



# The Morehead State University Water Testing Laboratory

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### ABSTRACT

The Morehead State University Water Testing Laboratory operates as the Kentucky principle drinking water microbiology lab. It provides qualitative and quantitative drinking water analyses for total coliform bacteria, a reliable indicator of potential microbial pathogens, and fecal coliform bacteria. The laboratory analyzes approximately 2,200 samples per year, and services over twenty public water districts throughout Morehead State's service region. A Kentucky Division of Water certified drinking water microbiology analyst, under the supervision of a laboratory manager, performs three primary methods for microbiology drinking water analyses, including: membrane filtration utilizing mEndo agar, Colilert-18®, and most probable number (MPN). The water testing laboratory offers opportunities for undergraduate students to become certified to participate in the operation of a certified laboratory for microbiological analysis of drinking water. A Certified Analyst at the laboratory is responsible for proper quality control of laboratory equipment and methods, processing water samples, and providing accurate, credible results. Thus, protecting the health and welfare of our constituents and the environment.

### INTRODUCTION

Total coliform bacteria indicate environmental contamination in drinking water samples. The laboratory uses *Klebsiella pneumoniae* as a model organism for total coliform quality control. Fecal coliform bacteria, which is a type of total coliform, indicates fecal contamination. *Escherichia coli* is a fecal coliform found in the mammalian gastrointestinal system and can be pathogenic when consumed. Reductions in fecal contamination should reduce the risk from waterborne pathogens. By Kentucky Division of Water mandates, public drinking water is only safe for consumption when it contains <1 CFU/100mL of both Total Coliform bacteria and *Escherichia coli*.

The Morehead State Water Testing Lab plays a critical role in ensuring the safety of public drinking water by employing various methods to test for these organisms. These methods allow results to be reported in twenty four hours or less. Results of these tests are reported to the Kentucky Division of Water, and further action is taken if a sample tests positive for contamination. Analysts ensure the integrity of employed methods through monthly quality control assessments and maintain extensive data collection procedures.

