

## Quality Control for Water Testing

The water laboratory is the last line of defense against water-borne infections. For this reason, accurate results are a priority. A robust Quality Assurance/Quality Control program will give the laboratory confidence in its results. Microbiologics can help laboratories establish an excellent quality control program by providing reliable, lyophilized, positive and negative microorganism controls based on EPA, Standard Methods, and ISO 11133 recommendations.

### Uses for Microbiologics QC Microorganisms

- Quality control (QC) of new batches of media and reagents
  - *Standard Methods for the Examination of Water and Wastewater*, Section 9020, *Quality Assurance/Quality Control* states, “For each lot of media received, each lab prepared batch of media, and each lot of purchased prepared media, verify appropriate response by testing with known positive and negative control cultures for the organism(s) under test.”
- Initial and ongoing demonstration of capability
- Quality control of test batches
- Verification and validation
- Spiking matrices
- To meet ISO 17025 requirements
  - *ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories*, 7.7.1 states, “The laboratory shall have a procedure for monitoring the validity of results...This monitoring shall be planned and reviewed and shall include, where appropriate, but not limited to: a) use of reference materials or quality materials.”

### EPA and Standard Methods QC Recommendations

The U.S. Environmental Protection Agency (EPA) *Manual for the Certification of Laboratories Analyzing Drinking Water* recommends specific bacterial species for tests for total coliform, fecal coliform, *Escherichia coli* and Enterococci. The species suggested by the EPA are listed below.

### Controls Suggested by the Environmental Protection Agency for Microbiological Tests

Group Targeted	Positive Controls	Negative Controls
Total Coliform	<i>Escherichia coli</i> <i>Enterobacter aerogenes</i>	<i>Staphylococcus aureus</i> <i>Pseudomonas aeruginosa</i> <i>Proteus vulgaris</i>
Fecal Coliform	<i>Escherichia coli</i> <i>Klebsiella pneumoniae</i> (thermotolerant)	<i>Enterobacter aerogenes</i>
<i>Escherichia coli</i>	<i>Escherichia coli</i> (MUG positive strain)	<i>Enterobacter aerogenes</i> <i>Klebsiella pneumoniae</i> (thermotolerant)
Fecal Enterococci/Streptococci	<i>Enterococcus faecalis</i> <i>Enterococcus faecium</i>	<i>Staphylococcus aureus</i> <i>Escherichia coli</i> <i>Serratia marcescens</i>

## Quality Control Suggestions

Based on EPA, Standard Methods, and ISO 11133 suggestions, Microbiologics has developed a list of suggested strains for use in a water microbiology laboratory's quality control program. If using a kit, consult the manufacturer's QC recommendations.

Microorganism Strain	WDCM #	Catalog #
<i>Aerococcus viridans</i> derived from ATCC® 10400™*		0263
<i>Klebsiella aerogenes</i> derived from ATCC® 13048™* <sup>1, 2, 3</sup> (formerly <i>Enterobacter aerogenes</i> derived from ATCC® 13048™*)	00175	0306
<i>Enterobacter cloacae</i> subsp. <i>cloacae</i> derived from ATCC® 35030™*		0388
<i>Enterococcus faecalis</i> derived from ATCC® 19433™* <sup>3</sup>	00009	0367
<i>Enterococcus faecalis</i> derived from ATCC® 29212™* <sup>3</sup>	00087	0366
<i>Enterococcus faecalis</i> derived from ATCC® 7080™*		0497
<i>Enterococcus faecium</i> derived from ATCC® 35667™*		0968
<i>Enterococcus faecium</i> derived from ATCC® 6057™* <sup>1, 2</sup>		01052
<i>Escherichia coli</i> derived from ATCC® 11775™* <sup>2, 3, 4</sup>	00090	0465
<i>Escherichia coli</i> derived from ATCC® 25922™* <sup>1, 2, 3, 5</sup>	00013	0335
<i>Escherichia coli</i> derived from ATCC® 35218™*		0495
<i>Escherichia coli</i> derived from ATCC® 35421™*		0422
<i>Escherichia coli</i> derived from ATCC® 51813™*		0791
<i>Escherichia coli</i> derived from ATCC® 8739™* <sup>1, 3</sup>	00012	0483
<i>Klebsiella pneumoniae</i> subsp. <i>pneumoniae</i> derived from ATCC® 13883™* <sup>1, 2, 6</sup>		0351
<i>Klebsiella pneumoniae</i> subsp. <i>pneumoniae</i> derived from ATCC® 27736™* <sup>4</sup>		0685
<i>Klebsiella variicola</i> derived from ATCC® 31488™* <sup>3, 4</sup> (formerly <i>Klebsiella pneumoniae</i> subsp. <i>pneumoniae</i> )	00206	0261
<i>Klebsiella pneumoniae</i> subsp. <i>pneumoniae</i> derived from ATCC® 33495™* <sup>4</sup>		0957
<i>Kocuria rhizophila</i> derived from ATCC® 9341™*		0688
<i>Legionella pneumophila</i> subsp. <i>pneumophila</i> derived from ATCC® 33152™* <sup>3, 7</sup>	00107	0211
<i>Proteus mirabilis</i> derived from ATCC® 25933™*		0690
<i>Proteus vulgaris</i> derived from ATCC® 13315™* <sup>1, 2</sup> (formerly <i>Proteus hauseri</i> derived from ATCC® 13315™)		0355
<i>Pseudomonas aeruginosa</i> derived from ATCC® 10145™*		0416
<i>Pseudomonas aeruginosa</i> derived from ATCC® 27853™* <sup>1, 2, 3</sup>	00025	0353
<i>Serratia marcescens</i> derived from ATCC® 14756™* <sup>1, 2</sup>		0806
<i>Serratia marcescens</i> derived from ATCC® 43862™*		0262
<i>Staphylococcus aureus</i> subsp. <i>aureus</i> derived from ATCC® 25923™* <sup>3</sup>	00034	0360
<i>Staphylococcus aureus</i> subsp. <i>aureus</i> derived from ATCC® 6538™* <sup>1, 2, 3</sup>	00032	0485

<sup>1</sup> Listed as an appropriate QC strain by U.S. Environmental Protection Agency, *Manual for Certification of Laboratories Analyzing Drinking Water*.

