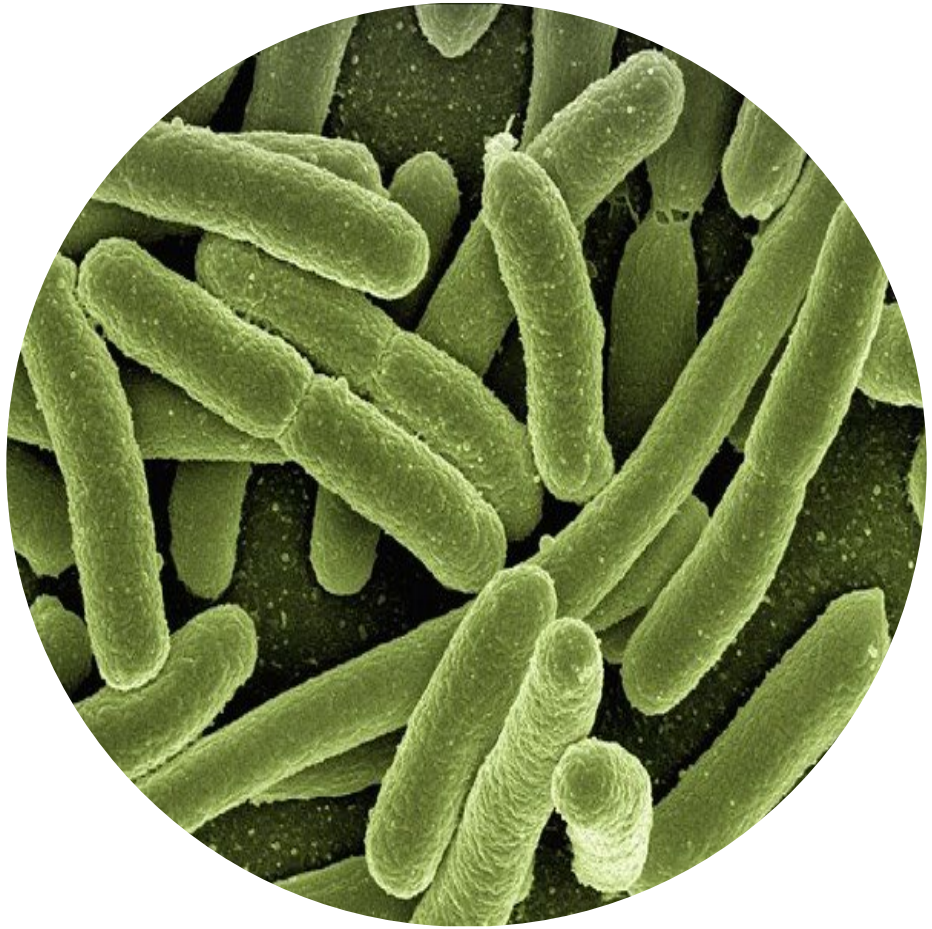
WRITTEN TEST:
Volunteers must pass a written evaluation with a score of at least 80% and must correctly identify E. coli colonies and calculate E. coli levels of example plates with accuracy of at least 90%

WHY IS BACTERIAL MONITORING IMPORTANT?

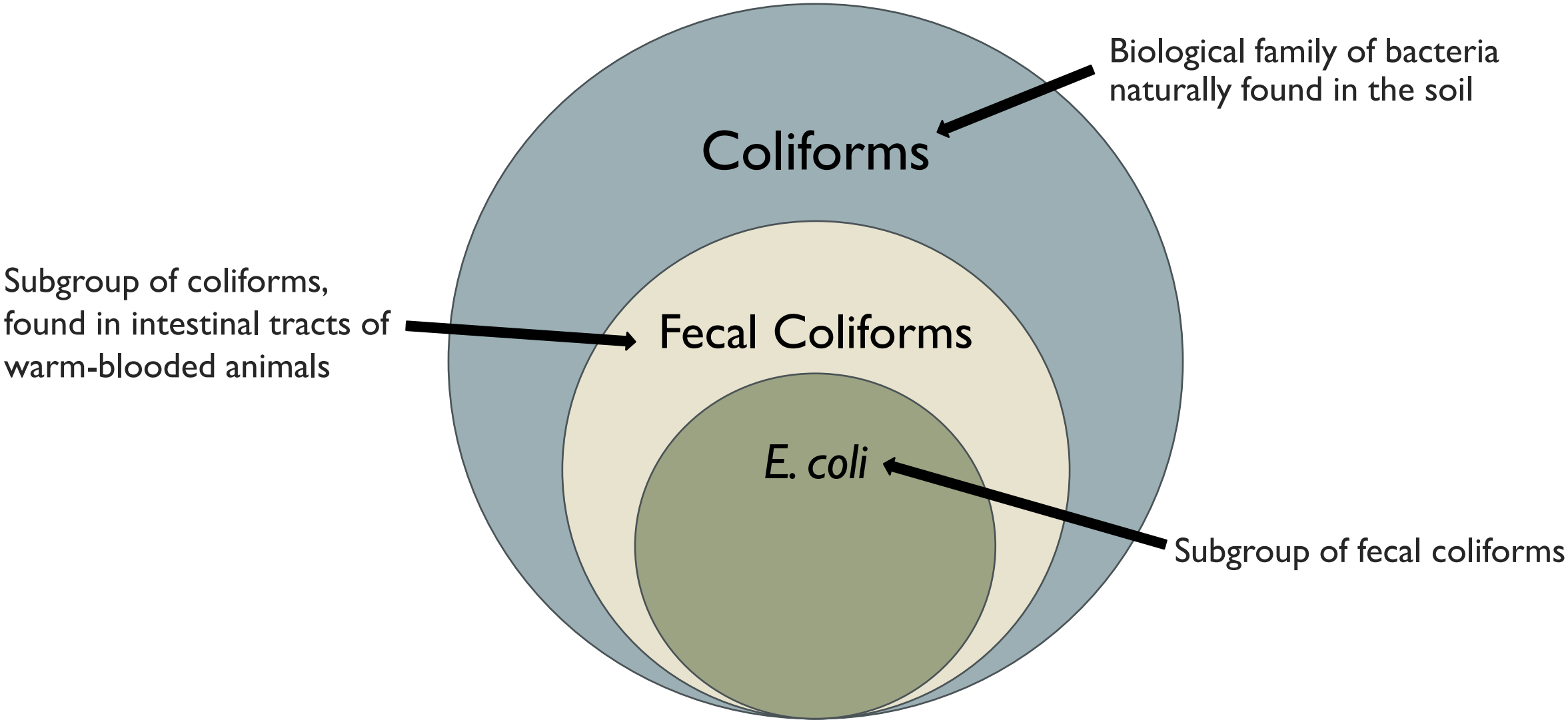
- **Monitor bacterial contamination of surface waters to assess if pathogens are present**
  - Human health is at risk when in contact with waters that contain harmful bacteria
  - Gaining a snapshot of surface water contamination (*E. coli* colonies), not long-term trends

ABOUT BACTERIA

- **Single-celled, living microscopic organisms**
- Pros:
  - Decomposition
  - Digestion
  - Nutrient Cycling
  - Pollution Control
- Risks:
  - Release Toxins
  - Cause Disease (Pathogens)



WHAT IS *E. COLI*?



WHY MONITOR FOR *E. COLI*?

- **High levels indicate the possible presence of pathogens**
- Sources of *E. coli* in waterways:
  - **Wildlife**
  - **Livestock**
  - **Urban storm runoff**
  - **Sewage**
    - Leaking sewage pipes
    - Combined sewer overflow
    - Wastewater treatment plants
    - Failing septic systems

WHERE, WHEN, AND HOW OFTEN?

- Where to monitor:
  - **Well mixed, flowing area of water**
  - Same site location
- When to monitor:
  - Normal flow conditions
  - Same time of day
- How often to monitor:
  - **Once a month**

FACTORS INFLUENCING *E. COLI* COUNTS

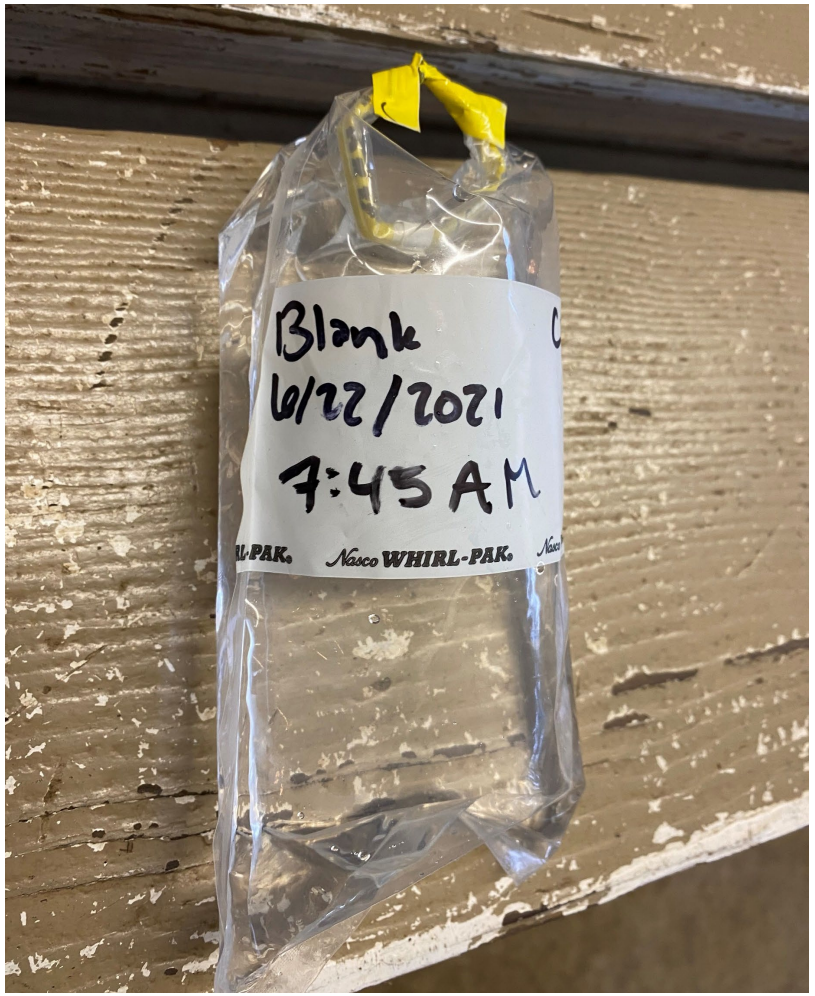
- Weather:
  - **Higher levels following a rainstorm or heavy runoff event**
  - Avoid sampling during high flow

- Season/Temperature:
  - **Warmer water temperature = higher *E. coli* replication rates**
  - **Colder water temperature = lower *E. coli* replication rates**

HOW TO MONITOR FOR *E. COLI*

STEP 1: PREPARE THE BLANK/CONTROL

- **Proves no contamination occurred during sample collection, transport, or plating**
- How to prepare a blank:
  - Label Whirl-pak® bag as a blank
  - Put gloves on and remove perforated seal
  - Use small white tabs to open the bag
  - Fill the bag 2/3 up with DISTILLED WATER
  - Whirl!
  - Place in sanitized cooler with ice

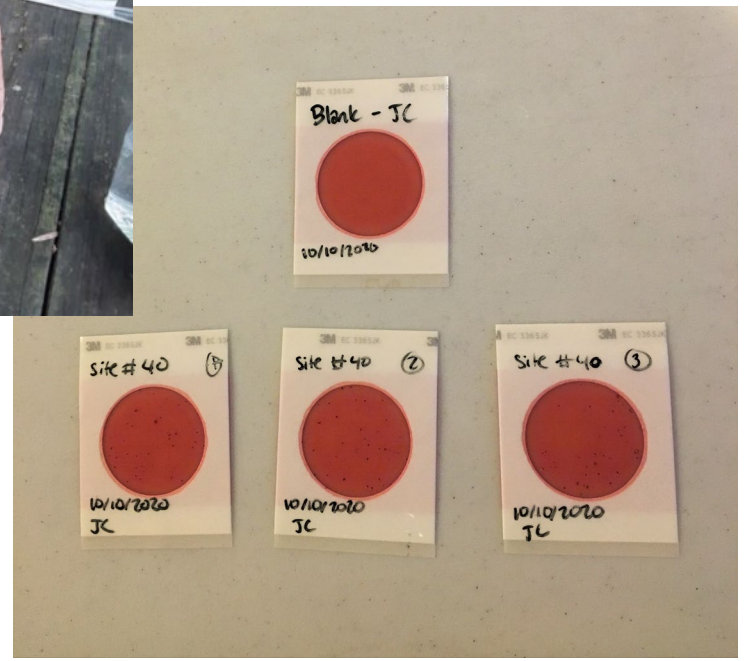


STEP 2: COLLECTING A SAMPLE

- Label a Whirl-pak® bag with the location, date, and time
- Use same procedure as blank to open
- Fill Whirl-pak® 2/3 with stream water (collected upstream) and whirl!
- **Place sample in cooler immediately after collection**
  - **Ice prevents E. coli from replicating**
  - **Lid prevents UV rays killing existing bacteria**
- **Plate within 24 hrs of collection**

STEP 3: PLATING YOUR SAMPLE

- Clean area with disinfectant
- Invert Whirl-pak® to mix sample
- Label 3M Petrifilm plates
  - Date and time
  - Site name
  - Blank, Plate 1, Plate 2, Plate 3
- Use pipette to take one **1 mL sample from the blank, plus three 1 mL samples from the stream water (4 plates total)**

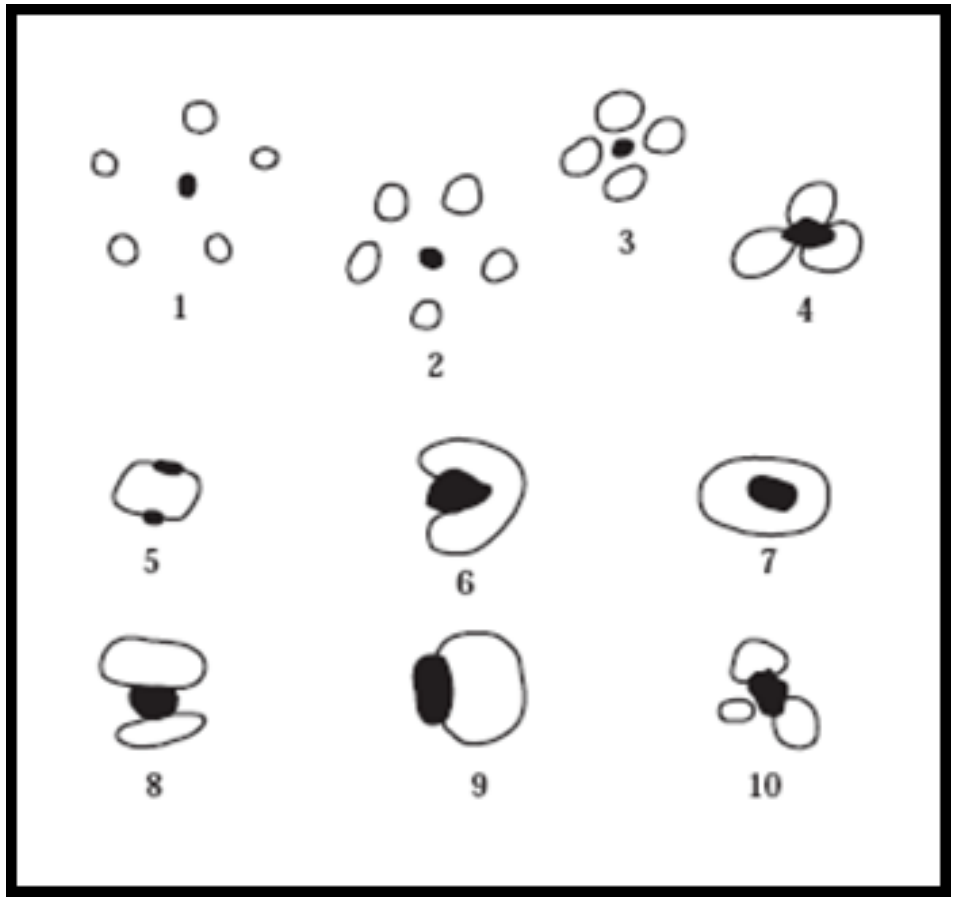


STEP 4: INCUBATING YOUR SAMPLE

- **35°C ± 1°C for 24 hours ± 1 hour**
- Check minimum and maximum temperatures after incubating
- Use AAS or EPA approved incubator

STEP 5: READING YOUR RESULTS

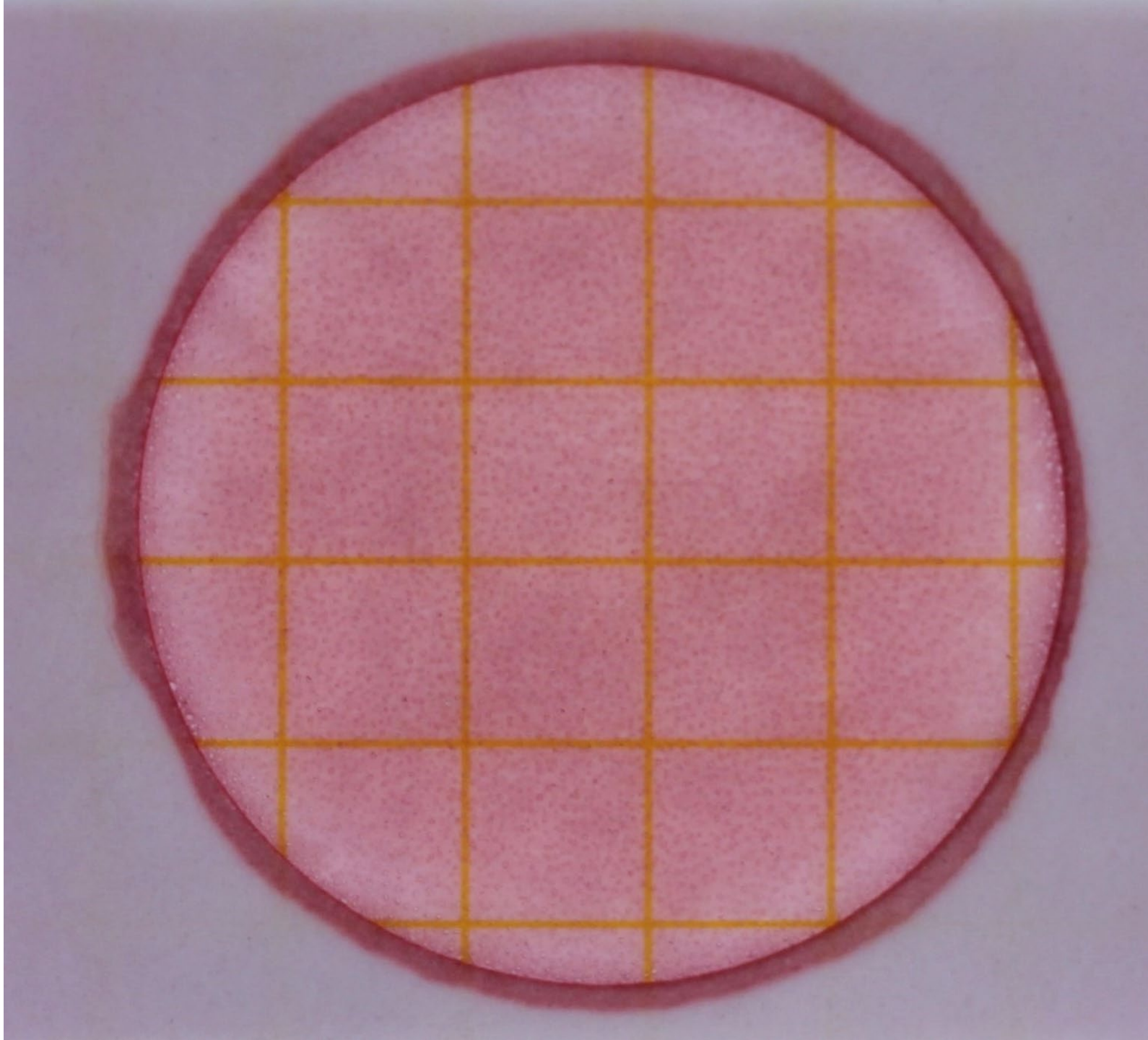
- Only count **blue colonies with gas bubbles**
- Do not count colonies growing more than halfway off the medium
- Units for bacteria: **Colony Forming Units (CFU)/100 mL**



