

CEU COURSE DESCRIPTION

BACTERIOLOGICAL DISEASES II - 24 Contact Hours

This short CEU Course is a continuation of Bacteriological Diseases volume one and will review in detail of commonly found water and wastewater pathogens/diseases, symptoms, and identification techniques. This course will cover water and wastewater sampling techniques, waterborne disease identification ND control, general water quality operations and definitions. It will also cover disease symptoms, disease diagnosis, and history of the disease, susceptibility, and disease sources of contamination. This course will apply to all categories of water treatment/distribution and wastewater treatment/collection. As water professionals, it is our responsibility to identify, stop, and control all waterborne diseases.

This course was designed for Water Laboratory Analysts, but can be utilized by Wastewater Treatment, Collections, Water Distribution, Well Drillers, Pump Installers, and Water Treatment Operators. This course is also an excellent introduction for a person interested in working in the water quality field, water/wastewater treatment or distribution or a collections facility and wishing to maintain CEUs for a certification license or to learn how to do the job safely and effectively, and/or to meet education needs for promotion. Every operator or customer service person that has contact with the public should have this booklet accessible to help answer water quality and waterborne disease related questions.

Course Statement of Need

Properly treated water is an essential function of all water and wastewater operators. Safe drinking water and properly treated effluent free from waterborne disease is the goal of professional operators. Without chlorination and final treatment, many would die of waterborne bacterial infections. In this CEU review, a general characterization of the most important bacterial diseases transmitted through water—cholera, typhoid fever and *Escherichia coli*—is presented, focusing on the biology and ecology of the causal agents and on the diseases' characteristics and their life cycles in the environment. The importance of pathogenic *Escherichia coli* strains and emerging pathogens in drinking water-transmitted diseases is also briefly discussed. Understanding microbiological water sampling and analysis is mainly based on the concept of fecal indicator bacteria. Important sources of bacterial fecal pollution of environmental waters are also briefly indicated. Indicators of fecal pollution will be reviewed for current drinking water microbiological analysis. An understanding of the need of halogens and proper disinfection will prepare the operator to provide safe and finished water or effluent for the customer.

Microbial Regulations

One of the key regulations developed and implemented by the United States Environmental Protection Agency (USEPA) to counter pathogens in drinking water is the Surface Water Treatment Rule. Among its provisions, the rule requires that a public water system, using surface water (or ground water under the direct influence of surface water) as its source, have sufficient treatment to reduce the source water concentration of *Giardia* and viruses by at least 99.9% and 99.99%, respectively. The Surface Water Treatment Rule specifies treatment criteria to assure that these performance requirements are met; they include turbidity limits, disinfectant residual and disinfectant contact time conditions.

The Interim Enhanced Surface Water Treatment Rule was established in December 1998 to control *Cryptosporidium*, and to maintain control of pathogens while systems lower disinfection byproduct levels to comply with the Stage 1 Disinfectants/ Disinfection Byproducts Rule.

The EPA established a Maximum Contaminant Level Goal (MCLG) of zero for all public water systems and a 99% removal requirement for *Cryptosporidium* in filtered public water systems that serve at least 10,000 people. The new rule tightened turbidity standards in December 2001. Turbidity is an indicator of the physical removal of particulates, including pathogens.

The EPA is also planning to develop other rules to further control pathogens. The EPA promulgated a Long Term 1 Enhanced Surface Water Treatment Rule, for systems serving fewer than 10,000 people to improve physical removal of *Cryptosporidium*, and to maintain control of pathogens while systems comply with Stage 1 Disinfectants/ Disinfection Byproducts Rule and EPA's data gathering and monitoring programs under the Unregulated Contaminant Monitoring Rule.

Task Analysis and Training Needs Assessment Process Information Gathering

Task Analysis and Training Needs Assessments have been conducted to determine or set Needs-To-Know for the basis of this continuing education course. TLC has primarily used Training Provider Manual for the Pennsylvania Water and Wastewater System Operator Training Program for course goal setting and learning objectives for all three training formats; conventional classroom, distance paper based and web based training.