<sup>2</sup> Control Culture suggested by *Standard Methods for the Examination of Water and Wastewater*.

<sup>3</sup> Listed by ISO 11133 as one of the strains used for quality control of media employed in water testing.

<sup>4</sup> Thermotolerant

<sup>5</sup> Microbiologics enumerated *E. coli*, 0335, derived from ATCC® 25922™\*, is not recommended for Fecal Coliform testing on mFC agar at 44.5°C. It is best to test a suspension of *E. coli*, 0335, prepared from fresh colonies grown overnight.

<sup>6</sup> Not thermotolerant. Does not grow at 44.5°C.

<sup>7</sup> Used for quality control of buffered charcoal yeast extract (BCYE) agar used in tests for water quality. Fluorescent antibody serogroup 1.



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## Microbiologics Products for Water Testing

Product	Concentration	Uses	Key Characteristics
<b>KWIK-STIK™</b>	Qualitative	<ul style="list-style-type: none"> <li>Used for QC of presence/absence tests</li> <li>Inoculate water sample with KWIK-STIK</li> </ul>	<ul style="list-style-type: none"> <li>2 or 6 KWIK-STIK units</li> <li>Online Certificate of Analysis</li> </ul>
<b>LYFO DISK™</b>	Qualitative	<ul style="list-style-type: none"> <li>Used for QC of presence/absence tests.</li> <li>Add LYFO DISK to water sample</li> </ul>	<ul style="list-style-type: none"> <li>6 pellets/vial</li> <li>Online Certificate of Analysis</li> </ul>
<b>Lab-Elite™ CRM</b>	Qualitative	<ul style="list-style-type: none"> <li>Certified Reference Material</li> <li>Used by labs following ISO 17025</li> <li>Used for QC of presence/absence tests</li> <li>Inoculate water sample with Lab-Elite swab.</li> </ul>	<ul style="list-style-type: none"> <li>1 Lab-Elite unit (KWIK-STIK format)</li> <li>Certificate of Analysis included with product</li> </ul>
<b>Epower™ E3</b>	1000-9999 CFU/pellet when tested on nonselective media*	Used for QC of presence/absence tests, quantitative enzyme substrate methods, membrane filtration methods, and fermentation broth methods using MPN	<ul style="list-style-type: none"> <li>10 pellets/vial</li> <li>Online Certificate of Analysis</li> <li>Online Statistical Analysis Certificate</li> </ul>
<b>Epower™ E3 CRM</b>	1000-9999 CFU/pellet when tested on nonselective media*	<ul style="list-style-type: none"> <li>Certified Reference Material</li> <li>Used by labs following ISO 17025</li> <li>Used for QC of presence/absence tests, quantitative enzyme substrate methods, membrane filtration methods, fermentation broth methods using MPN</li> </ul>	<ul style="list-style-type: none"> <li>10 pellets/vial</li> <li>Certificate of Analysis included with product</li> <li>COA includes certified value for organism preparation and expanded uncertainty</li> </ul>

\*Recovery may be less on selective agar.

## Presence/Absence Testing

- Microbiologics recommends using the LYFO DISK, KWIK-STIK, or Lab-Elite CRM for presence/absence testing.
- A water sample can be inoculated by:
  - Adding a LYFO DISK directly to a sterile water sample.
  - Inoculating a sterile water sample with a KWIK-STIK swab or a Lab-Elite CRM inoculating swab.
  - Inoculating a sterile water sample with a freshly grown colony or colonies.

## Enumerated Testing

- Microbiologics recommends Epower and Epower CRM quantitative tests.
- In the case of analytical quality control procedures for established methods, *Standard Methods for the Examination of Water and Wastewater*, Section 9020:9, says, "Use certified reference cultures obtained from nationally or internationally recognized sources."
- Recovery on some types of selective media may be less than recovery on nonselective media even when both are inoculated with the same number of CFU.

## Support Hub

Helpful information can be found in the Support Hub at [www.microbiologics.com](http://www.microbiologics.com).

- [Instructions for Use](#) for the products listed in the table above.
- [Membrane Filtration Method Illustrated Instructions](#) for Epower and Epower CRM.

Please contact Microbiologics Technical Support for assistance with any other application questions.

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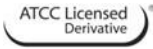
## References

International Organization for Standardization. (2014). *ISO 11133:2014 [Microbiology of food, animal feed and water -- Preparation, production, storage and performance testing of culture media](#)*. First Edition. Switzerland.

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Standard Methods Committee. Hunt, M. E., Best, J., Boczek, L., Dichter, G., Dichter, G., Ehnes, K. R., Harris, S. I., Northeimer, W. W., Volk, C.J.(2015). *9020 Quality Assurance/ Quality Control; Standard Methods for the Examination of Water and Wastewater*. Washington, DC: American Public Health Association.

United States Environmental Protection Agency. (2005). Chapter V *Critical Elements for Microbiology, Manual for the Certification of Laboratories Analyzing Drinking Water Criteria and Procedures, Criteria and Procedures Quality Assurance* (5th ed.). Cincinnati, Ohio: US EPA Office of Water.



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