Possible gas bubble patterns

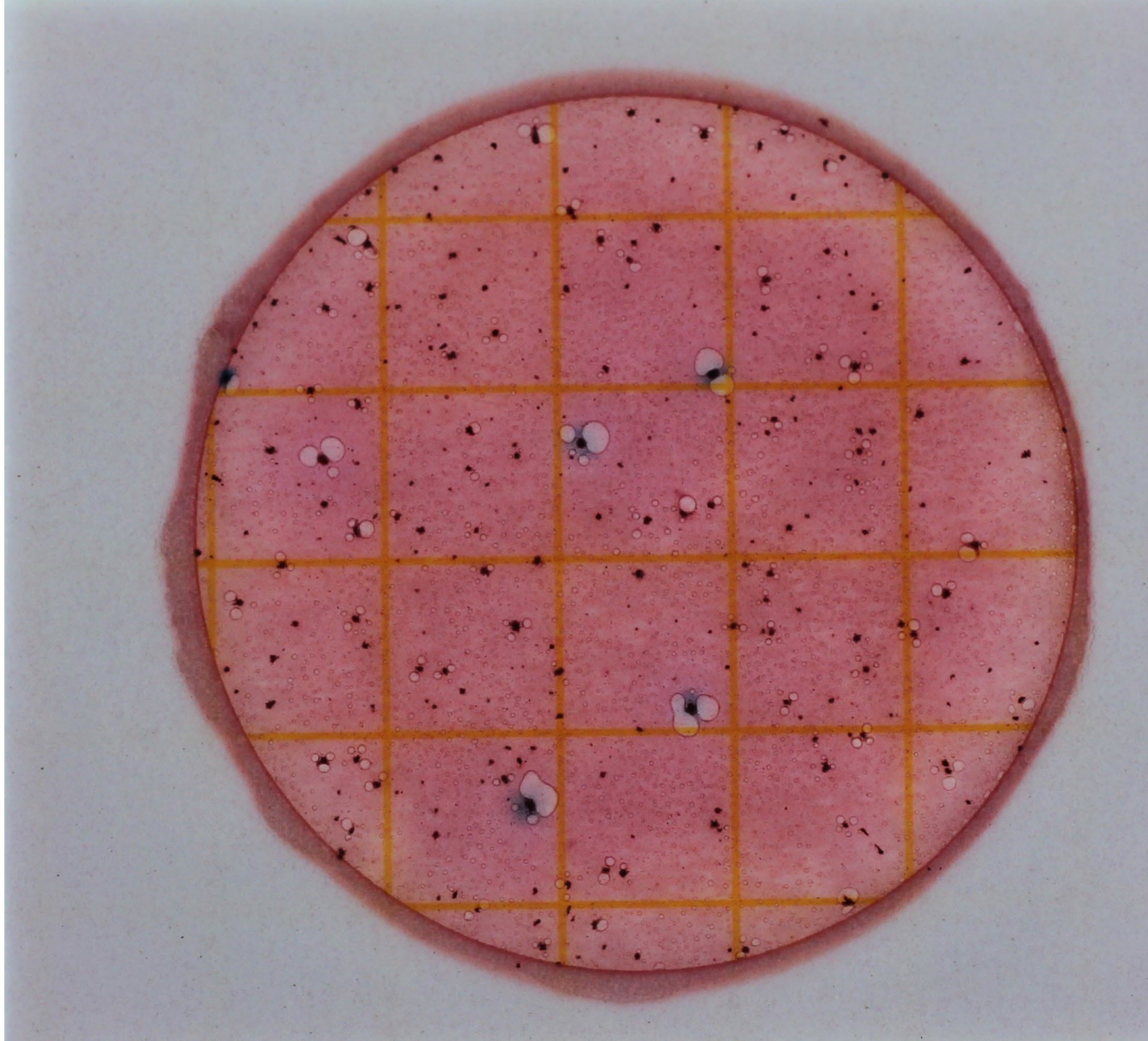
BLANK/ CONTROL

There should not be any colonies (*E. coli* or general coliform) on the blank!



EXAMPLE #1

How many *E. coli* colonies do you see?



EXAMPLE #1 ANSWER

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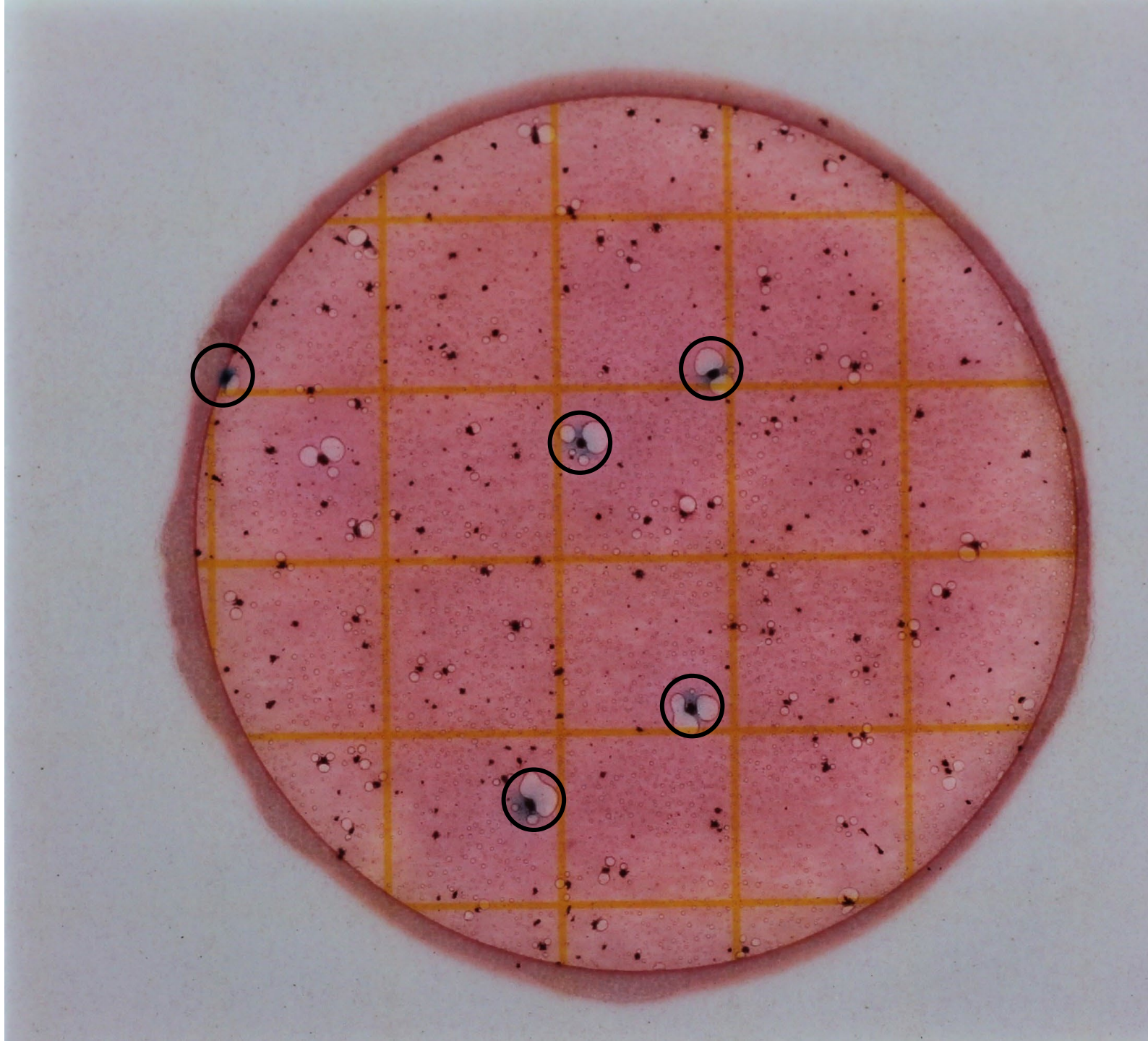

EXAMPLE #2

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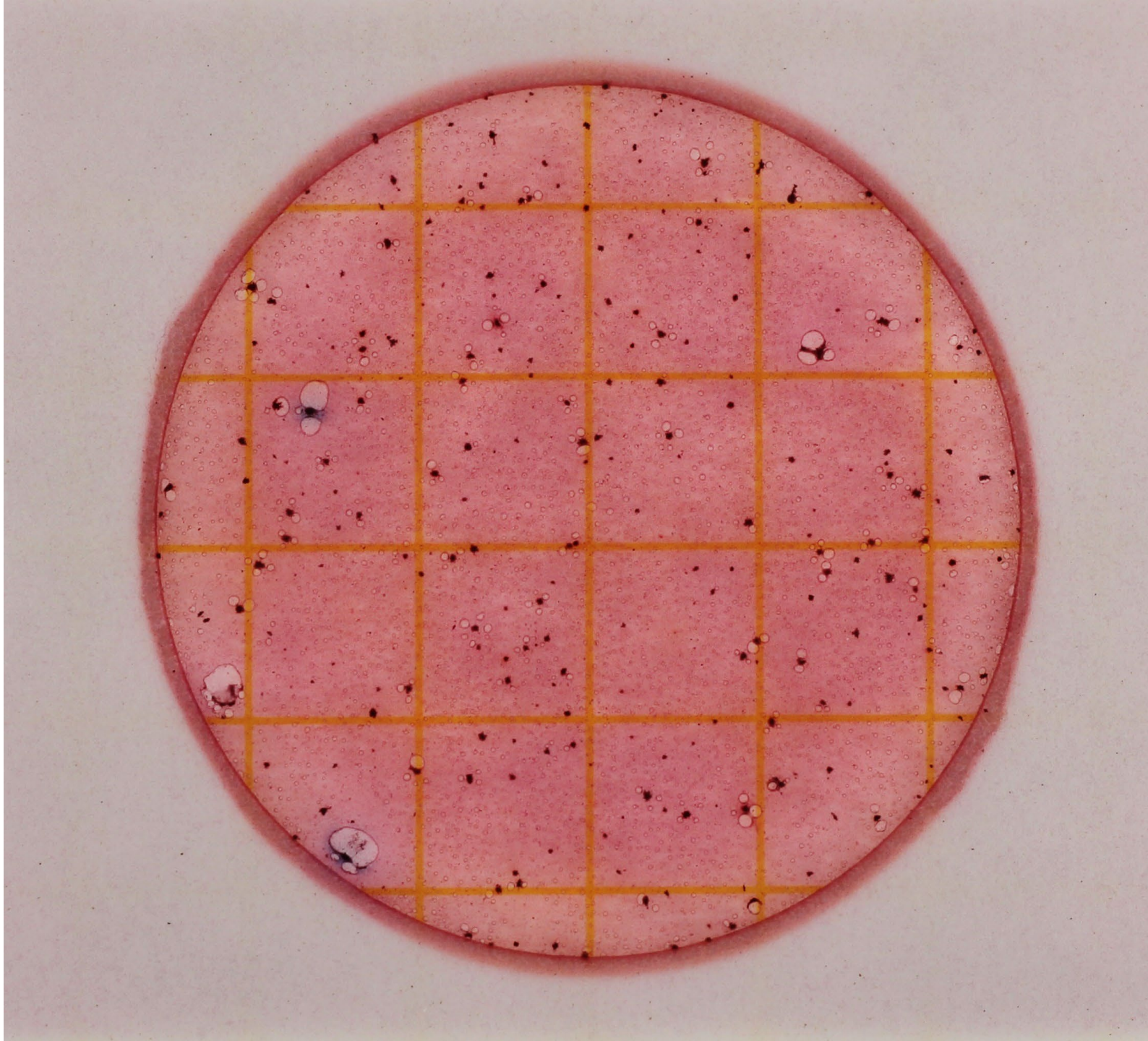

EXAMPLE #2 ANSWER

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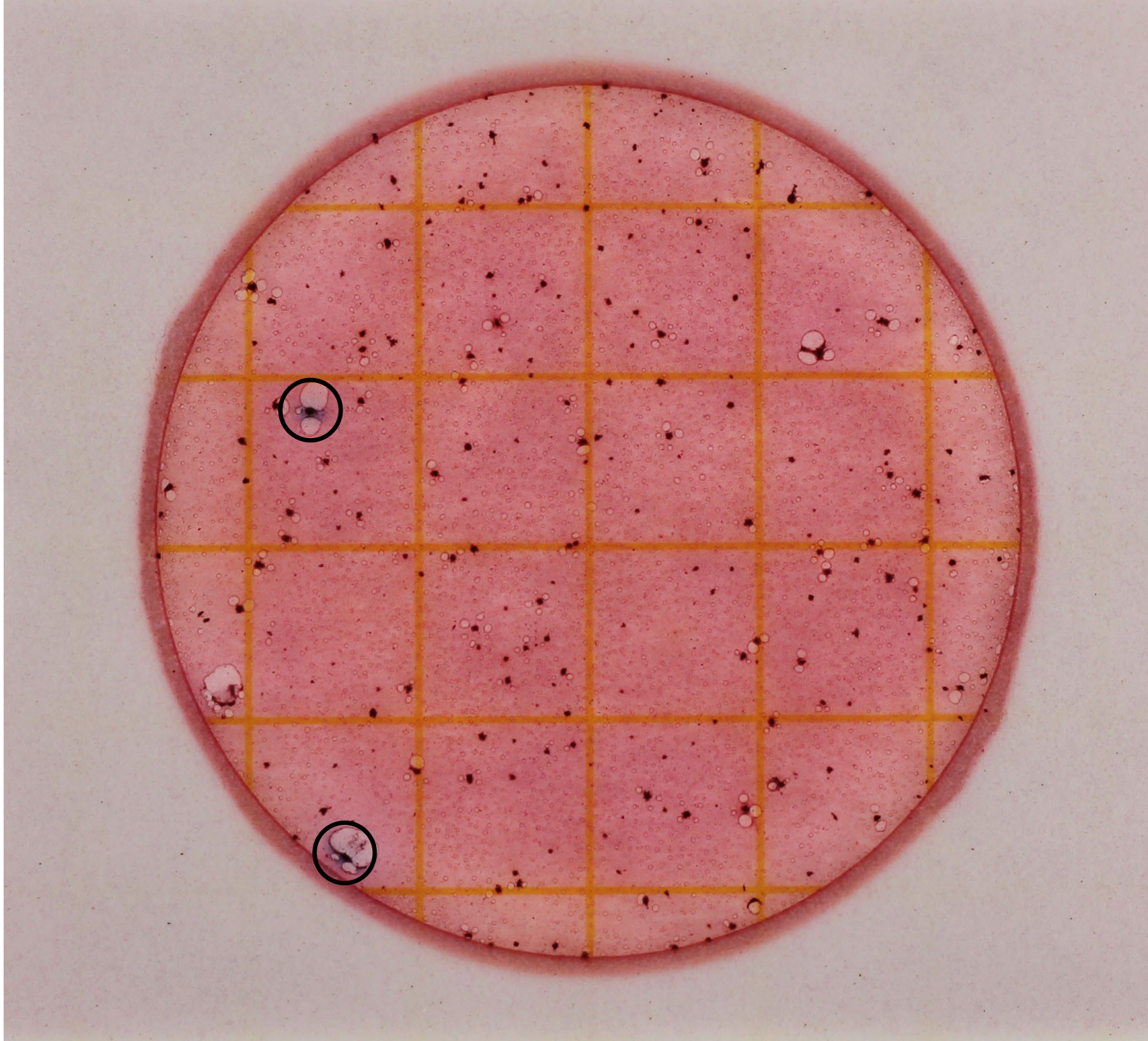