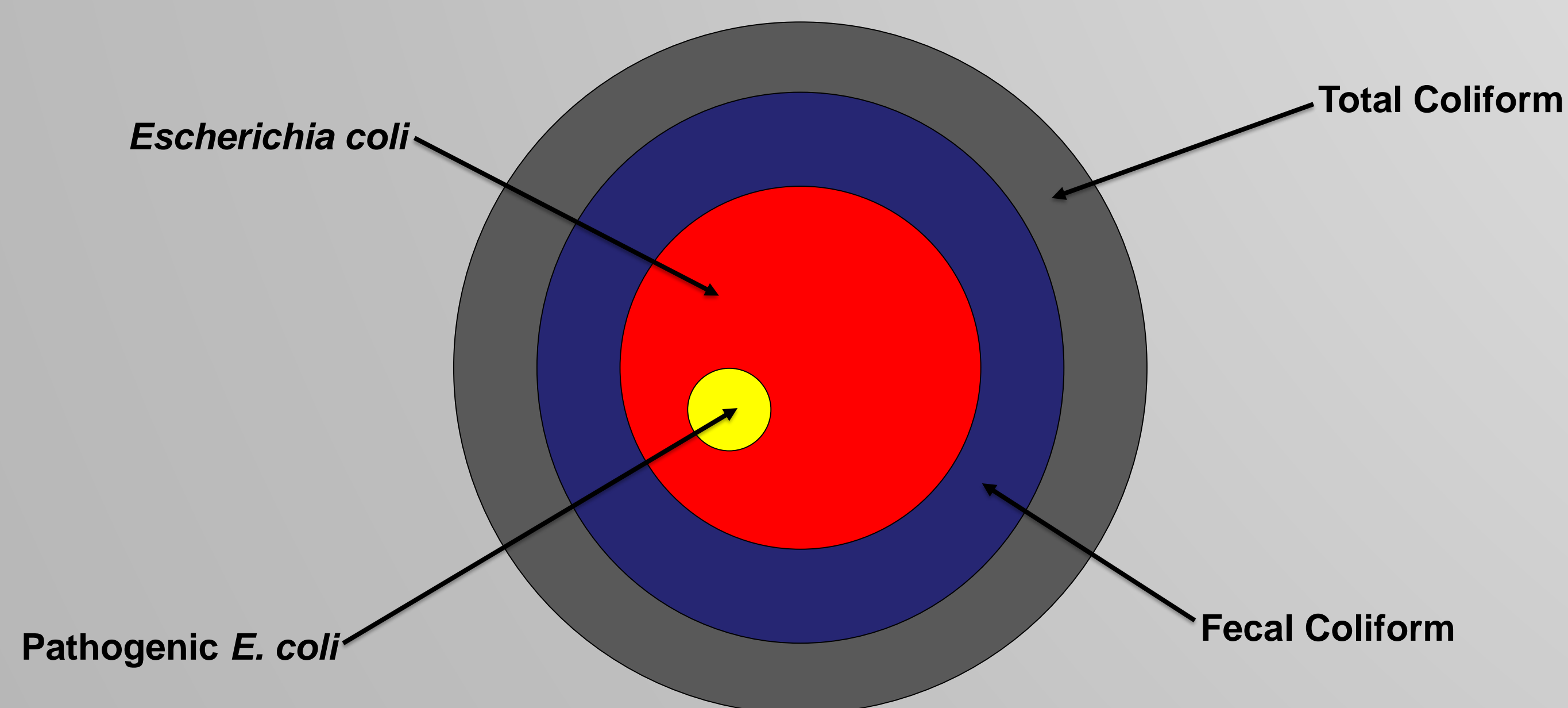


Figure 1. What is a Coliform?

### References

Manual for the certification of laboratories analyzing drinking water: Criteria and procedures, quality assurance (5th ed.). (2005). Cincinnati, OH: U.S. Environmental Protection Agency, Office of Water, Office of Ground Water and Drinking Water, Technical Support Center..

### METHODS

- For the MPN method, Colilert - 18® media is added to a 100-mL aliquot of drinking water sample then processed through a Quanti – Tray Sealer in a MPN tray.
- For presence/absence method, Colilert - 18® media is added to a 100-mL aliquot of drinking water sample. The sample bottle is pre-warmed for 7 to 10 minutes in a 44.5°C ± 0.2 incubator.
- Techniques involving Colilert - 18® are incubated for 18 to 22 hours in a 35°C ± 0.5 incubator.
- For the membrane filtration (MF) technique with mEndo Les Agar, 100-mL aliquots of drinking water samples are filtered through Millipore 0.45-µm filters using a three-place manifold attached to a vacuum pump. The filters are transferred to the agar and a incubated for 22 to 24 hours in a 35°C ± 0.5 incubator.