Primary Course Learning Objectives Course Goals

Understanding and professional knowledge of the following:

1. The student will understand and understand the function and purposes of halogens, and halogens are highly reactive, and as such can be harmful or lethal to biological organisms in sufficient quantities.
2. The student will understand and understand various disinfection concerns. Selecting the right disinfection weapon requires understanding the factors governing the particular site and the water or wastewater to be treated.
3. The student will understand and describe the correct procedures to follow in collecting bacteriological samples.
4. The student will understand and describe various bacteria, viruses, and protozoans that cause disease are known as pathogens. Most pathogens are generally associated with diseases that cause intestinal illness and affect people in a relatively short amount of time, generally a few days to two weeks. They can cause illness through exposure to small quantities of contaminated water or food, or from direct contact with infected people or animals.
5. The student will understand and describe the diverse assemblage of organisms that carry out all of their life functions within the confines of a single, complex eukaryotic cell are called protozoa.
6. The student will understand describe and classify bacteria according to their shape: spherical, rod-shaped, and spiral-shaped.
7. The student will understand and describe various public water systems and Safe Drinking Water Act (SDWA) rules and regulations. Under SDWA, the EPA is authorized to set national standards to protect drinking water and its sources against naturally occurring or man-made contaminants.
8. The student will understand and describe fecal coliform bacteria and other microscopic organisms that live in the intestines of warm-blooded animals. Although not necessarily agents of disease, fecal coliform bacteria may indicate the presence of disease-carrying organisms, which live in the same environment as the fecal coliform bacteria.
9. The student will understand and describe various EPA rules, Disinfection Byproduct Rule (DBPR) and students are expected to minimize exposure to disinfection byproducts (DBPs) at

individual locations in the distribution system and to shave the peak values of DBPs in the system.

10. The student will understand and describe proper collection and handling of a water sample and is critical for obtaining a valid water test.

11. The student will understand and describe EPA Method 1623, EPA Method 1604 and 1605. The student will understand performance-based methods applicable to the determination of Cryptosporidium and Giardia in aqueous matrices.

Course Learning Objectives Detailed

1. Halogen Section: The student will understand and understand the function and purposes of halogens and halogens are highly reactive, and as such can be harmful or lethal to biological organisms in sufficient quantities. 310 Minutes

Halides	Iodine
Fluorine	Astatine
Bromine	

2. Disinfection Section: The student will understand and understand various disinfection concerns. Selecting the right disinfection weapon requires understanding the factors governing the particular site and the water or wastewater to be treated. 320 Minutes

State and Local Regulations	Chlorine's Appearance and Odor
Alternative Disinfectants	Chlorine Exposure Limits
Unknown Factors Associated with Alternatives	Chlorine Basics
Modern Water Treatment Disinfectants	Disinfectant Qualities
Chlorine	Oxidation
Chloramine	Chemistry of Chlorination
Chlorine Dioxide	Types of Residual
Disinfection Byproducts (DBPS)	Chlorine Review
Total Trihalomethanes	Chlor-Alkali Membrane Process
Haloacetic Acids	Chlorine's Effectiveness
Bromate	Oxidation Chemistry
Chlorite	Sodium Hypochlorite
Disinfection Rules	Calcium Hypochlorite
Disinfection Byproduct Regulations	Chlorine-Based Disinfectants and Chloramines
Microbial Regulations	Chlorine Storage
Chlorine (DDBP)	Spills and Leaks
Chlorine By-Products	Evacuation and Emergency Procedures
Chlorine Disinfectants/Disinfectant By-Products (DBPs)	Leak Procedures
Risks and Benefits of Chlorine	Emergency Response Contingency Plans
Chlorine Timeline	Ozone
Chlorine Gas Information	Chlorine Dioxide

3. Water Quality and Sampling Section: The student will understand and describe the correct procedures to follow in collecting bacteriological samples. 25 Minutes

Fecal Coliform	Non-acute violation
Presence-absence Test	Routine Sample
Physical Characteristics of Water	Repeat Sample
Point-of-entry sample (POE)	Action level
Acute Health Effect	Pathogenic

pH
Escherichia Coliform

Total coliform, fecal coliform, and E. coli
Cryptosporidium

4. Waterborne Pathogens and Disease Section: The student will understand and describe various bacteria, viruses, and protozoans that cause disease are known as pathogens. Most pathogens are generally associated with diseases that cause intestinal illness and affect people in a relatively short amount of time, generally a few days to two weeks. They can cause illness through exposure to small quantities of contaminated water or food, or from direct contact with infected people or animals. 155 Minutes