EXAMPLE #3

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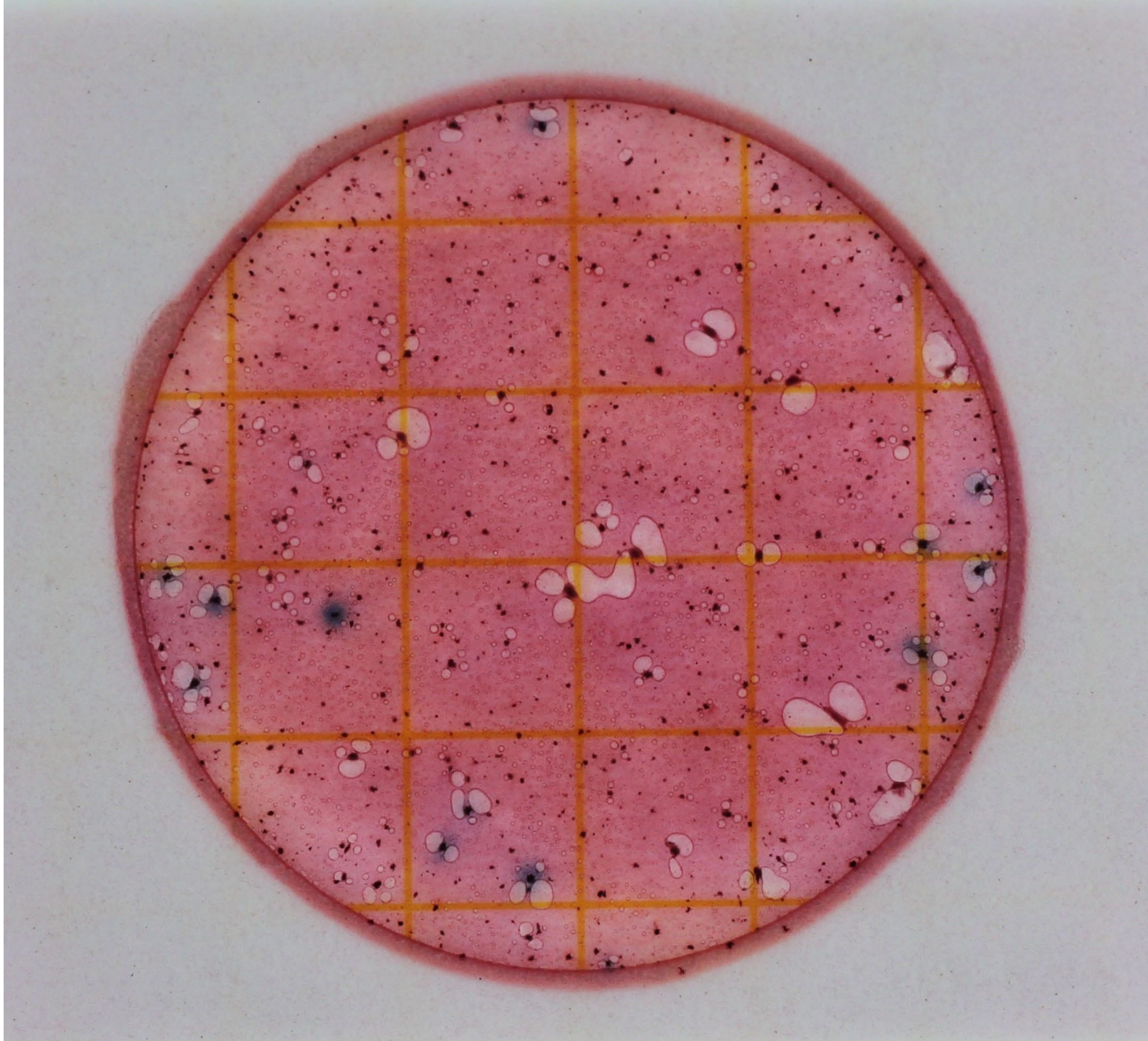

EXAMPLE #3 ANSWER

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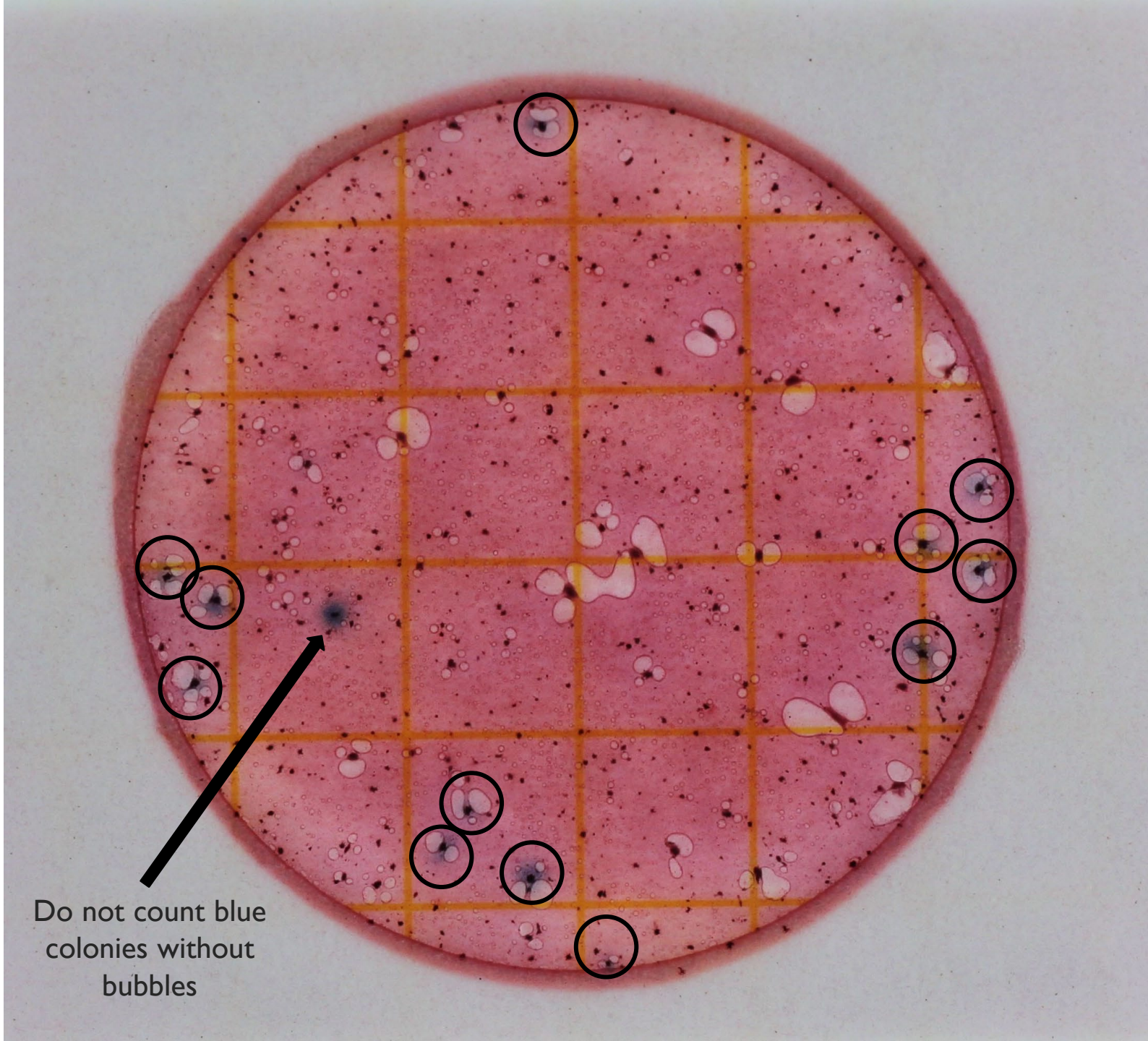
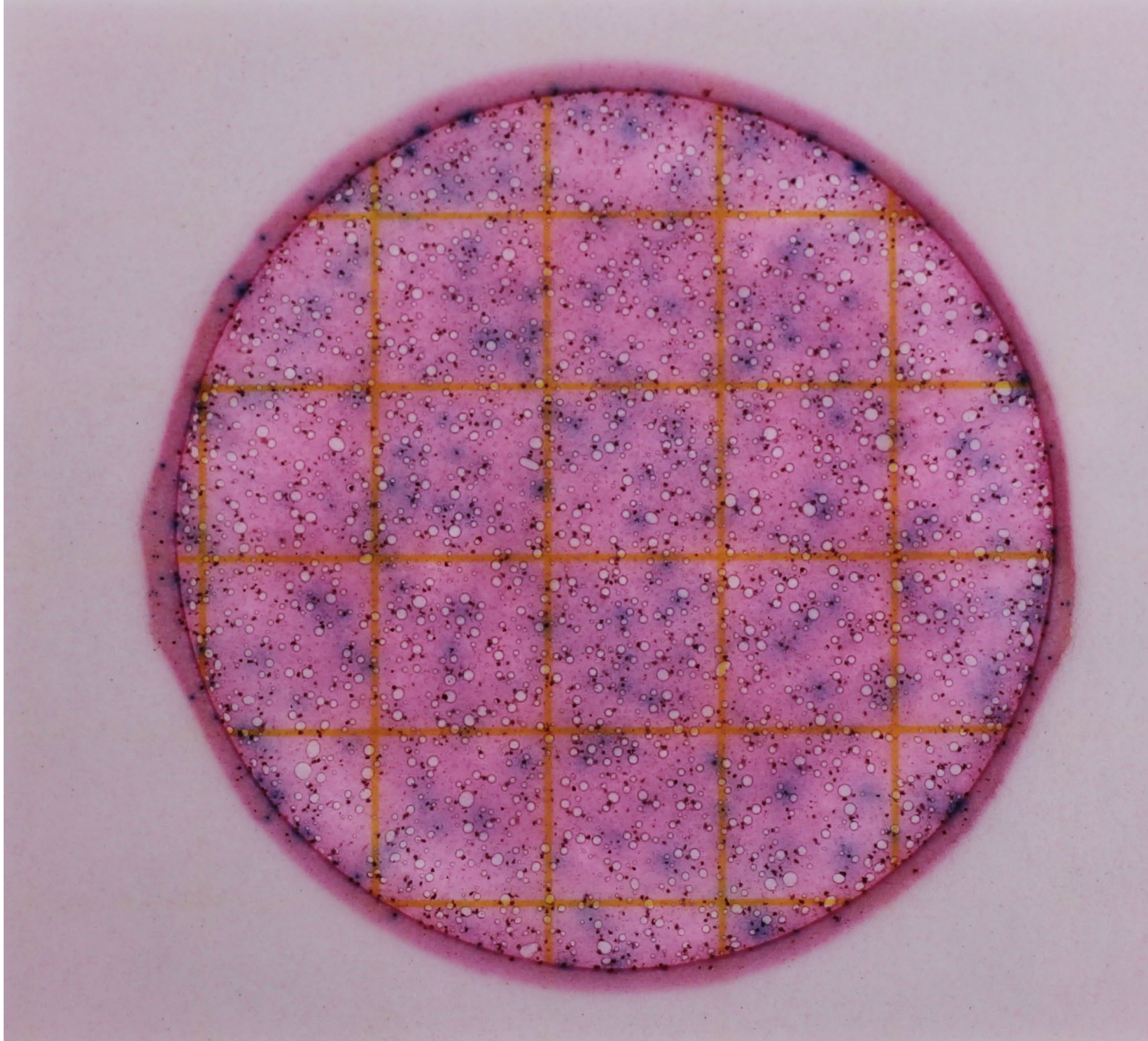


EXAMPLE #4

How many *E. coli* colonies do you see?



EXAMPLE #4 ANSWER

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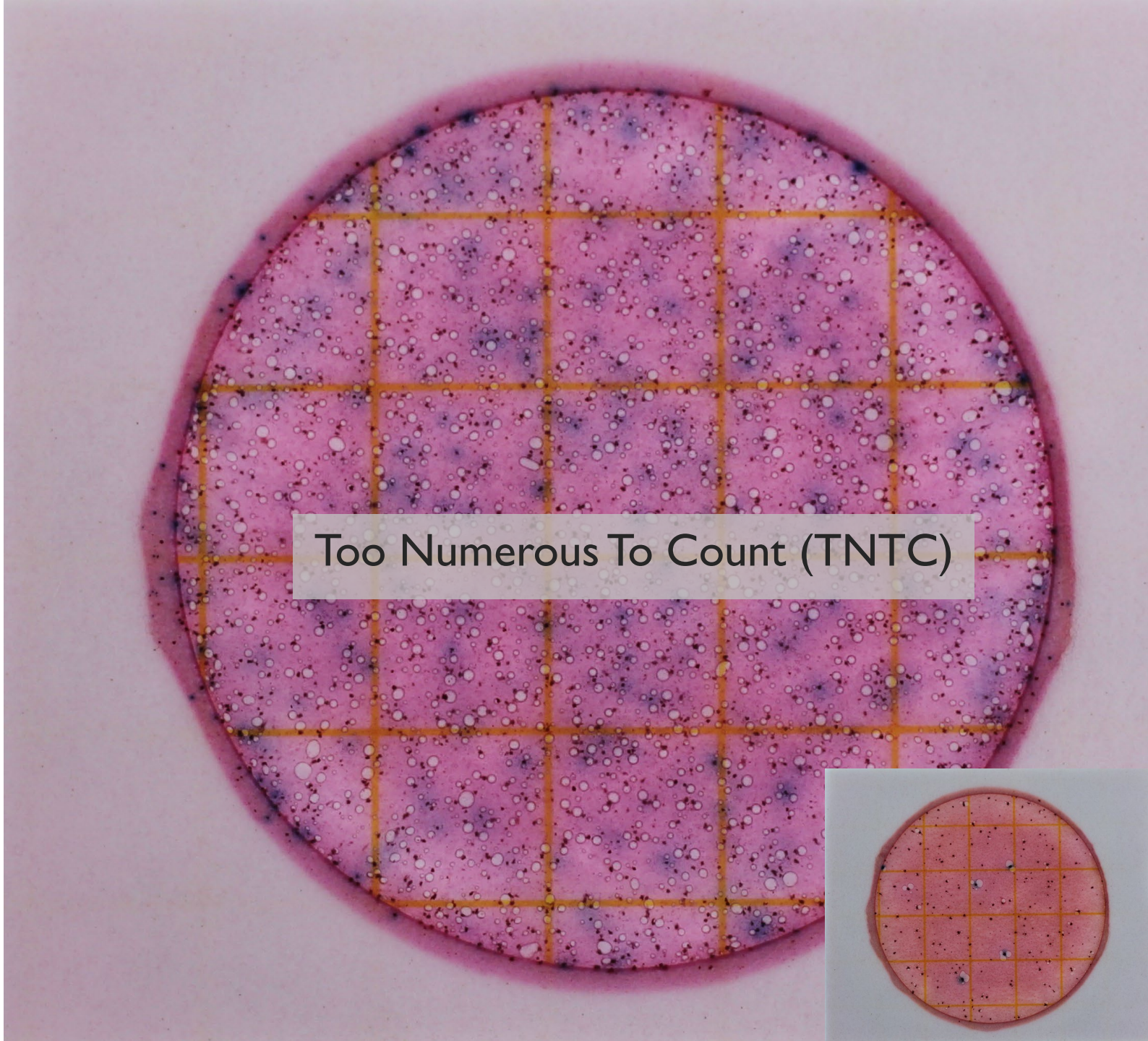
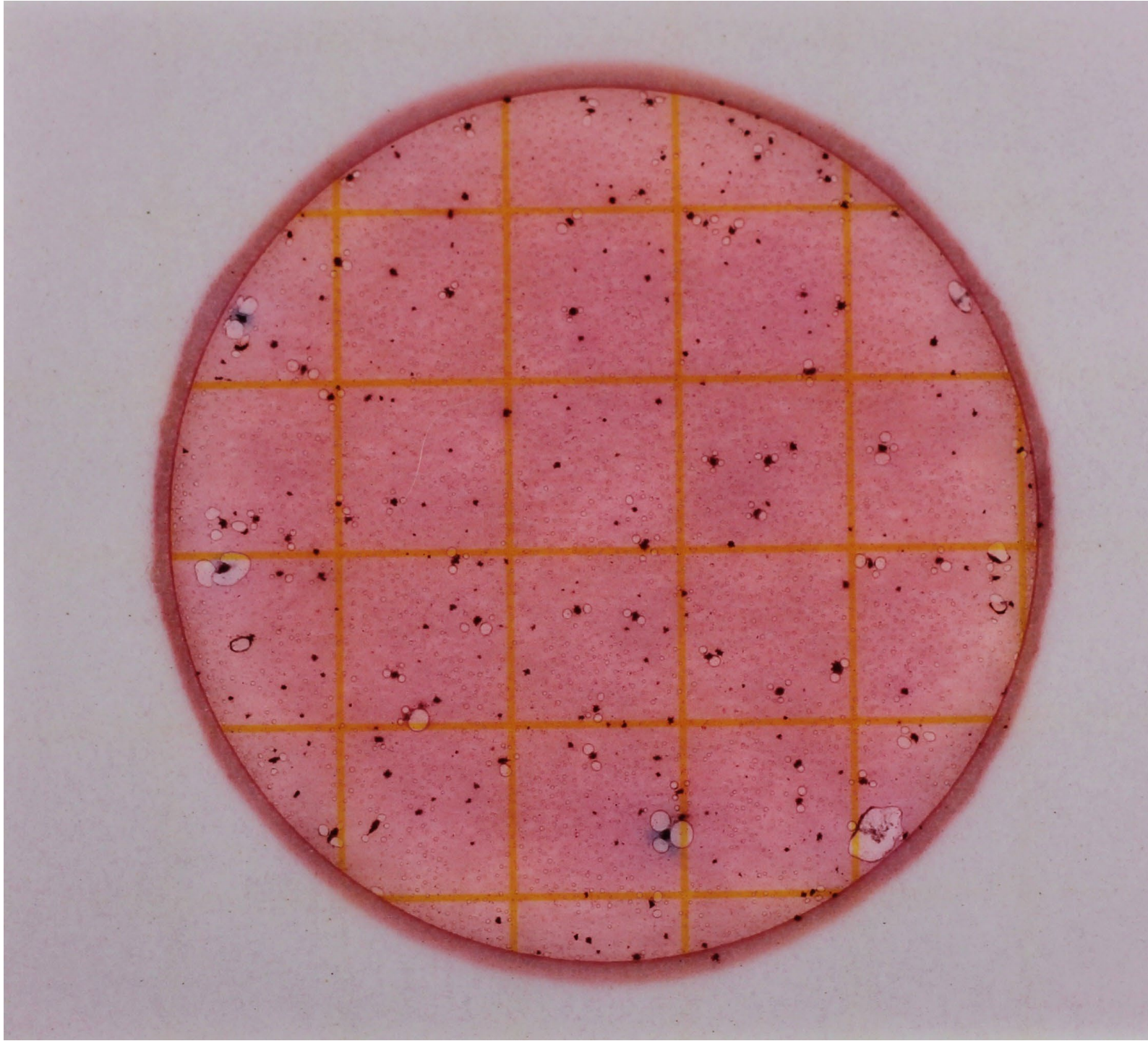


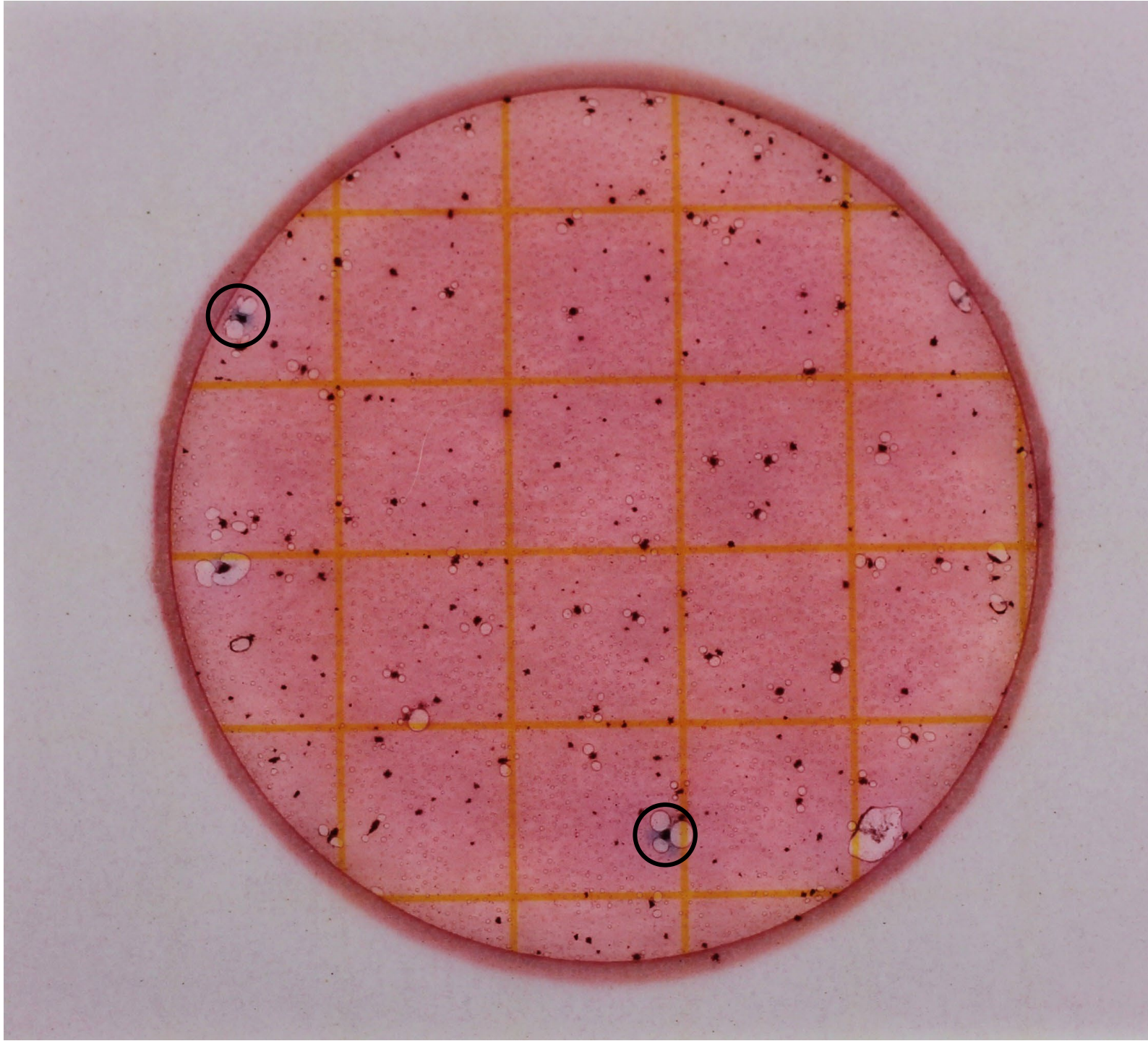
EXAMPLE #5

How many *E. coli* colonies do you see?