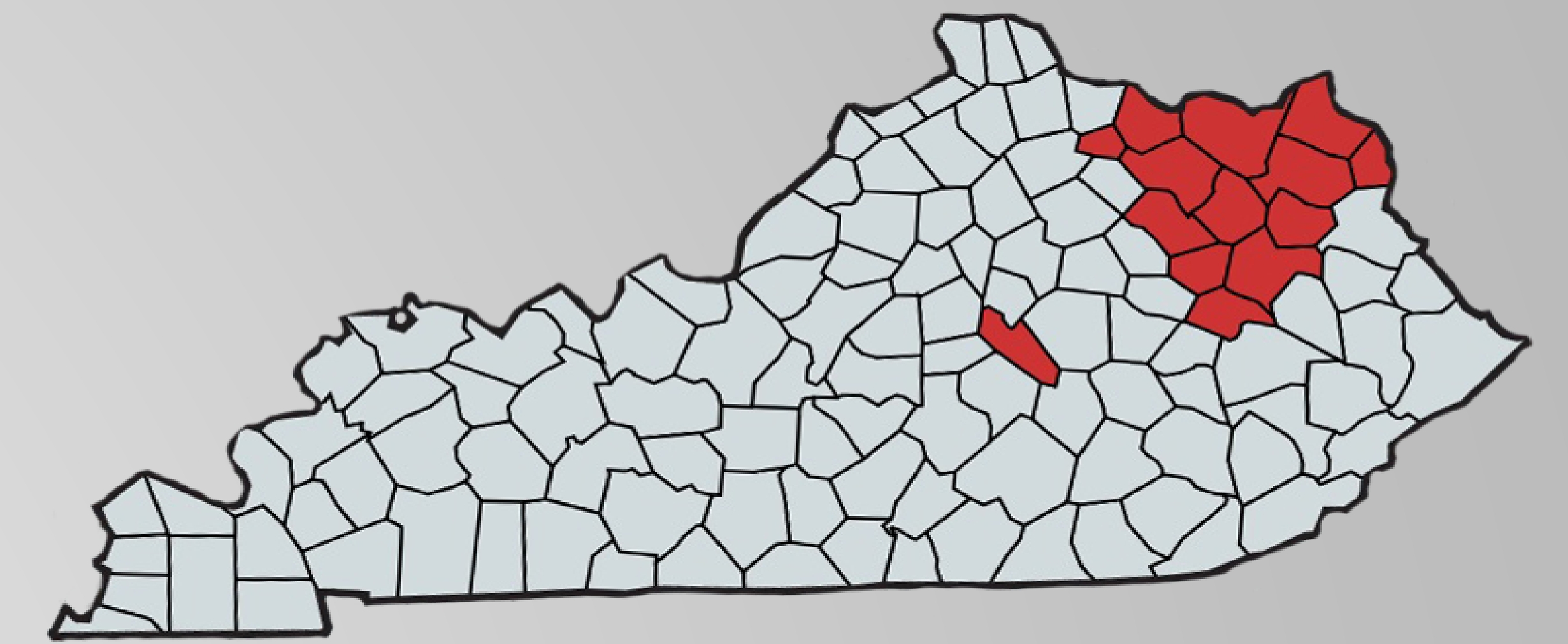


Figure 6. Water Testing Lab Service Region.

### RESULTS

A presumptive positive for total coliform on MF mEndo Les Agar, is confirmed by inoculating lauryl tryptose broth (LTB) and brilliant green bile broth (BGLB). EC-MUG is also inoculated to confirm the presence of *E. coli*. The Enteropluri ID system is used to identify total coliform and *E. coli* positive samples.

If a sample is presumptive positive for total coliform bacteria, the public water system (PWS) is notified within four hours of detection. The PWS is allotted 24 hours to obtain three repeat samples at the original sampling site including a downstream and upstream sample, and is required to conduct a level one assessment. The KDOW Total Coliform Rule Manager is also notified. If the sample is *E. coli* positive, the PWS receives a level two assessment by the state. The PWS also receives a level two assessment if a repeat sample is positive after having a positive total coliform sample.