Chain of Transmission	Cholera Vibrio cholerae
Bacterial Diseases	Vibrio cholerae
Cholera	Vibrio Cholerae Bacterium
Legionellosis	John Snow
Salmonellosis	Cryptosporidiosis Cryptosporidium
Shigellosis	Cryptosporidium
Yersiniosis	Cryptosporidiosis Oocysts
Viral Diseases or Viruses	Escherichia Coli Section
Hepatitis	Fecal Coliform Bacteria
Microorganisms	Membrane Filter Total Coliform Technique
History of Waterborne Pathogens/Diseases	El Tor
Germ Theory of Disease History	Gastroenteritis
Koch's Postulates	Giardiasis
Metabolism	Giardia Lamblia
Prokaryotes	Hepatitis
Anthrax	Legionnaires' Disease
Botulism	Leptospirosis
Smallpox (variola)	Noroviruses
Collection of Samples	Salmonellosis
Amebiasis	Protozoan Diseases
Amebic dysentery; Intestinal amebiasis	Pseudomonas aeruginosa
Expectations (prognosis)	Salmonella
Complications	Schistosomes
Entamoeba histolytica	Tularemia
Trophozoites	Typhoid Fever
Amebic Meningoencephalitis	Viruses
Calicivirus	Viral Gastroenteritis
Rotavirus	

5. Protozoa Section: The student will understand and describe the diverse assemblage of organisms that carry out all of their life functions within the confines of a single, complex eukaryotic cell are called protozoa. 20 Minutes

Paramecium	Contractile Vacuoles
Euglena	Centrioles
Amoeba	Wastewater Treatment Biology
Free-living Protozoa	Euglypha sp.
Environmental Quality Indicators	Euchlanis sp.
Mitochondria	Vorticella
Symbiotic Protozoa	Rotifer
Parasites	

6. Bacteria Section: The student will understand describe and classify bacteria according to their shape: spherical, rod-shaped, and spiral-shaped. 95 Minutes

Peritrichous Bacteria	Cytoplasm
Bacteriophage	Capsules
Release of Virions	Flagella
Cyanobacteria	Pili or Fimbriae
Eukaryote	Spores
Protists	Bacterial Nutrition
Gram Stain	Nitrogen
Procaryotes and Eucaryotes	Carbon
Structure of a Eukaryotic Cell	Oxygen
Cell Membrane	Phosphorous
Nucleus	Sulfur
Cytoplasm	Magnesium
Cell Wall	Potassium
Cilia and Flagella	Sodium.
Structure of a Procaryotic Cell	Calcium
Chromosome	Fastidious

7. Drinking Water Rules and Disease Relationship Section: The student will understand and describe various public water systems and Safe Drinking Water Act (SDWA) rules and regulations. Under SDWA, the EPA is authorized to set national standards to protect drinking water and its sources against naturally occurring or man-made contaminants. 50 Minutes

Total Coliform Rule (TCR)	Parasites
Long Term 1 Enhanced SWTR (LT1ESWTR)	Viruses
1996 Amendments	Chemicals
Information Collection Rule	Unidentified Etiologic Agents
Surface water	Microorganisms
Recreational Water	Water-Quality Data
Data Sources	Water Systems and Water Sources
Deficiency classifications	Irrigation Waters
Outbreak Classification	Unknown Etiology
Outbreaks Associated with Drinking Water	Gastroenteritis
Etiologic Agents	PAM
	Leptospirosis

8. Escherichia Coli Section: The student will understand and describe fecal coliform bacteria and other microscopic organisms that live in the intestines of warm-blooded animals. Although not necessarily agents of disease, fecal coliform bacteria may indicate the presence of disease-carrying organisms, which live in the same environment as the fecal coliform bacteria. 20 Minutes

Reasons for Natural Variation	Keratosis of the feet
Expected Impact of Pollution	Blackfoot disease
Indicator Connection Varies	Blue Baby Syndrome
Chemical Related Disease Section	Causes, incidence, and risk factors
Arsenic	