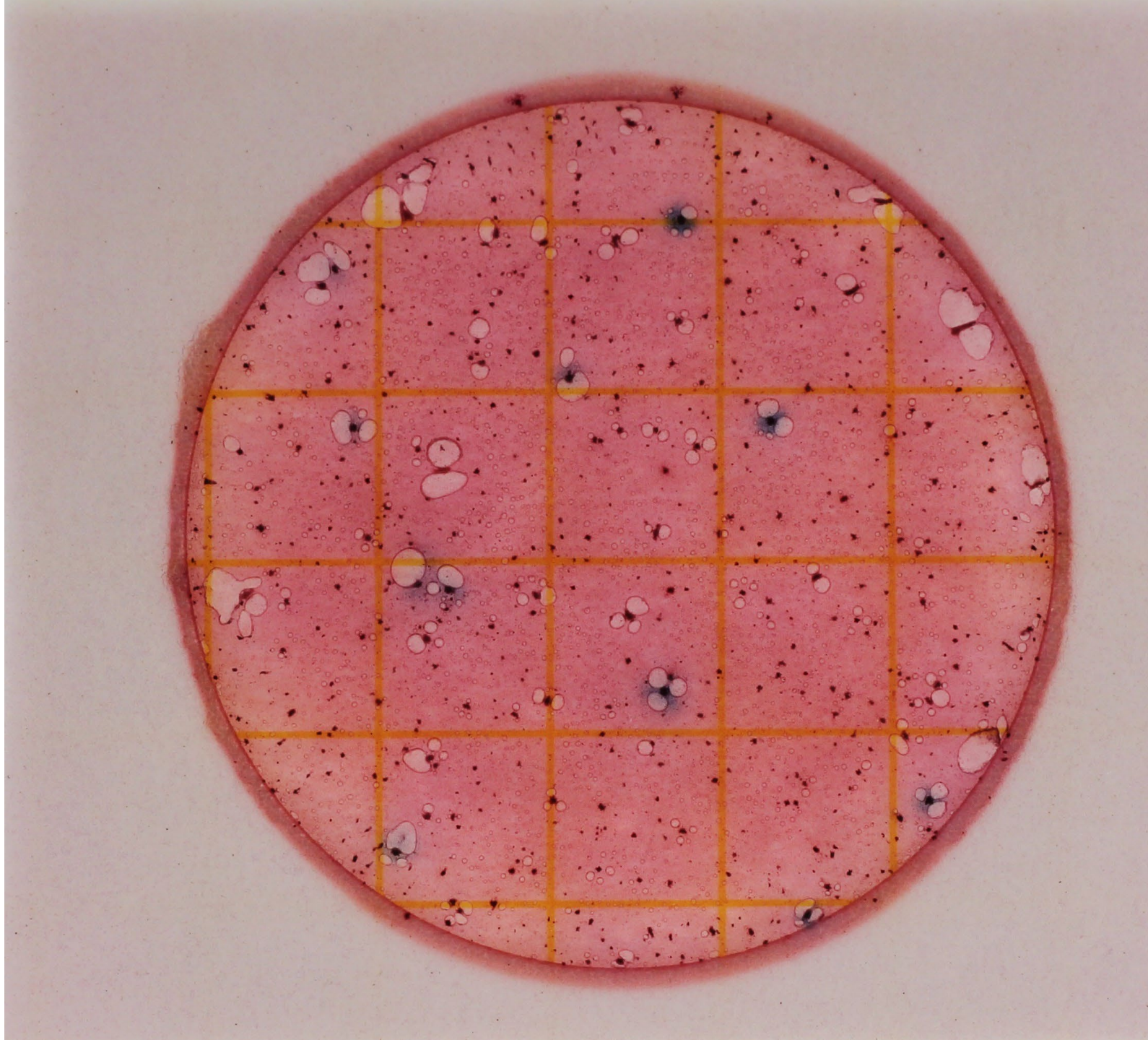
EXAMPLE #5 ANSWER

How many *E. coli* colonies do you see?



EXAMPLE #6

How many *E. coli* colonies do you see?



EXAMPLE #6 ANSWER

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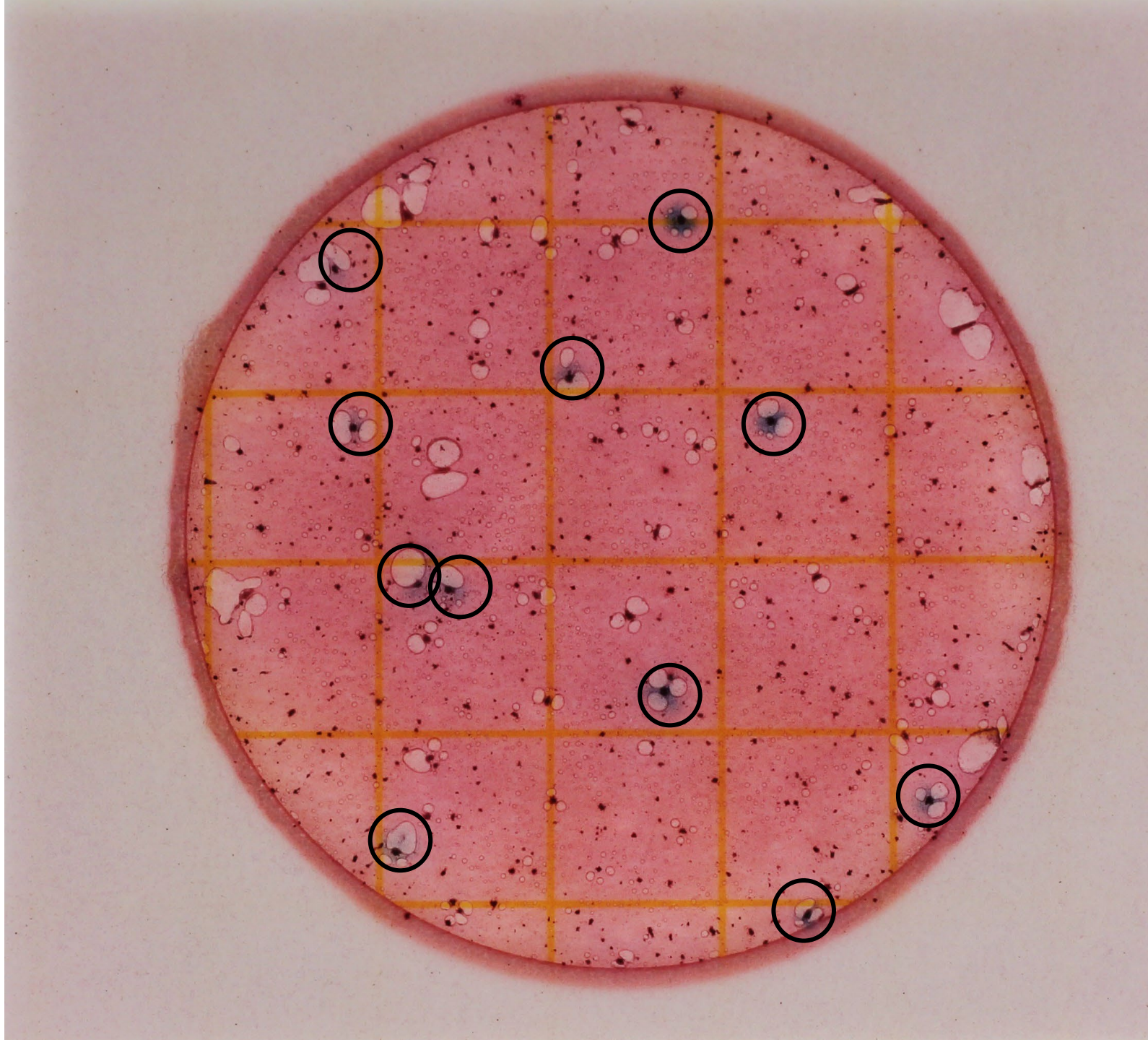
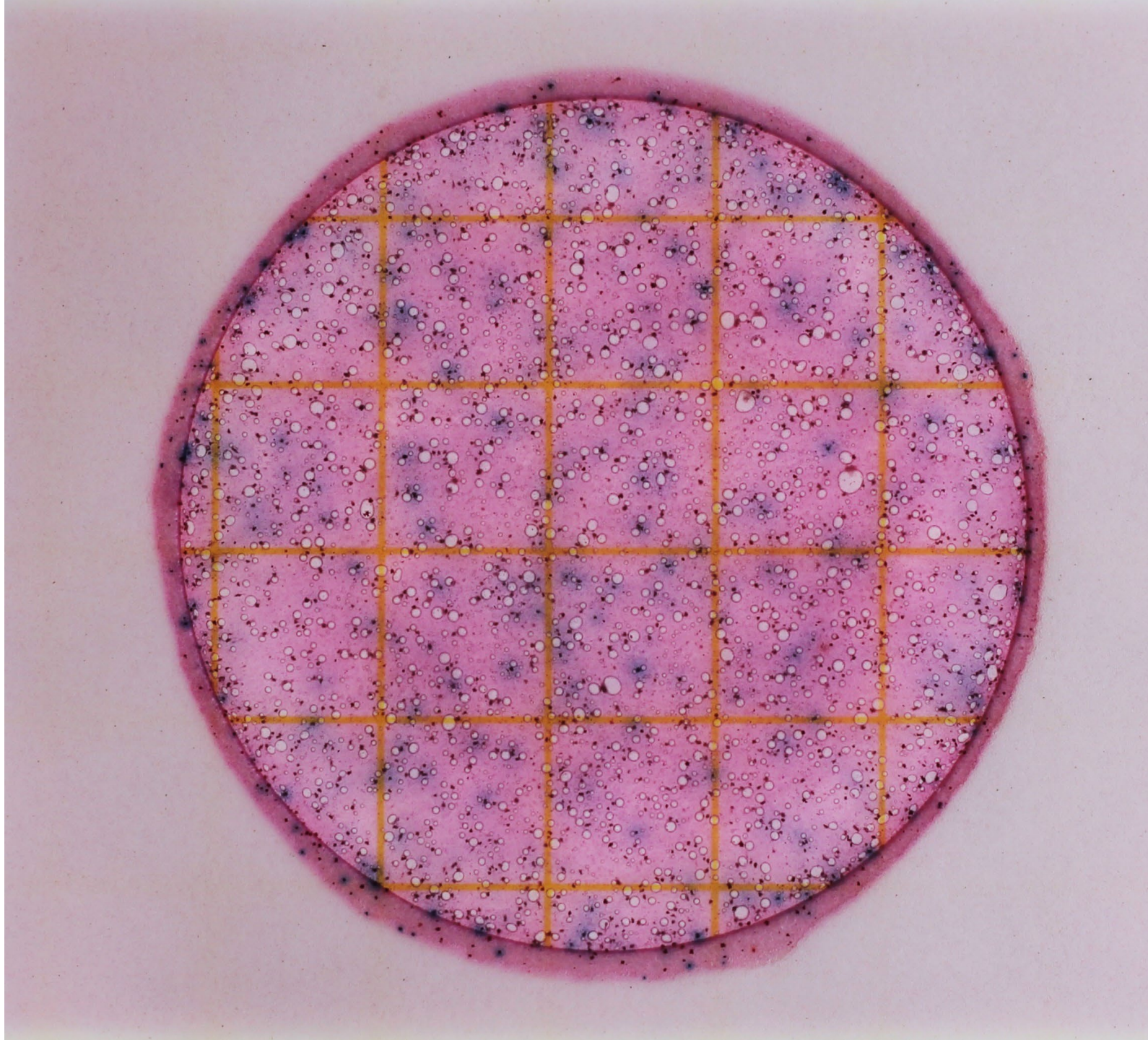


EXAMPLE #7

How many *E. coli* colonies do you see?



EXAMPLE #7 ANSWER

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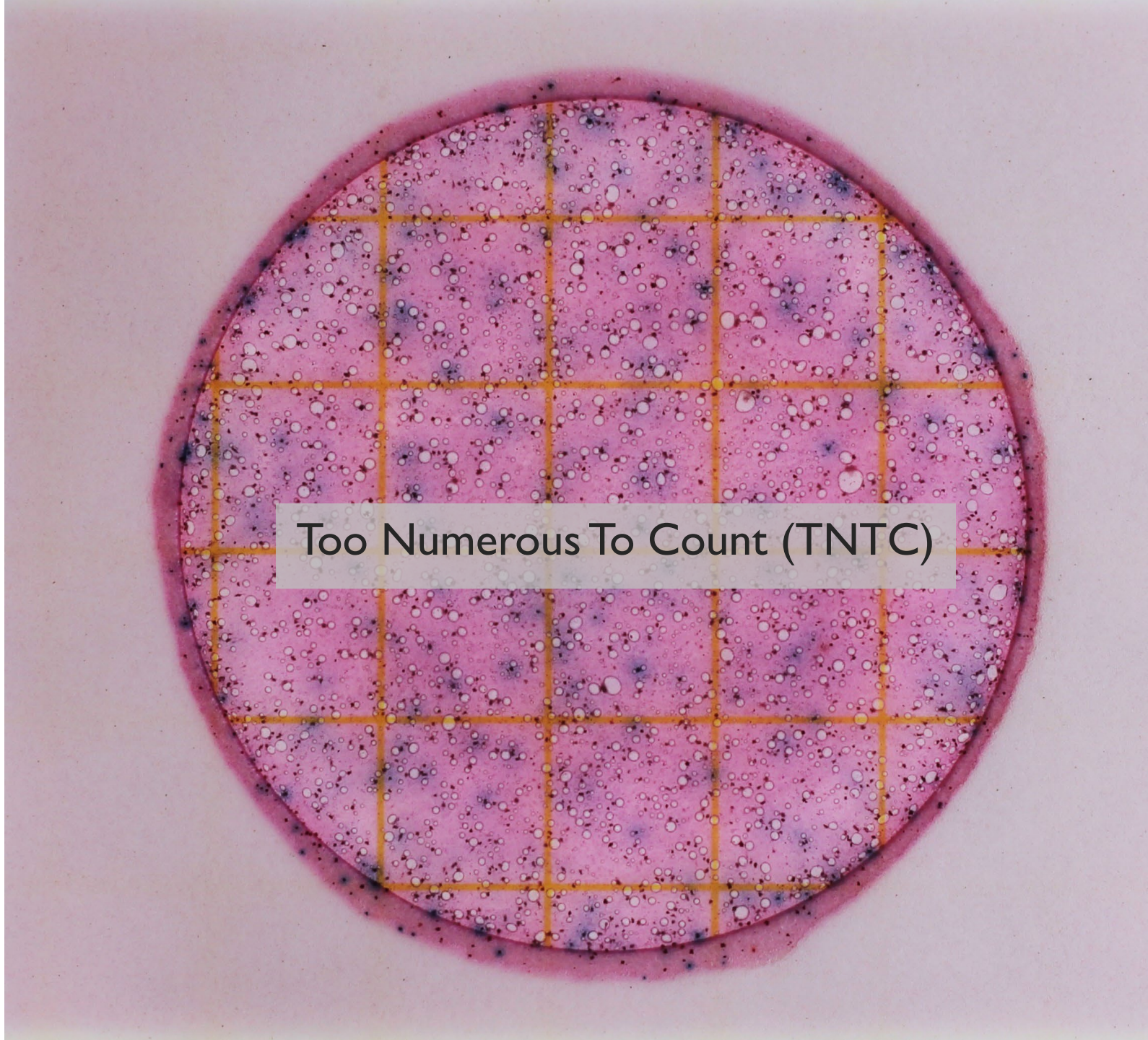