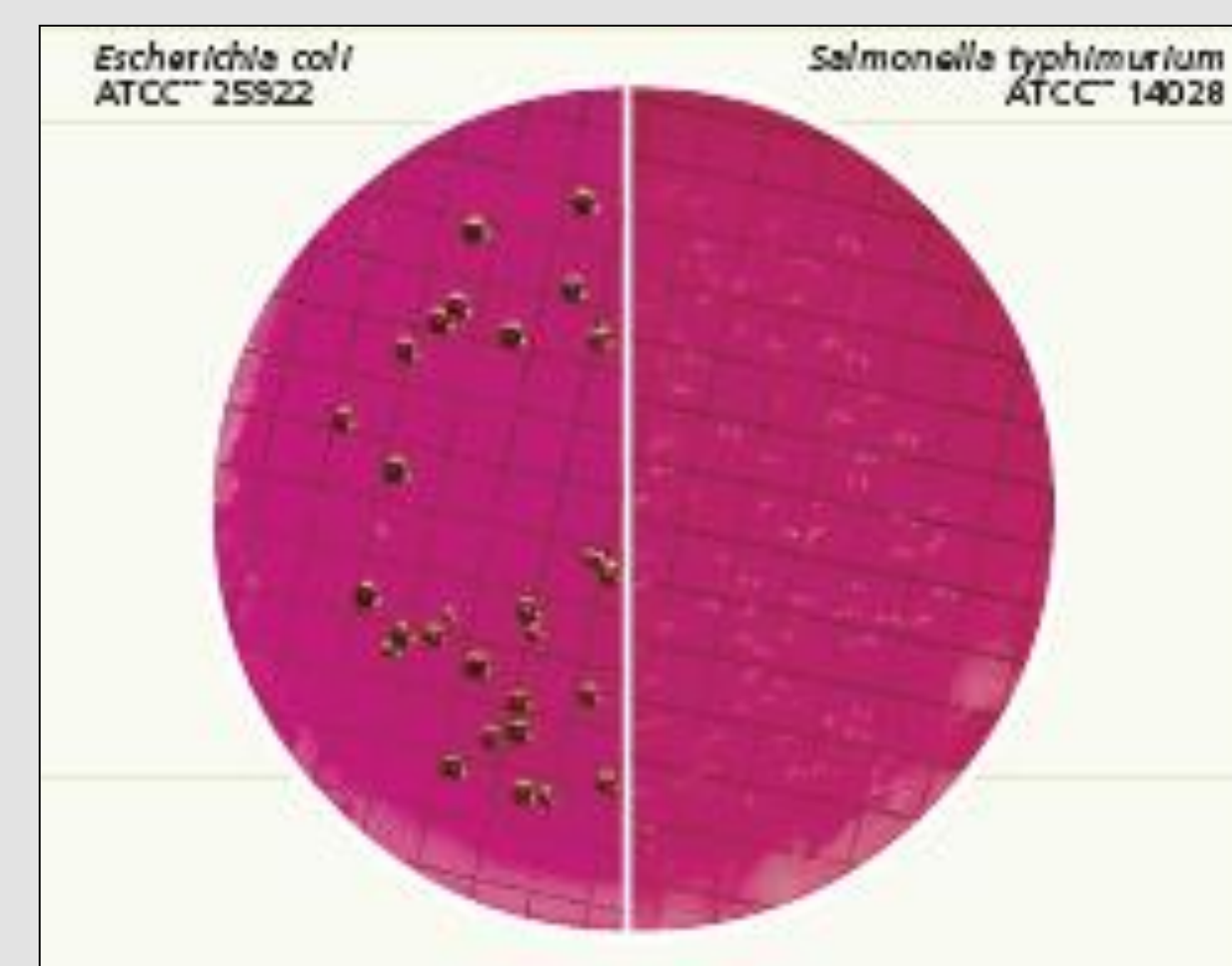


Figure 2. Total Coliform Bacteria on mEndo Les Agar.