9. EPA Regulations Section: The student will understand and describe various EPA rules, Disinfection Byproduct Rule (DBPR) and students are expected to minimize exposure to disinfection byproducts (DBPs) at individual locations in the distribution system and to shave the peak values of DBPs in the system. 25 Minutes

Stage 2 DBPR	HAA5 MCL
Compliance Monitoring Sites	IDSE Monitoring and Reporting
Compliance Calculation Basis	
TTHM MCL	

10. Water Sampling and Laboratory Procedures Section: The student will understand and describe proper collection and handling of a water sample and is critical for obtaining a valid water test. 235 Minutes

Bacteriological Monitoring	Follow-up to Coliform Positive Samples
Bacteria Sampling	Invalidating Sample Results
Standard Sample Methods	Compliance, Violations, and Follow-up Actions
MMO-MUG test	MCL
Types of Water Samples	Tier 1 Violations or other Situations
Routine, Repeat, Special	Tier 2 Violations
Positive or Coliform Present Results	Tier 3 Violations or other Situations
Maximum Contaminant Levels (MCLs)	Common Mistakes to Avoid
Heterotrophic Plate Count (HPC)	Proper Sampling Handling
Spread Plate Method	QA/QC Measures
Membrane Filter Method	Preservation of Samples
Counting and Recording	Collection of Surface Water Samples
Acute Risk to Health (Fecal coliforms and E. coli)	Streamflow Measurement
Public Notice	River and Stream Sampling
Violation of the MCL for nitrate.	Composite Sampling
Total Coliform Rule	River or Channel Grab Sampling
Monitoring Requirements	Chain-of-Custody Report Example
Interpretation of Results	Chain-of-Custody Procedures

11. Laboratory Analysis Section: The student will understand and describe EPA Method 1623, EPA Method 1604 and 1605. The student will understand performance-based methods applicable to the determination of Cryptosporidium and Giardia in aqueous matrices. 15 Minutes

- Method 1604: Total Coliforms and Escherichia coli in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium)
- Method 1605: Aeromonas in Finished Water by Membrane Filtration using Ampicillin-Dextrin Agar with Vancomycin (ADA-V)

Accreditation Formula for Figuring CEU Credit

The results of beta-testing were used in conjunction with a formula to determine average student time for accreditation purposes for intended audiences. This formula may not work for unintended audiences.

120 words of text = 1 minute of student time.

1 exam question = 1 minute of student time.

Course Text 238,000 words divided by 200 divided by 60 minutes = 19.8 hours

500 questions equals 8.3 hours

Total time 28.1 hours *We are asking for 24 hours of credit.*

**CEU was awarded based on guidelines established by the International Association of Continuing Education and Training (IACET). We are former IACET providers.

Course Page Count Total

1 page of text = 2 minutes of student time.

1 exam question = 1 minute of student time

560 pages times 2 equals 1120 divided by 60 minutes =18.7 hours

500 questions equals 8.3 hours

Total time 27 hours *We are asking for 24 hours of credit.*

Specific Course Goals and Timed Outcomes (Beta Testing)

Fifty students were invited to participate in this program and the average time necessary to complete each task was recorded. In the above timed outcome section area, the tasks were measured using times spent on each specific objective goal and final assignment grading of 70% and higher.

All fifty students were given a task assignment survey in which to track their times on the above learning objectives (course content) and utilized a Scantron answer sheet to complete their final assignment. All students were given 30 days to complete this assignment and survey. The majority of the students were in prison and part of TLC outreach program. Their objective was to read and complete the course and finish the assignment. They were also encouraged to review, edit, and improve the assessment, if possible. Tasks at all levels from 1 to the 4 licenses were reviewed.