EXAMPLE #8

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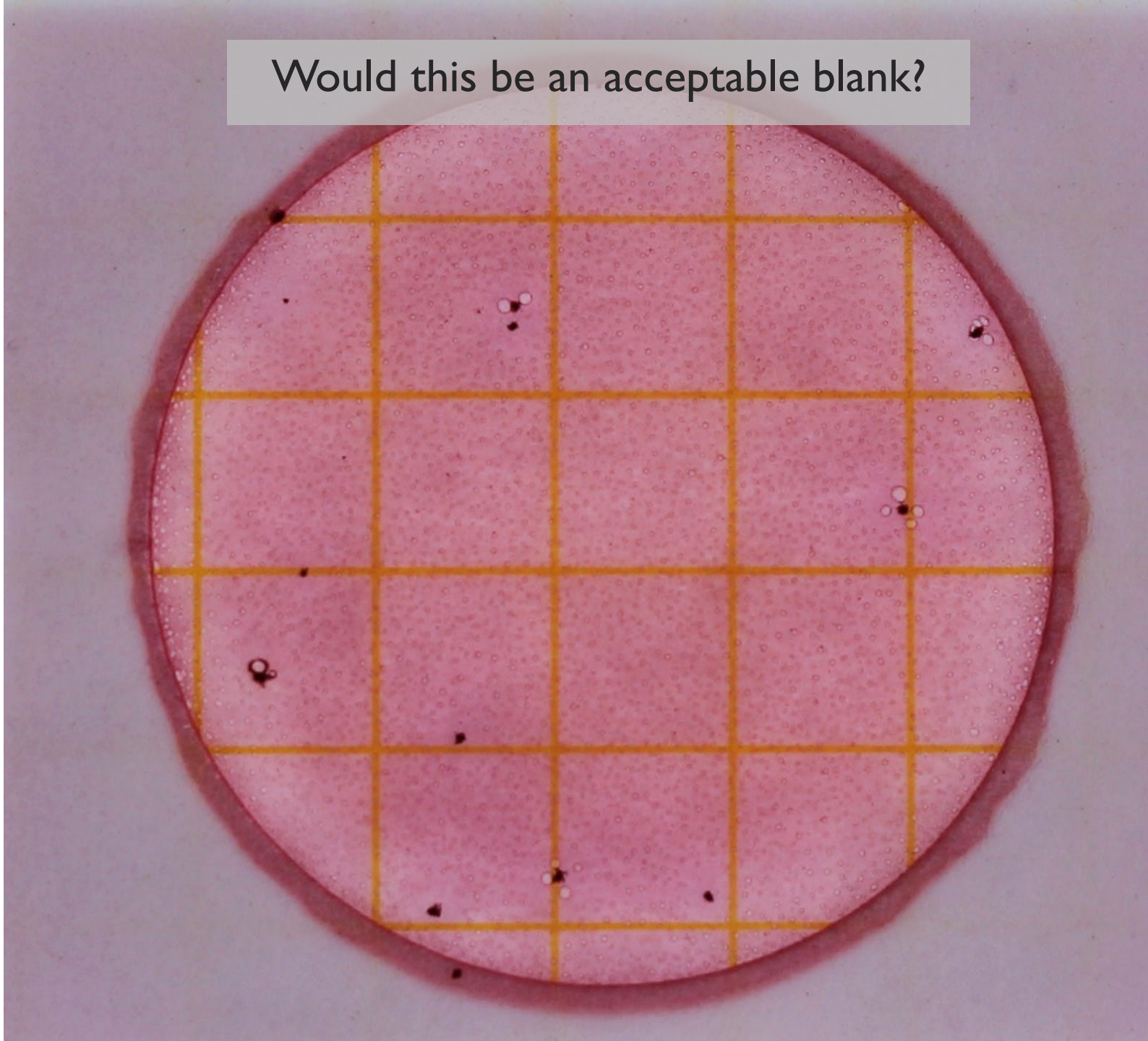

EXAMPLE #9

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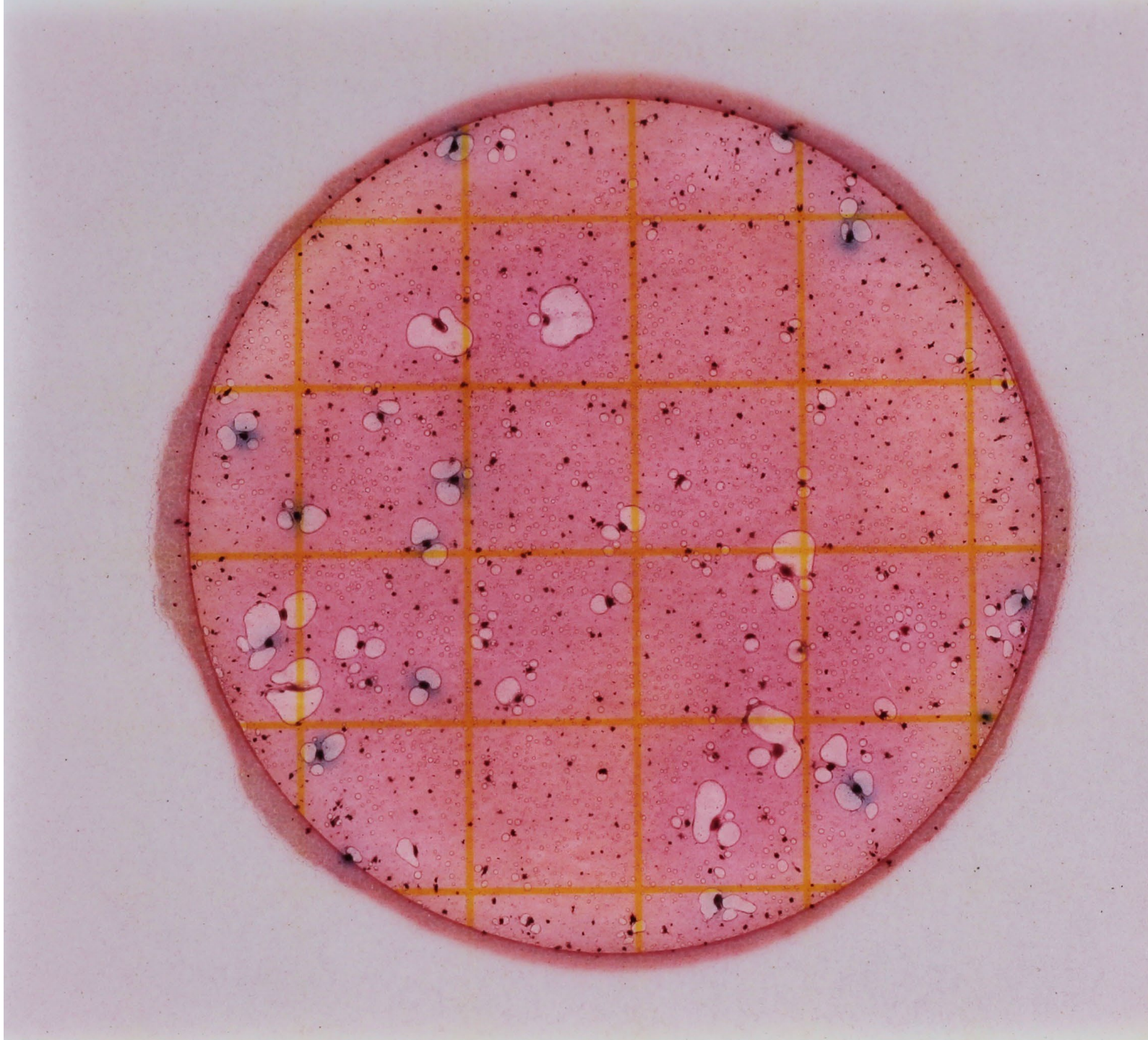

EXAMPLE #9 ANSWER

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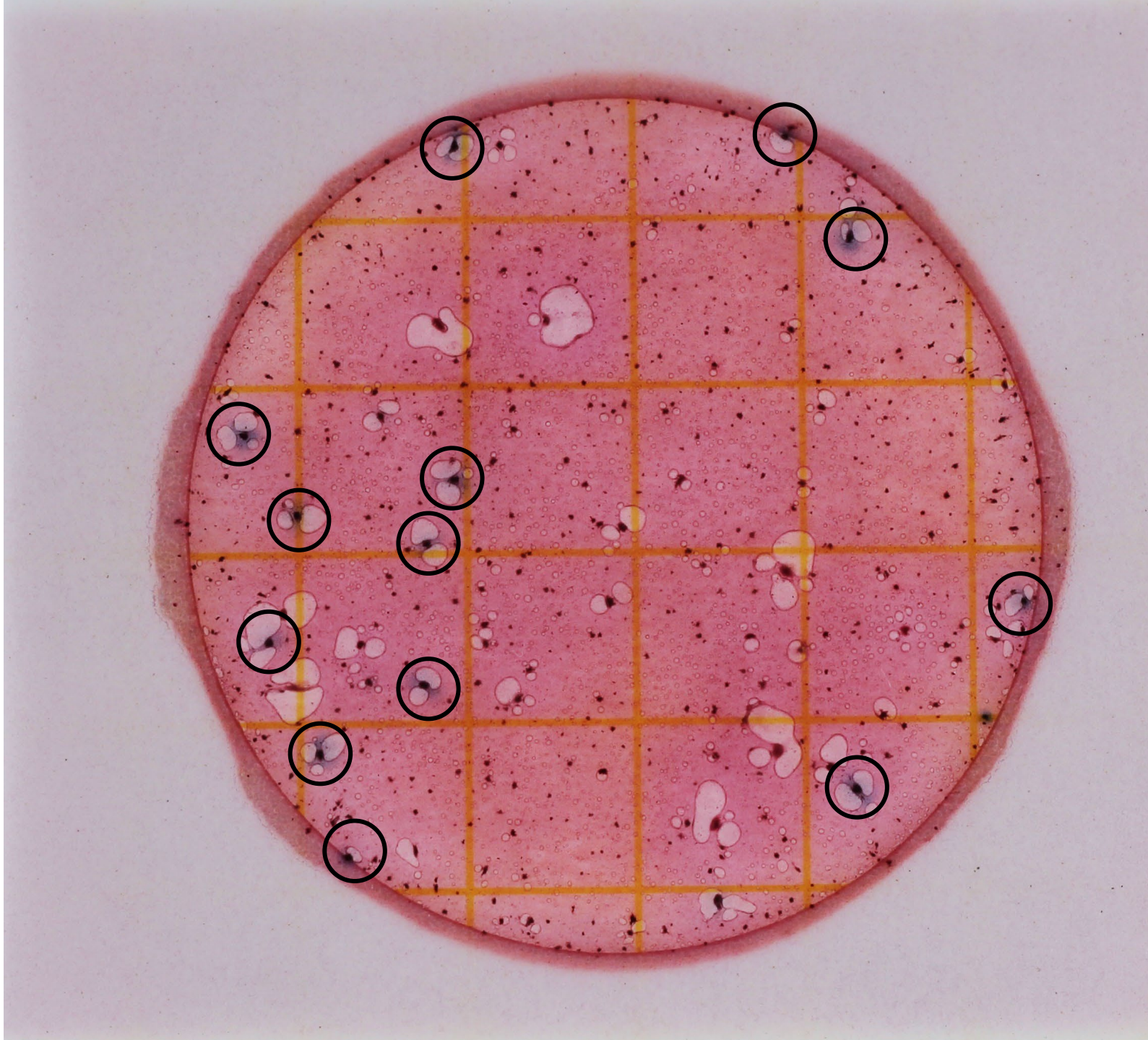

EXAMPLE #10

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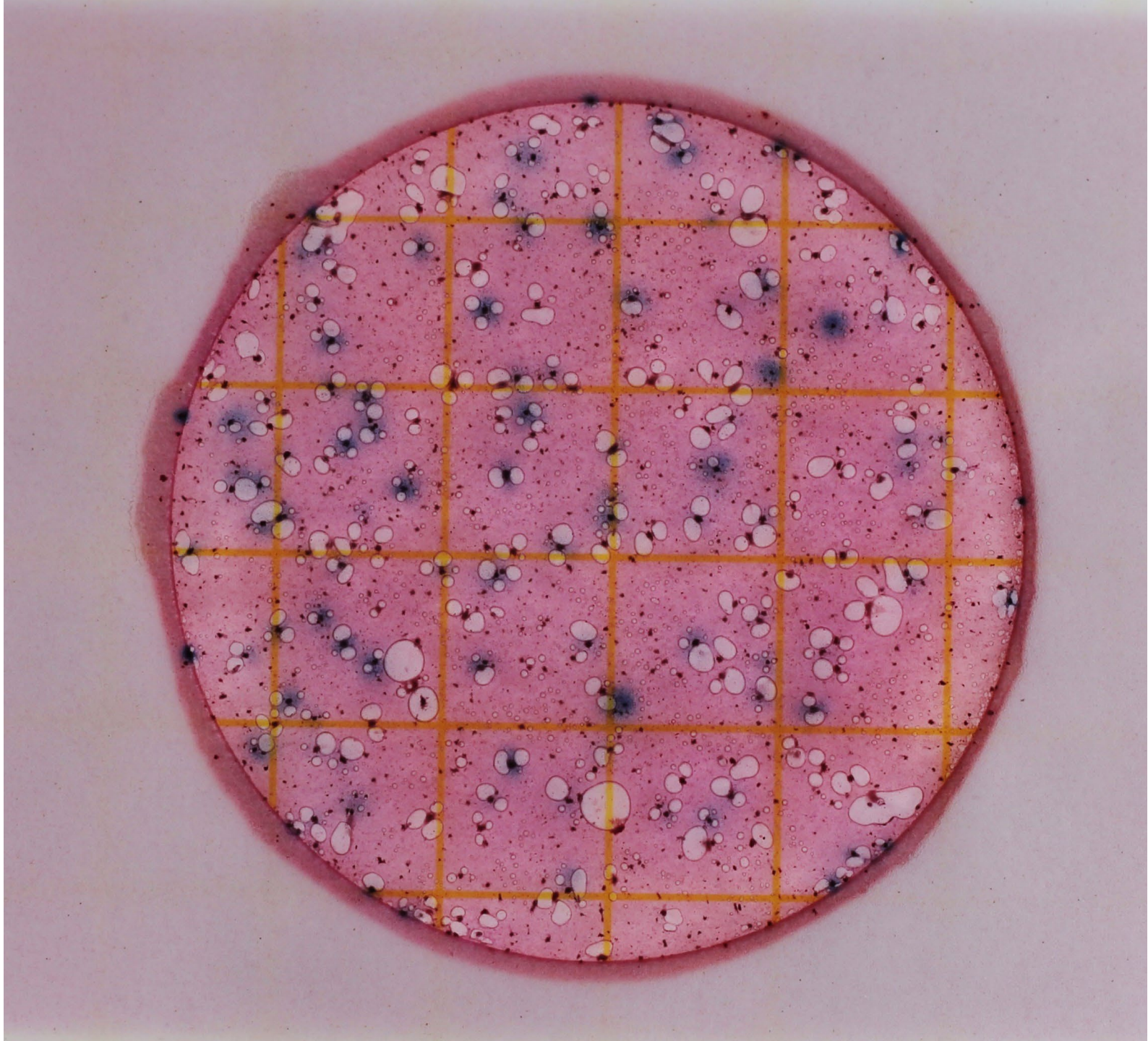

EXAMPLE #11

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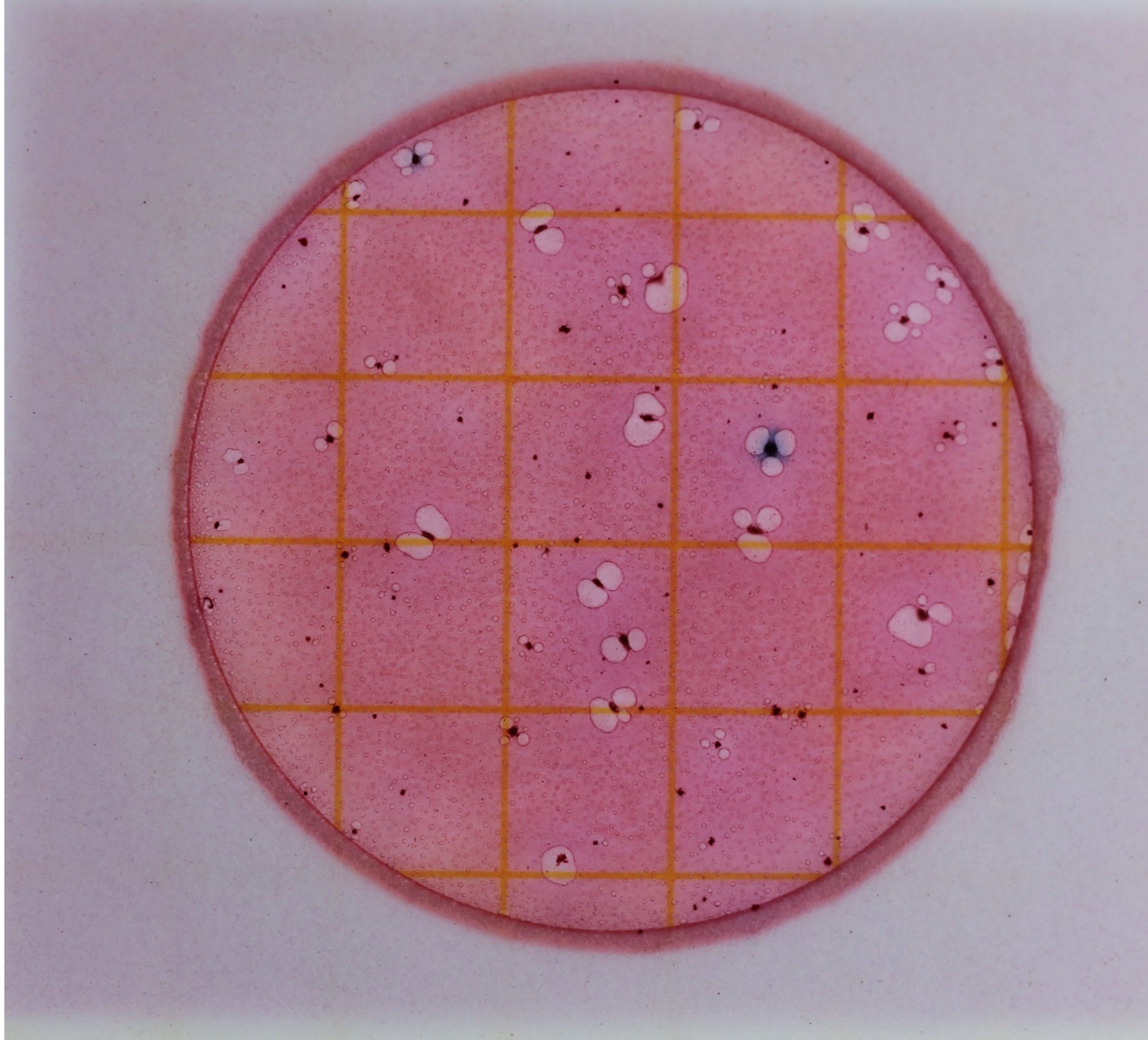