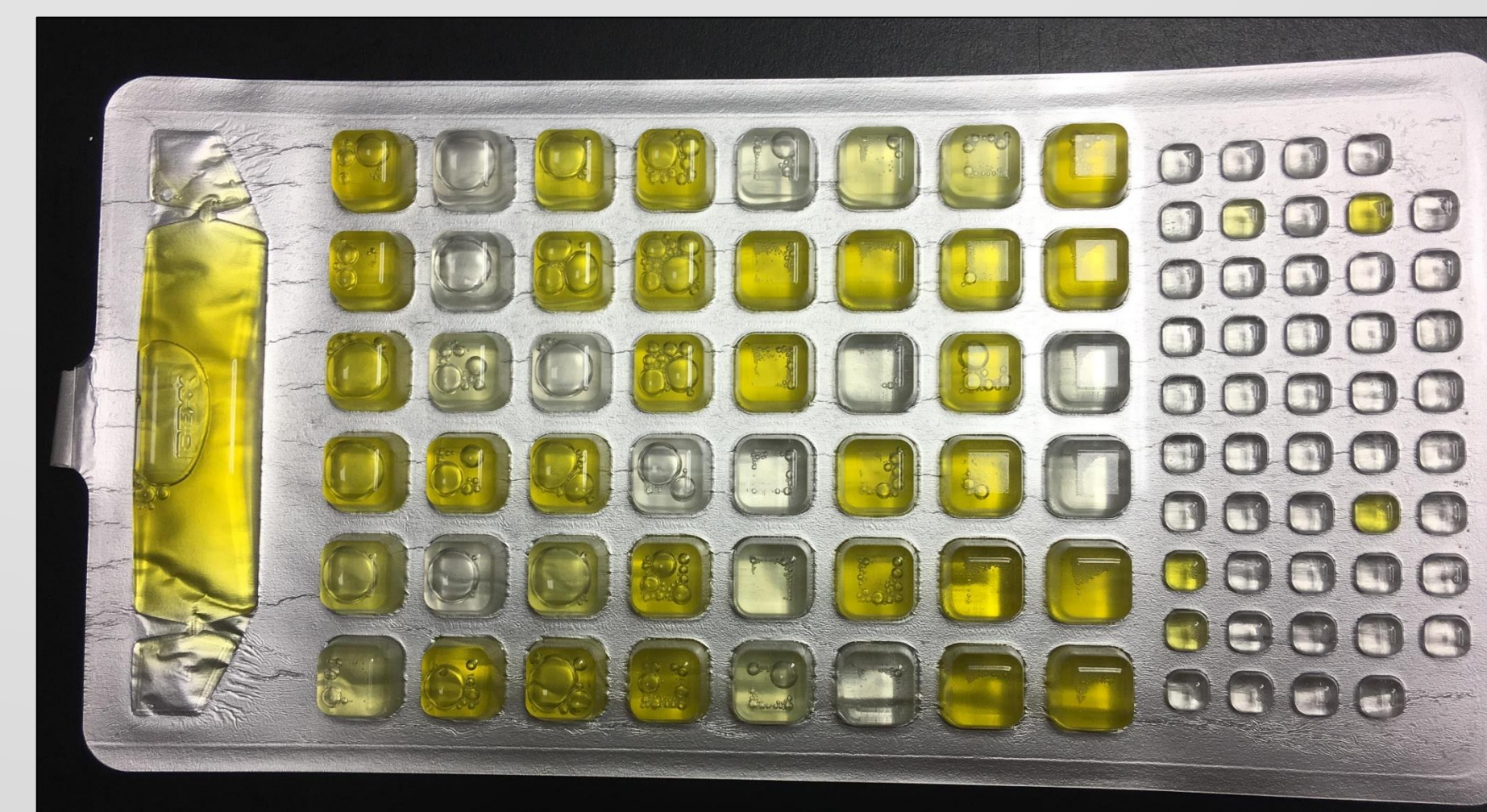


Figure 3. Total Coliform Positive MPN Tray.



Figure 4. Total Coliform Positive using Colilert - 18®.



Figure 5. *Escherichia coli* Fluorescence using Colilert - 18®.



Figure 6. Indole Reaction of *Escherichia coli*.

### DISCUSSION

Since the Morehead State University Water Testing Laboratory began operation in 1979, it has conducted microbiological analysis for those in Rowan County and in the surrounding Morehead State Service region. In 1991, the Natural Resources and Environmental Protection Cabinet Division of Water Drinking Water Branch contracted with Morehead State University to become the Commonwealth of Kentucky's principle microbiology laboratory. Today, the Water Testing Laboratory maintains major clients in 14 counties. In 2018, the Water Testing Laboratory processes 2,371 samples for public water systems as well as numerous samples for private companies and individuals. The laboratory assists the Kentucky Division of Water with environmental issues which have impacted source and drinking water for communities across the state.

The Water Testing Laboratory also provides crucial experience of Undergraduate students by providing them hands-on experience in the daily maintenance of a professional laboratory. Analysts are responsible for maintaining the integrity of all samples, reporting to state official and USEPA, maintaining an efficient office filing system, and maintaining preventative maintenance procedures and schedules.

Overall, the Morehead State University Watering Testing Laboratory plays and indispensable role in both public safety and education. The work of the Water Testing Laboratory ensures the safety of public drinking water while providing vital educational experiences for Biology students.

### ACKNOWLEDGEMENTS

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