EXAMPLE #11 ANSWER

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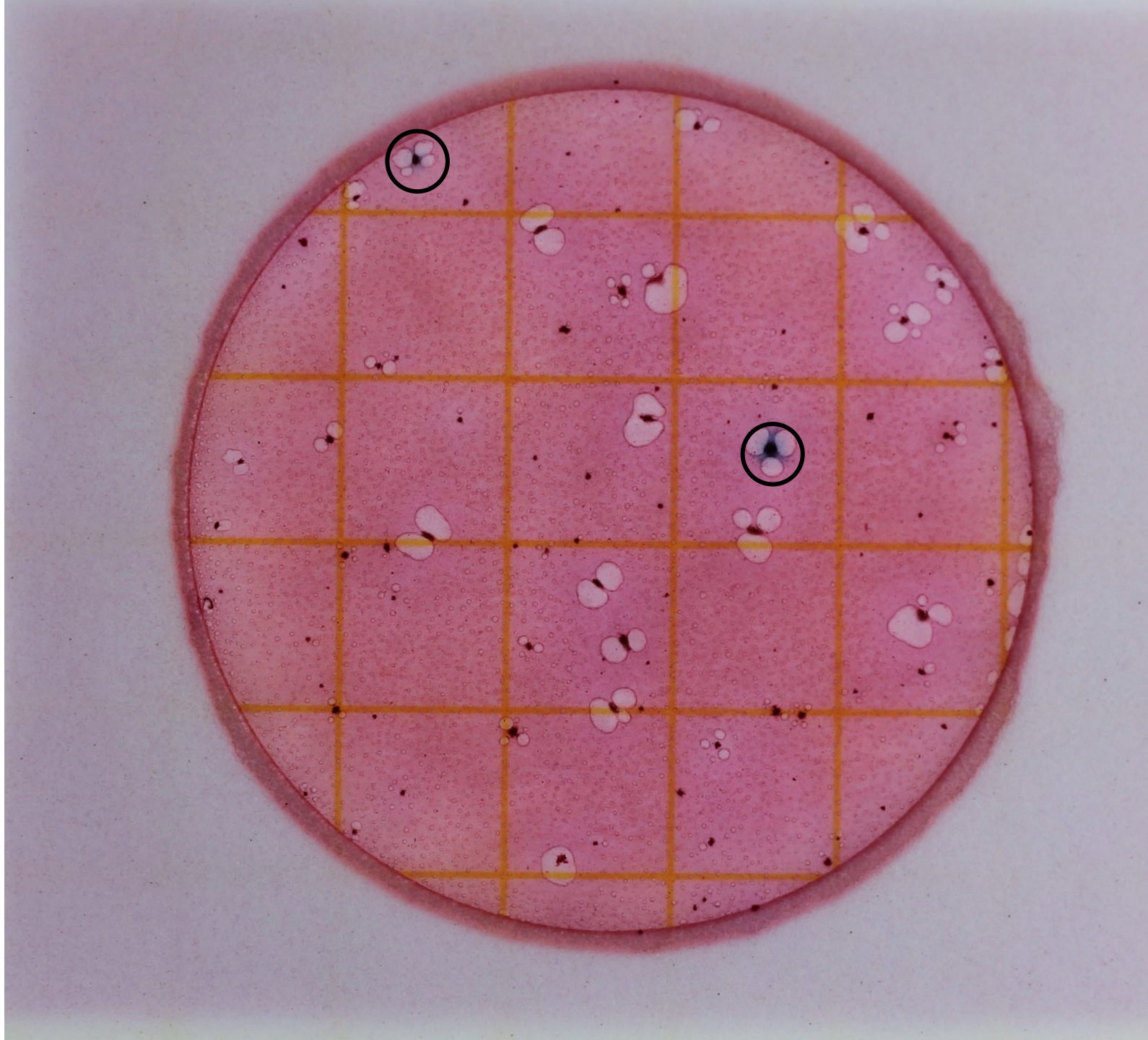
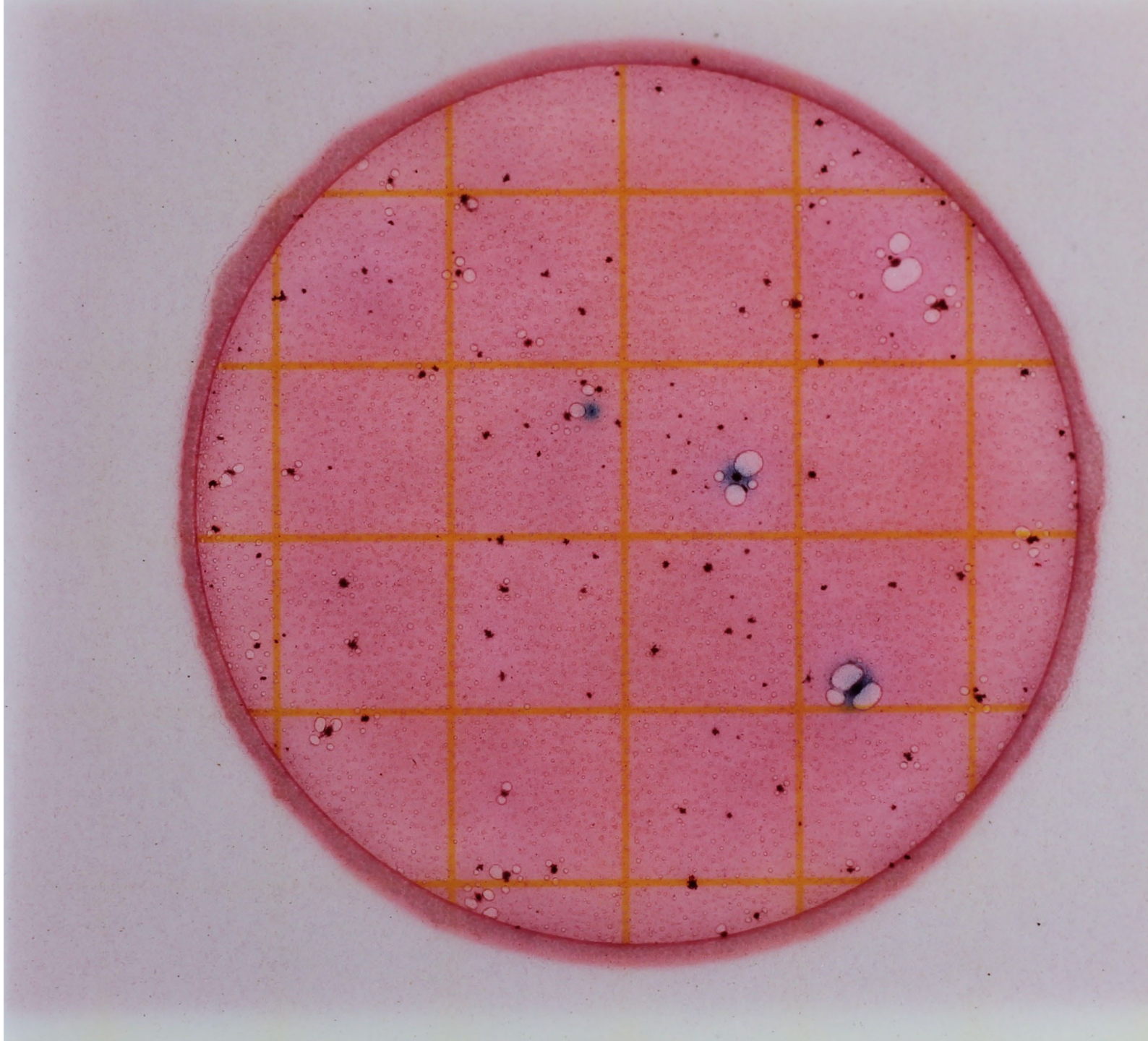


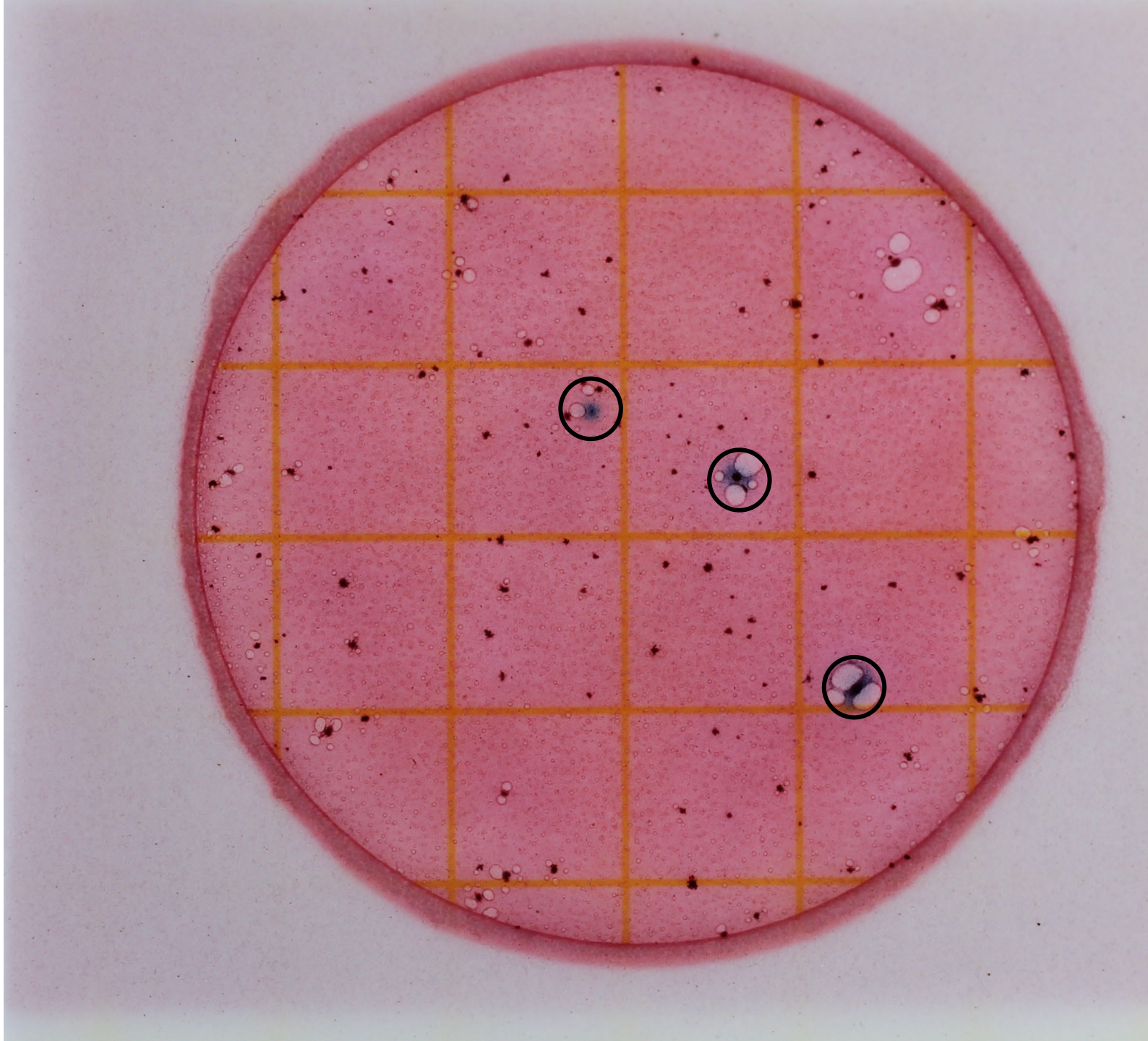
EXAMPLE #12

How many *E. coli* colonies do you see?



EXAMPLE #12 ANSWER

How many *E. coli* colonies do you see?



STEP 6: CALCULATING YOUR RESULTS

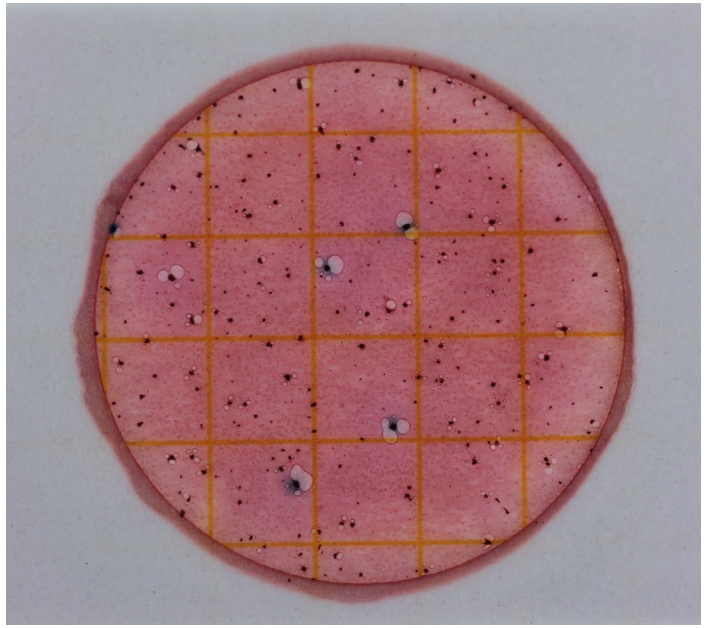


Plate 1

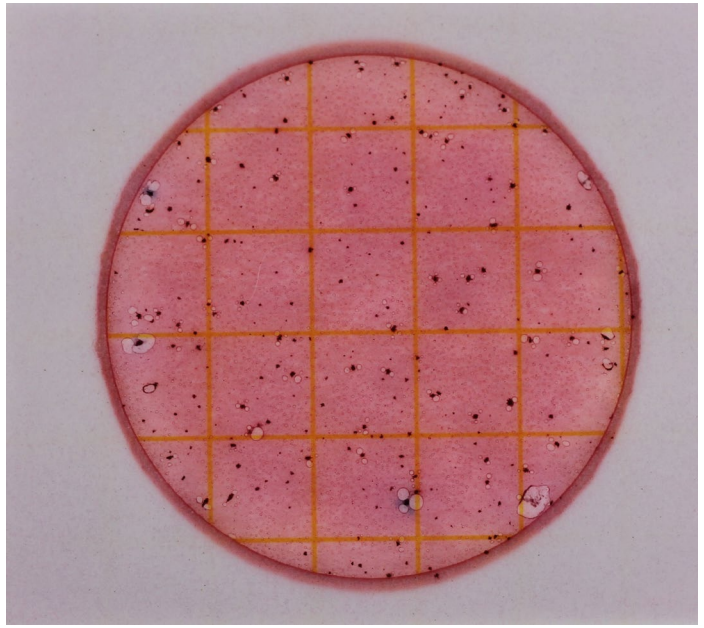


Plate 2

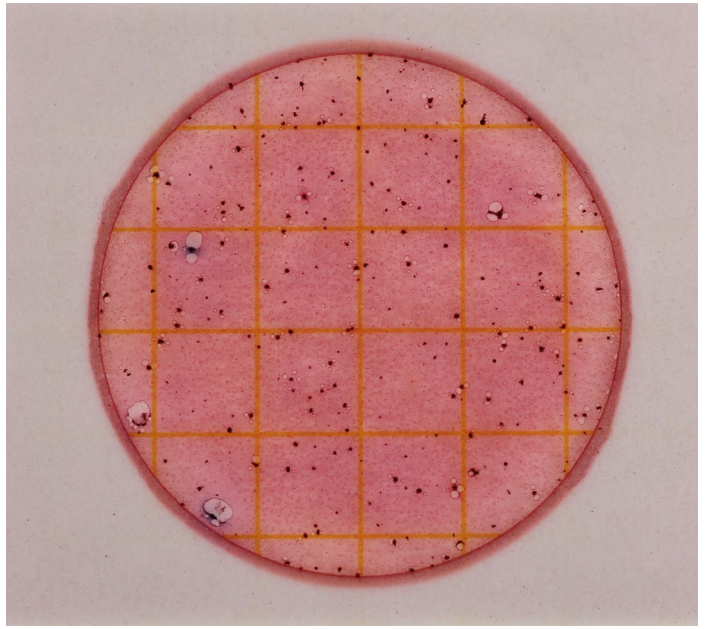


Plate 3

	Plate 1	**Plate 2**	**Plate 3**
E . coli colonies	5	2	2

STEP 6: CALCULATING YOUR RESULTS

Step 1: $\frac{(\text{Plate 1} + \text{Plate 2} + \text{Plate 3})}{3}$ = Average CFU/1 mL

(total # of plates)

Step 2: Average CFU/1 mL * 100 = Average CFU/100 mL

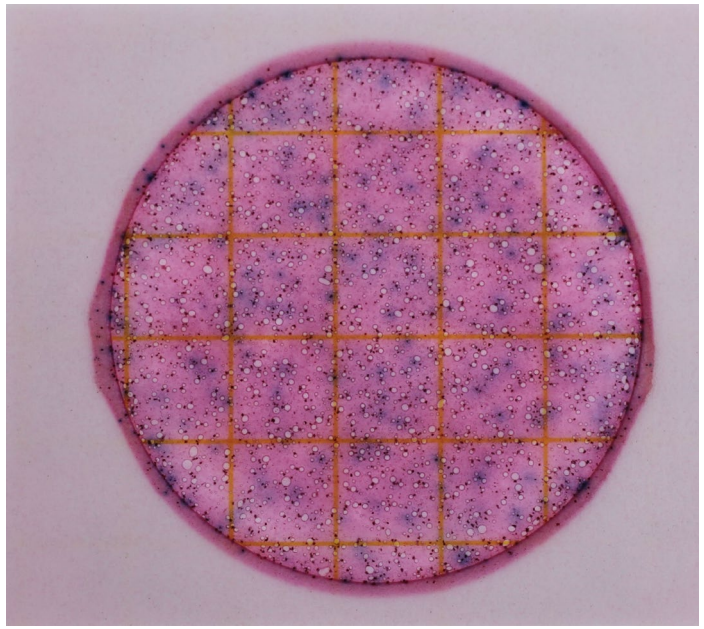
STEP 6: CALCULATING YOUR RESULTS

	Plate 1	**Plate 2**	**Plate 3**
E . coli colonies	5	2	2

Step 1: $\frac{(5 + 2 + 2)}{3}$ = 3.00 CFU/1 mL

Step 2: 3.00 CFU/1 mL * 100 = 300 CFU/100 mL

STEP 6: CALCULATING YOUR RESULTS



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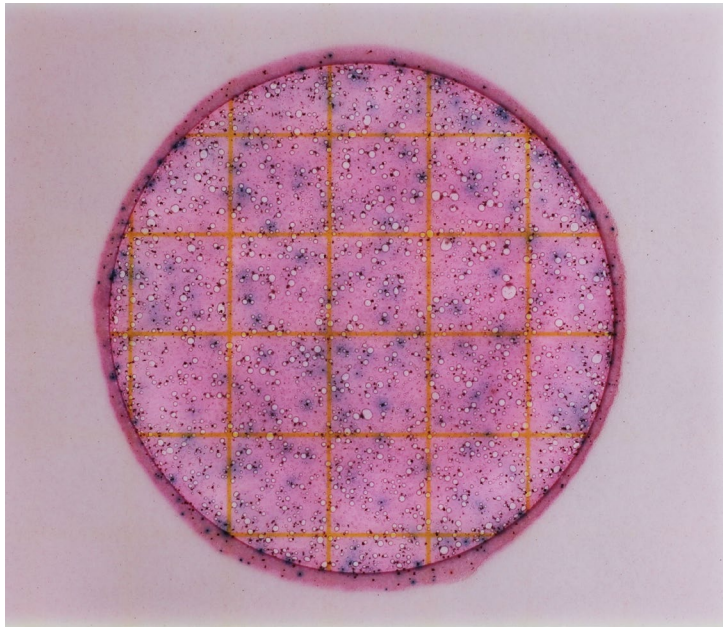


Plate 2

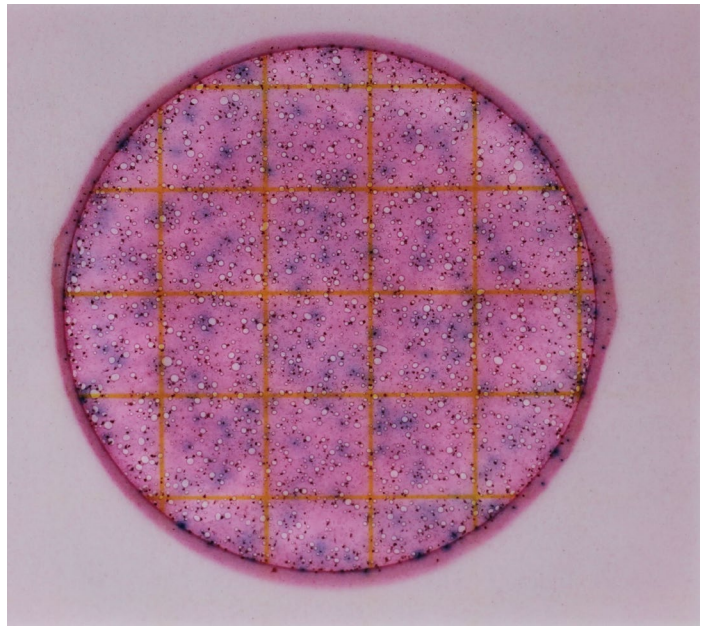


Plate 3

	Plate 1	**Plate 2**	**Plate 3**
E . coli colonies	TNTC	TNTC	TNTC

STEP 6: CALCULATING YOUR RESULTS

	Plate 1	**Plate 2**	**Plate 3**
E . coli colonies	TNTC	TNTC	TNTC

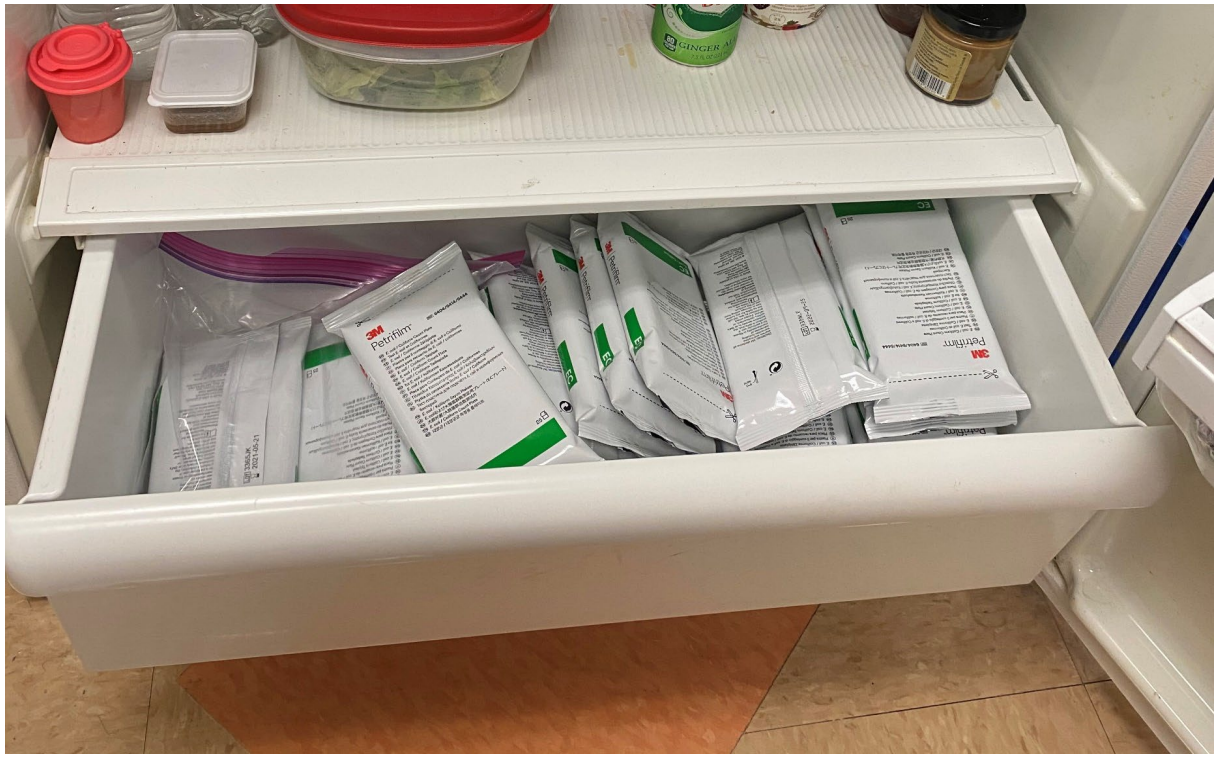
$$\frac{(\text{TNTC} + \text{TNTC} + \text{TNTC})}{3} = \text{TNTC}$$

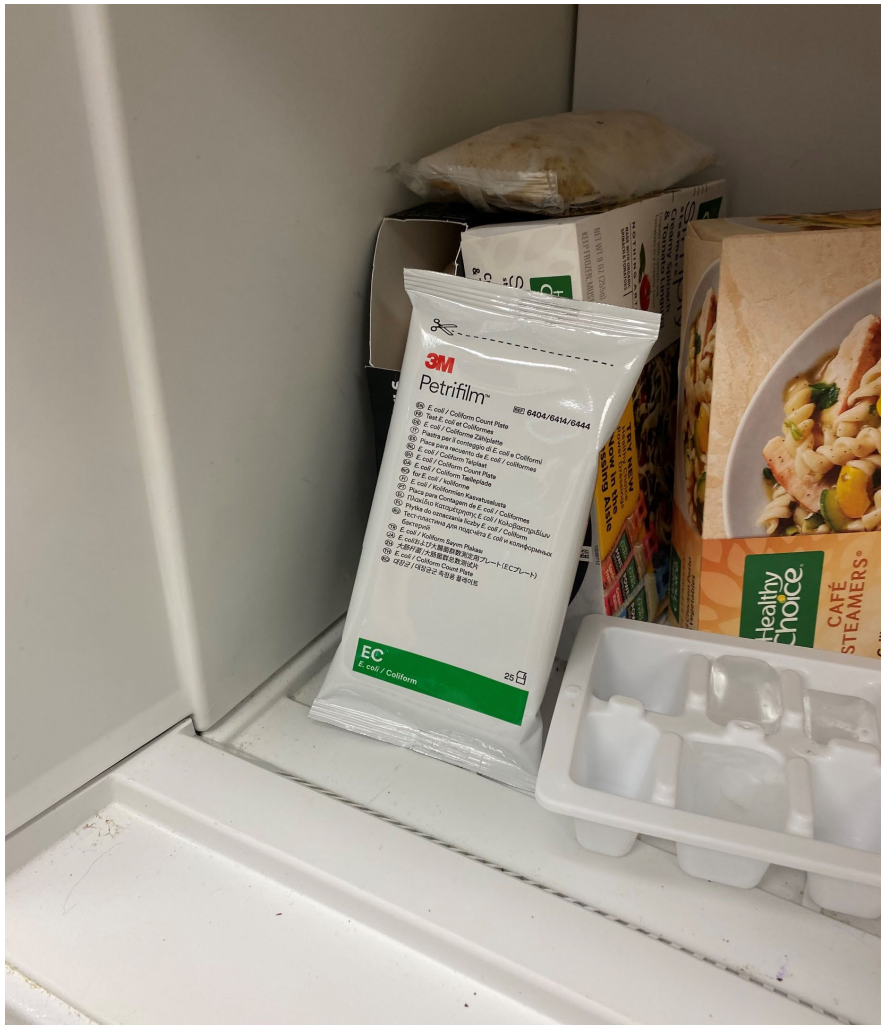
STEP 7: DISPOSAL AND CLEAN-UP

- **Spray plates with disinfectant, seal in bag/used Whirl-Pak, and throw away**
- Wipe down incubator & surrounding surfaces with disinfectant
- Wash hands!

HOW TO STORE PETRIFILM

- If using within one month, keep in the fridge
- If not, store in the freezer and thaw before use





REGULATORY STANDARDS

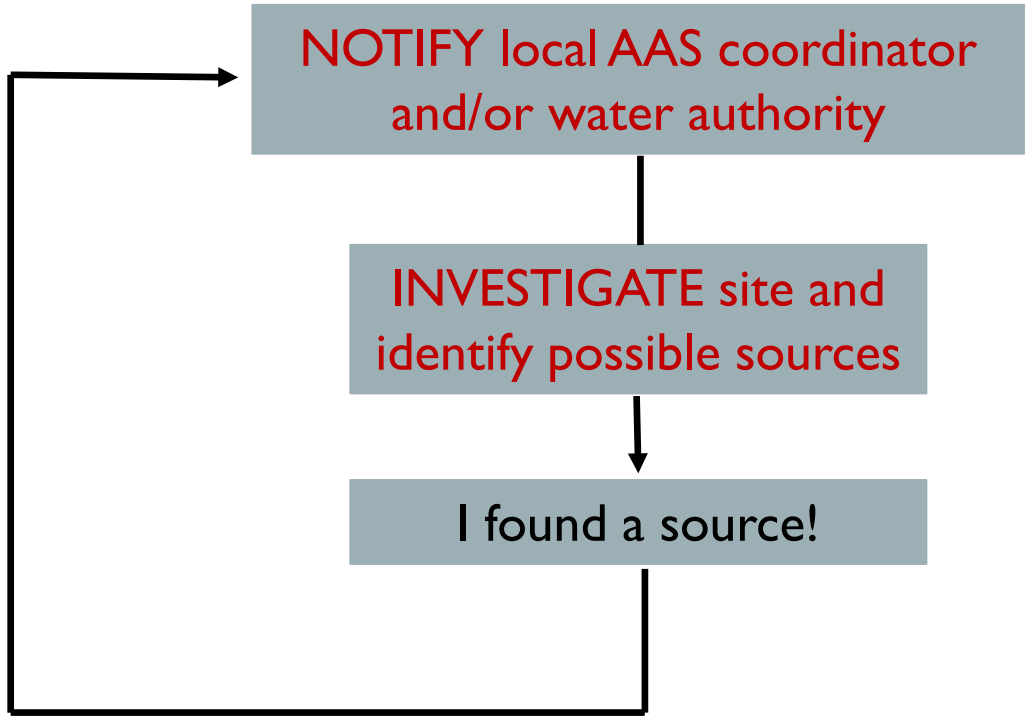
- State of GA regulatory data transitioned from fecal coliforms to *E. coli*
  - State standards reflect established EPA guidelines
  - Includes enterococci to indicate presence of pathogens in coastal waters
- Statistical Threshold Value (STV) - <10% of samples should exceed given level
  - Risk level of 36/1,000 people getting sick from primary contact activities
  - **Sample again if sample > STV**
  - **Report if samples are consistently > STV (2+ months out of the year)**

	E. coli **STV**	**Enterococci STV**
EPA recommended level (CFU/100 mL)	**<410**	**<130**

HIGH *E. COLI* COUNTS

AAS Action Value: >1000 CFU/100 mL

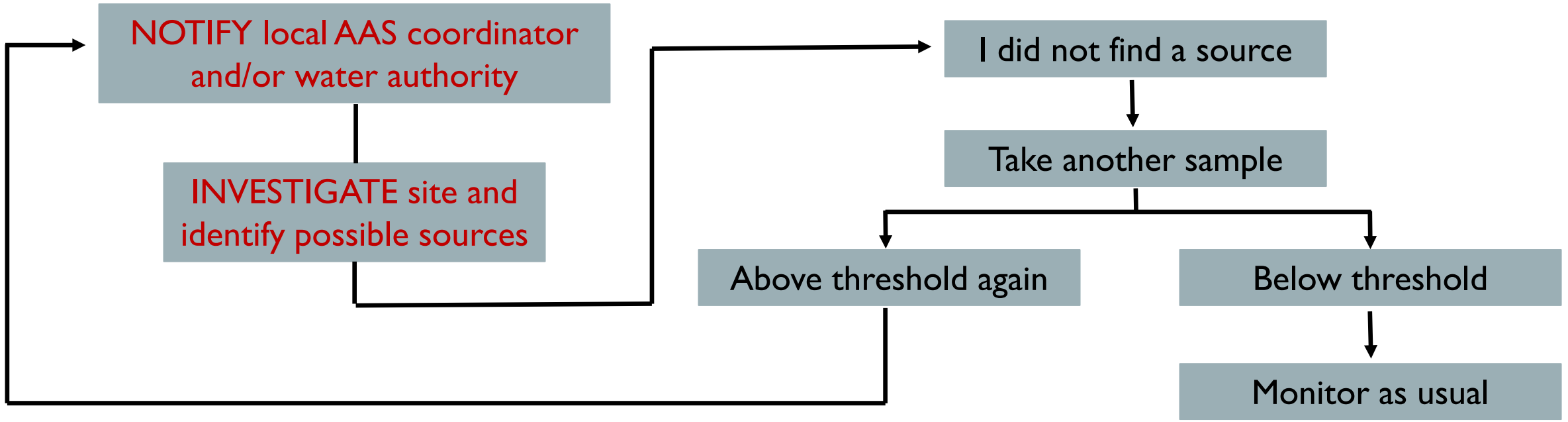
If your count exceeds this value and you <u>did find</u> a source:



HIGH *E. COLI* COUNTS

AAS Action Value: >1000 CFU/100 mL

If your count exceeds this value and you <u>did not find</u> a source:



SAFETY

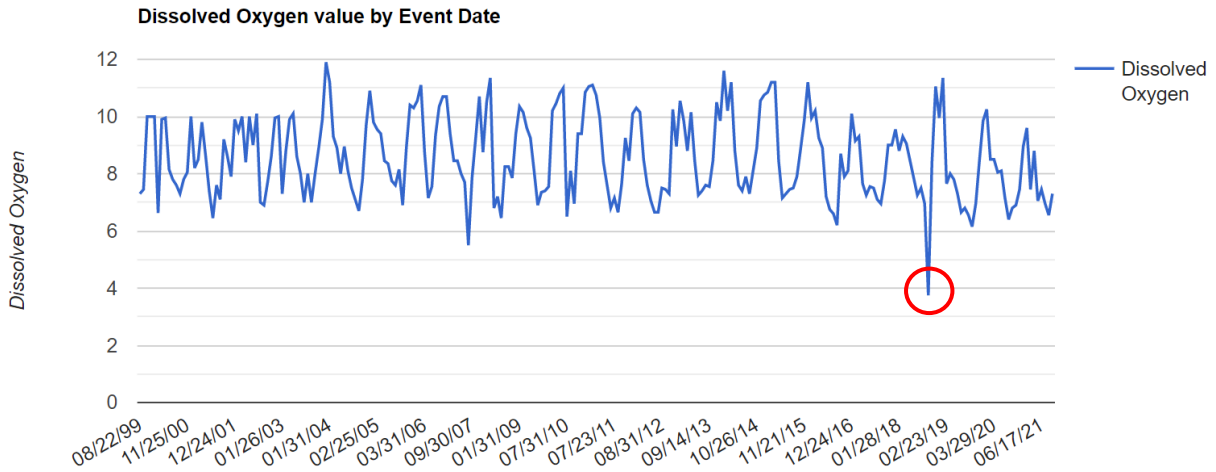
- Try not to sample alone- take a monitoring buddy!
- Do not sample during high flows or after a heavy rain event
- Obtain permission if sampling on private property
- Wear PPE when sampling and plating
- Disinfect thoroughly before and after plating and counting

ONCE YOU'RE CERTIFIED

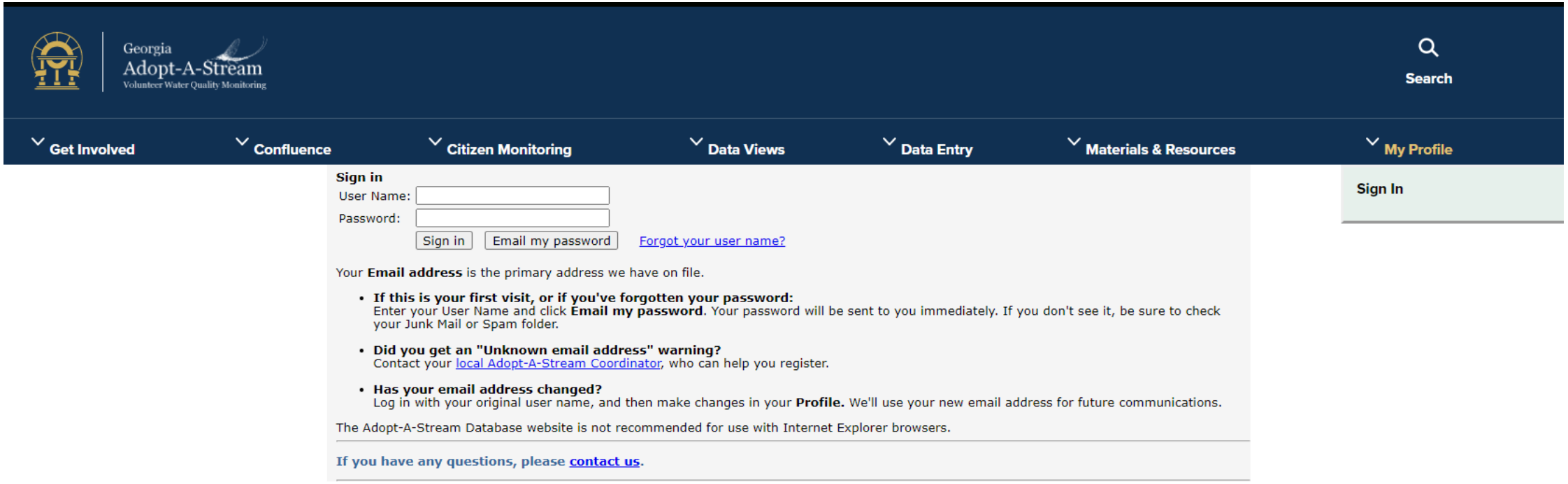
- You get an account to our online database!
- Only certified volunteers can submit data
- Certification is valid for one year
- Volunteers must attend an annual recertification workshop

HOW ARE YOUR DATA USED?

- Establish baseline conditions for waterbodies across the state
- Discover and report water quality issues
- Educate your community
- Help inform status of streams for 303d/305b list

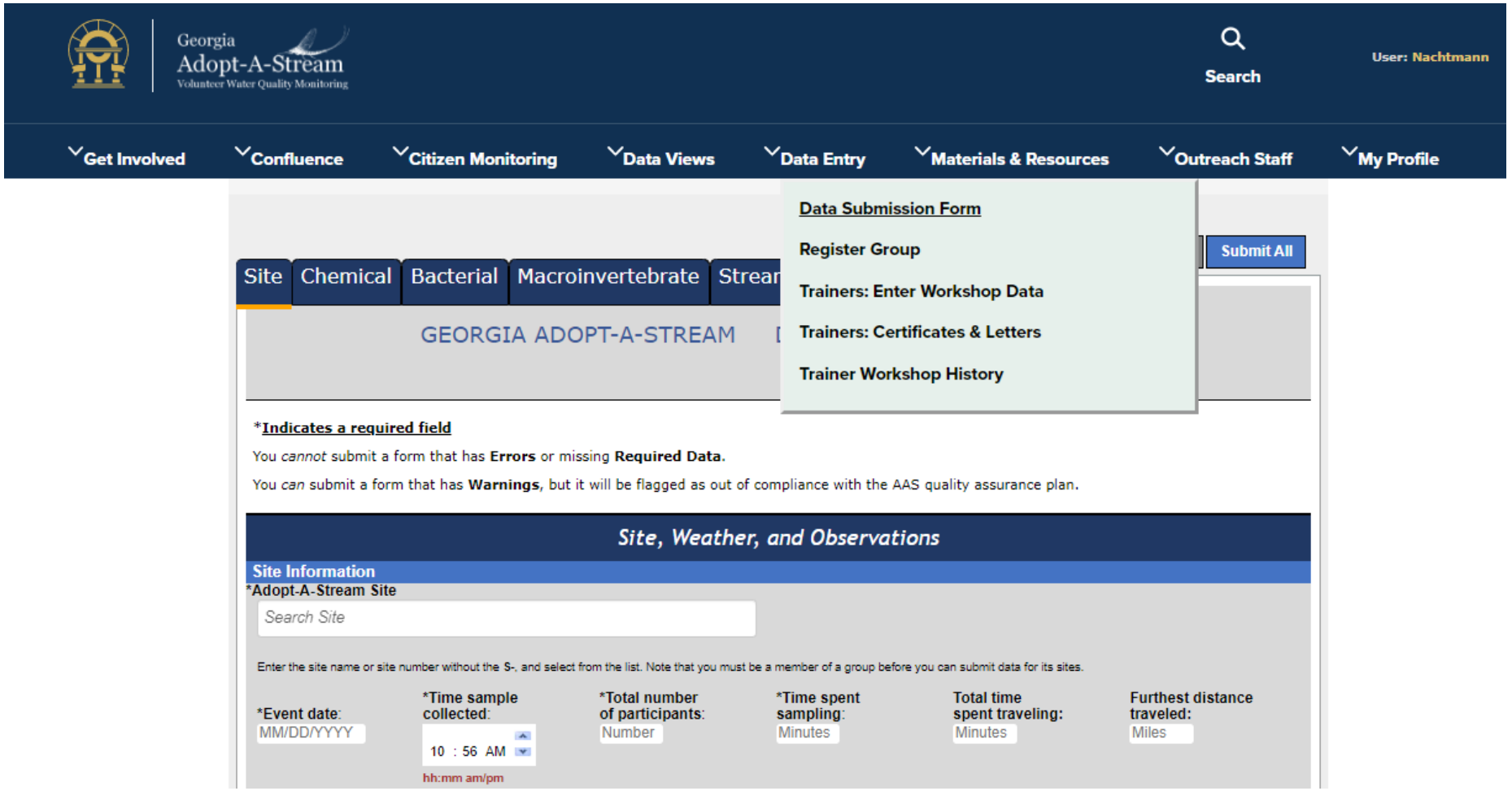


DATABASE LOGIN



From the AAS website's homepage, hover over the My Profile tab and click Sign In

DATA SUBMISSION FORM



From the AAS website's homepage, hover over the Data Entry tab and click Data Submission Form

SITE, WEATHER, AND OBSERVATIONS

GEORGIA ADOPT-A-STREAM: Bacterial Form

To be conducted every month

SITE INFORMATION

Group Name:_____ Event Date: _____ (MMDDYYYY)

Group ID: G-_____ Site ID: S-_____ Time Sample Collected:_____ (HHMM am/pm)

Stream Name:_____ Time Spent Sampling: _____ (Min)

Monitor(s):_____ Total Time Spent Traveling *(optional)* : _____ (Min)

Number of Participants:_____ Furthest Distance Traveled *(optional)* : _____(Miles)

WEATHER

Present conditions (check all that apply)

☐ Heavy Rain ☐ Steady Rain ☐ Intermittent Rain

☐ Overcast ☐ Partly Cloudy ☐ Clear/Sunny

Amount of rain, if known?

Amount in Inches :_____

In Last Hours/Days:_____

*Refer to *wunderground.com* for rainfall data

OBSERVATIONS

Flow/Water Level: *(check all that apply)* ☐ Dry ☐ Stagnant/Still ☐ Low ☐ Normal ☐ High ☐ Flow (over banks)

Water Clarity: ☐ Clear/Transparent ☐ Cloudy/Somewhat Turbid ☐ Opaque/Turbid

Water Color: ☐ No Color ☐ Brown/Muddy ☐ Green ☐ Milky/White ☐ Tannic ☐ Other:_____

Water Surface: ☐ Clear ☐ Oily Sheen: does it break when disturbed? Yes/No (circle one) ☐ Algae

☐ Foam ◯ Greater than 3" high ◯ It is white

Water Odor: ☐ Natural/None ☐ Gasoline ☐ Sewage ☐ Rotten Egg

☐ Fishy ☐ Chlorine ☐ Other:_____

Photos: Please take images to document your observations and changes in water quality conditions. Photo point directions can be found in the manuals. Send photos to AAS@gaepd.org.

Trash: ☐ None ☐ Yes, I did a cleanup ☐ This site needs an organized cleanup

BACTERIAL DATA

BACTERIAL

3M Petrifilm Method: *Escherichia coli*

Run three (3) plates/tests for each site, plus one (1) blank plate. Process within 6-24hrs, incubate at 35°C ±1° and read at 24 ± 1 hr

Plate	Colonies	Find AVG of Number of Colonies (total # colonies/total # of plates (do not include blank))	cfu/100mL
Blank			
1		(/) x 100 =	
2			
3			
Total # Colonies			

Sample Holding Time (HH): _____

Date START(MMDDYYYY): _____ Date END (MMDDYYYY):_____

Time START (HHMM):_____ Time END (HHMM):_____

MIN Temp (^{0}C):_____ MAX Temp (^{0}C): _____

COMMENTS

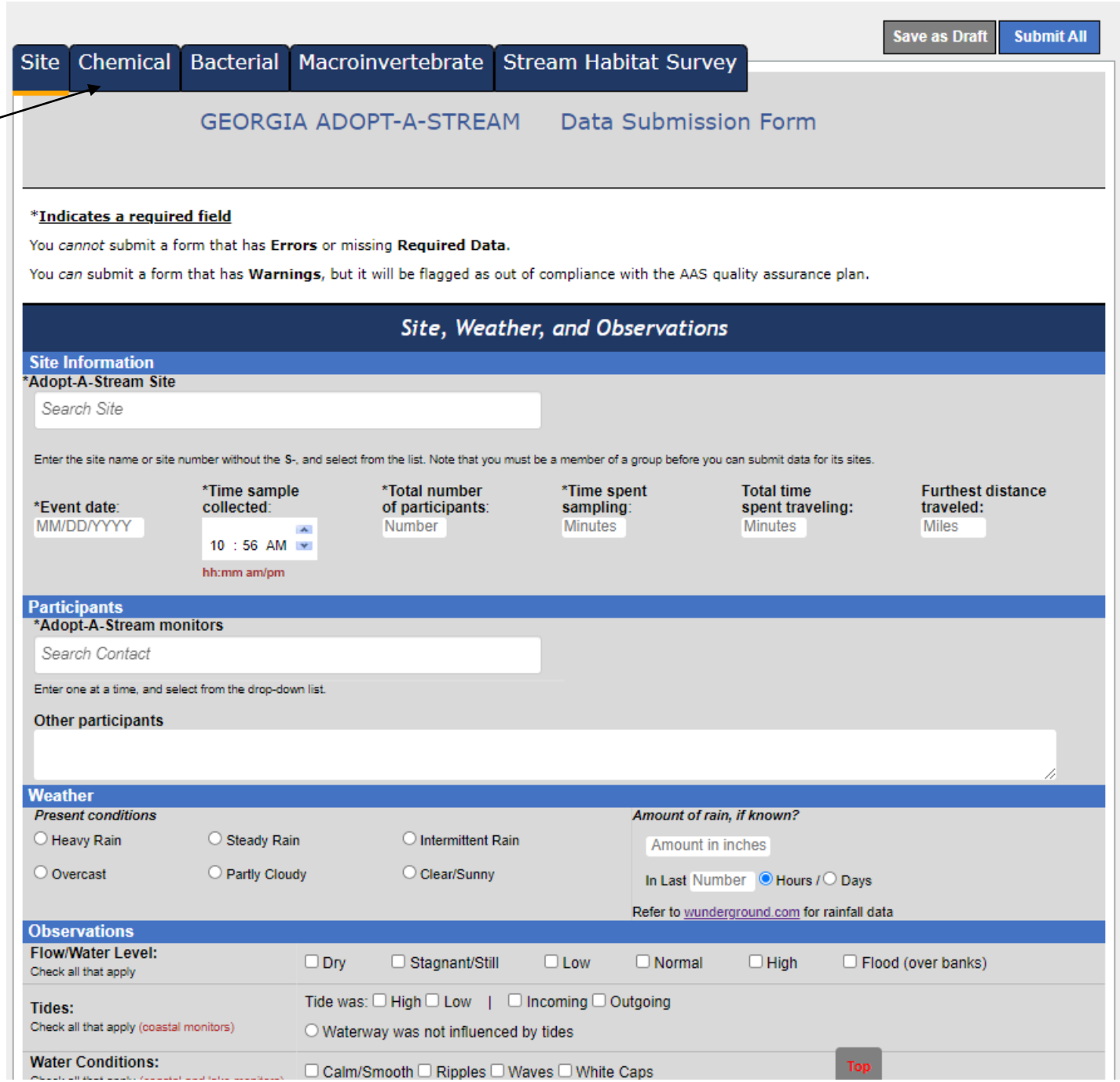
Any changes since you last sampled at this site? If yes, please describe.

Please submit data to our online database at AdoptAStream.Georgia.gov

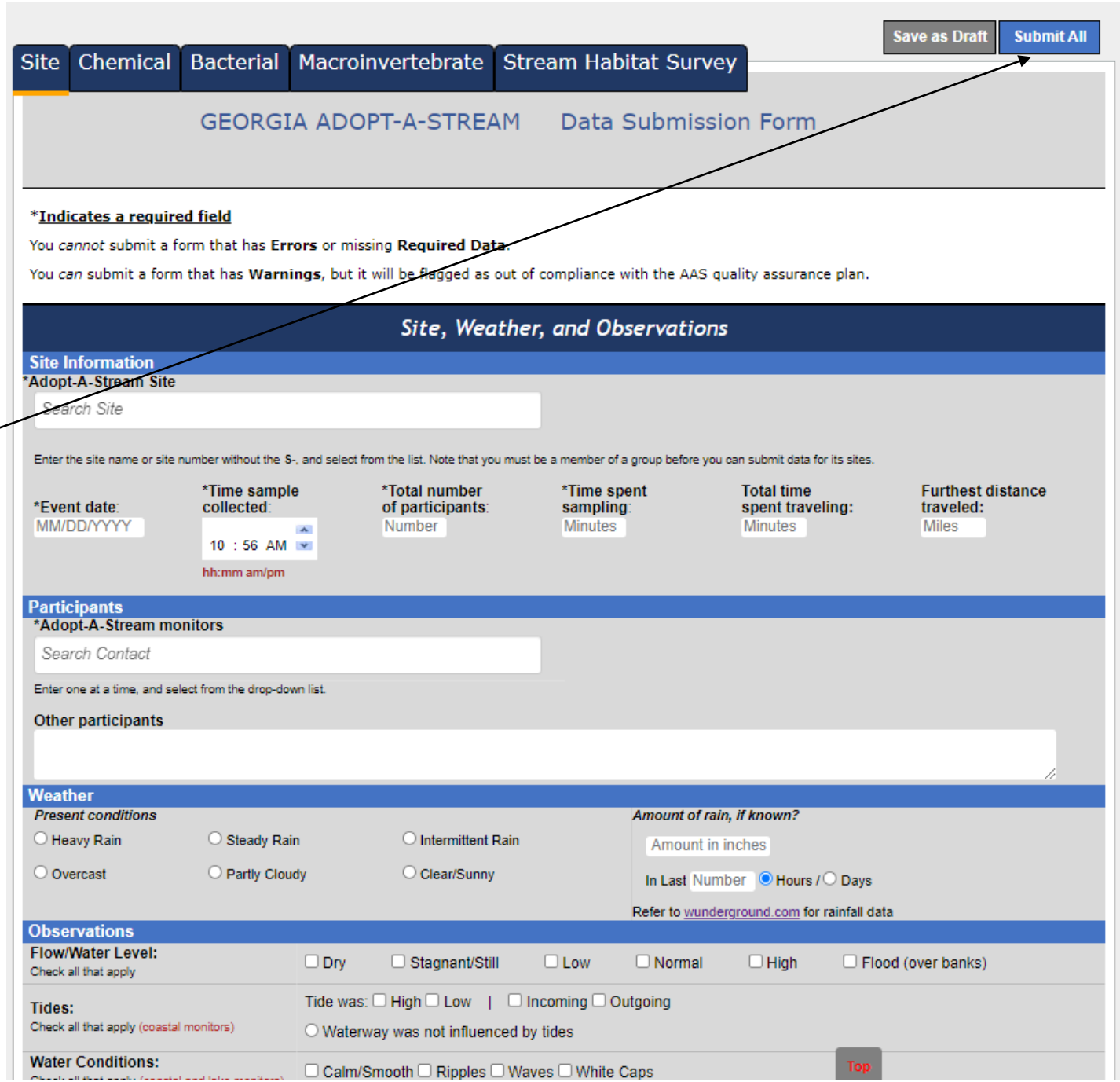
Submit data ASAP to online database

Access database via AdoptAStream.Georgia.gov

Fill out site data first, then navigate to the chemical tab to continue entering data

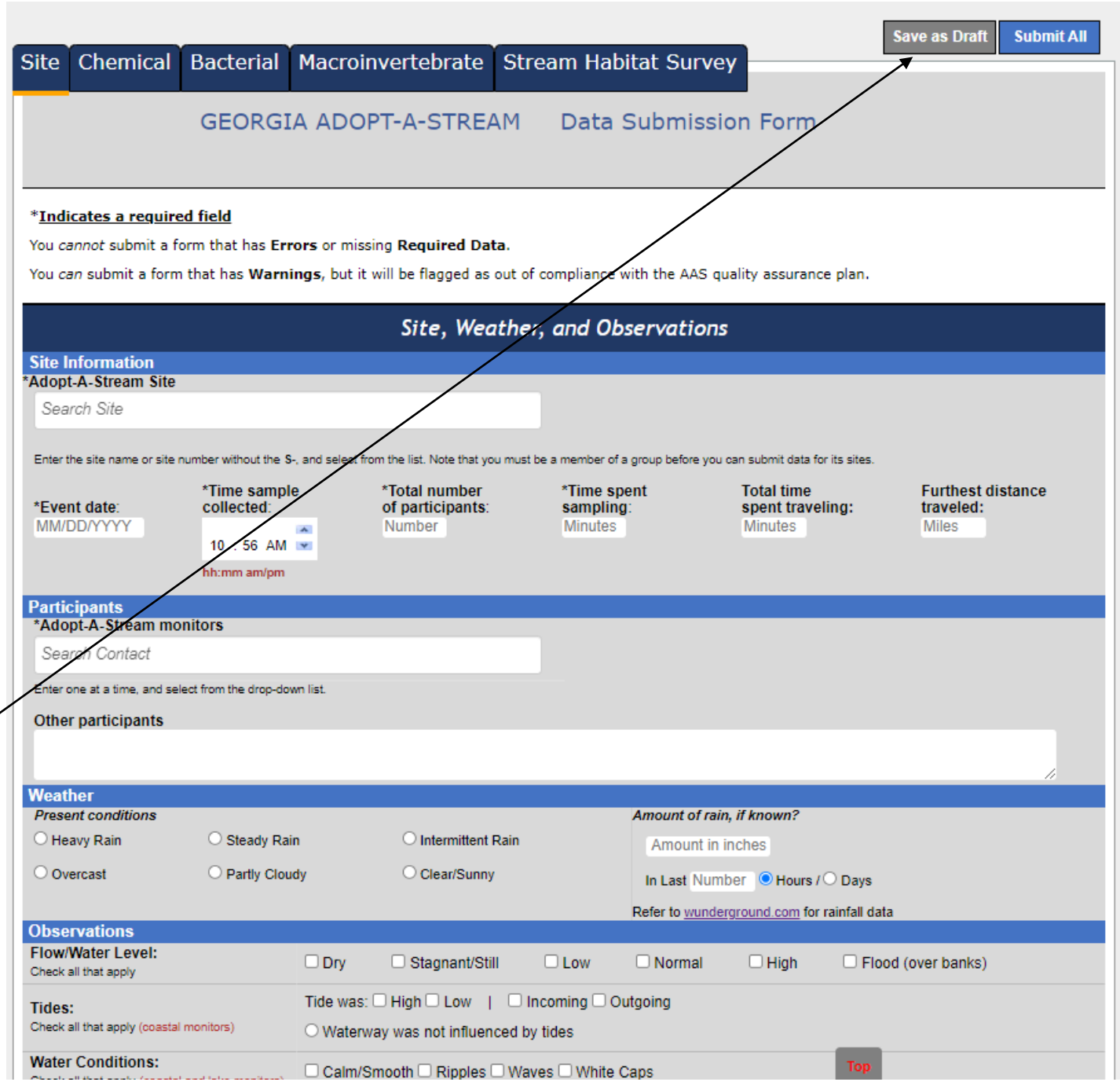


After entering all of your data, click "Submit All" to submit your data to the database



Use “Save as Draft” to finish submitting data at a later time.

Data must be submitted within 7 days of saving as a draft.



FOLLOW AAS AND STAY CONNECTED

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TEST REVIEW