Beta Testing Group Statistics (Short Summary)

Fifty students were selected for this assignment. All the students held water or wastewater treatment operator certification positions. All operators had a minimum of two years of experience and the average was 5 years of service. None of the test group received credit for their assignment. Twenty-six students did not complete the reading assignment and surrendered. Six students failed the final examination with the highest score of 68 percent and the lowest score of 56 percent. The average completion times were based upon the outcome of eighteen students with an average score of 83 percent. The highest student scored 99 percent and the lowest passing score was 71 percent. One student complained the exam was filled with "trick questions" but scored 89 percent. Three student complained of having to read too much and averaged 28-29 hours to complete with a score of, 72, 85 and 89 percent. Ten students said they learned something new and useful. The average time to complete the exam was 23 hours. The shortest successful recorded time was for 15 hours, the longest successful recorded time was 34 hours. The average complaint was the exam was too long. The students agreed the pathogen exam area that was the most difficult, for many of the bugs had similar issues. The course was reviewed and adjusted to provide ease for the student in finding specific areas. Rusty Randall Proctor, September 2011.

2013 Second Beta Testing Breakdown

Sixty four percent of successful students performed at or above the *Basic* level in 2013. Thirty one percent of successful students performed at or above the *Proficient* level, demonstrating their competency over challenging wastewater concepts content. Four percent of successful students performed at the *Advanced* level in follow-up 2013 beta testing. London, Ohio MACI.

Course Training/Assessment Needs Methodology

Technical Learning College identified training/assessment needs by placing identifying them in two categories; internal and external.

1. The difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

3. Please rate the subject matter on the exam to your actual field or work.

Very Similar 0 1 2 3 4 5 Very Different

Assessment Implications

Core tasks have been statistically analyzed then reviewed and edited by the Advisory Committee, SME Experts. These tasks now form a distinct definition of the course and assessment content. The emphasis for most of the levels of operation would be found in the duty/functions discussion below. To recap, bodies of knowledge and concepts that support the understanding and valid performance of the following duty/functions should be taught first:

1. The student will understand and understand the function and purposes of halogens, and halogens are highly reactive, and as such can be harmful or lethal to biological organisms in sufficient quantities.
2. The student will understand and understand various disinfection concerns. Selecting the right disinfection weapon requires understanding the factors governing the particular site and the water or wastewater to be treated.
3. The student will understand and describe the correct procedures to follow in collecting bacteriological samples.
4. The student will understand and describe various bacteria, viruses, and protozoans that cause disease are known as pathogens. Most pathogens are generally associated with diseases that cause intestinal illness and affect people in a relatively short amount of time, generally a few days to two weeks. They can cause illness through exposure to small quantities of contaminated water or food, or from direct contact with infected people or animals.
5. The student will understand and describe the diverse assemblage of organisms that carry out all of their life functions within the confines of a single, complex eukaryotic cell are called protozoa.
6. The student will understand describe and classify bacteria according to their shape: spherical, rod-shaped, and spiral-shaped.
7. The student will understand and describe various public water systems and Safe Drinking Water Act (SDWA) rules and regulations. Under SDWA, the EPA is authorized to set national standards to protect drinking water and its sources against naturally occurring or man-made contaminants.
8. The student will understand and describe fecal coliform bacteria and other microscopic organisms that live in the intestines of warm-blooded animals. Although not necessarily agents

of disease, fecal coliform bacteria may indicate the presence of disease-carrying organisms, which live in the same environment as the fecal coliform bacteria.

9. The student will understand and describe various EPA rules, Disinfection Byproduct Rule (DBPR) and students are expected to minimize exposure to disinfection byproducts (DBPs) at individual locations in the distribution system and to shave the peak values of DBPs in the system.

10. The student will understand and describe proper collection and handling of a water sample and is critical for obtaining a valid water test.

11. The student will understand and describe EPA Method 1623, EPA Method 1604 and 1605. The student will understand performance-based methods applicable to the determination of Cryptosporidium and Giardia in aqueous matrices.

Based on the job-task survey data and beta-testing, the most useful parts of the course are beneficial for the following categories:

Suggested/Recommended for

Water Treatment Levels 1 and 2

Water Distribution Level 1 and 2

Wastewater Treatment Level 1 and 2

Water/Wastewater Samplers

Safe Drinking Water Act Rules and Regulations

Clean Water Act Rules and Regulations

Backflow Awareness

Water Chemistry

Onsite, Pretreatment Operators

The advance-level assignment. Based on the job-task survey data, the most useful part of the course is:

Permissible/Recommended for

Water Distribution Level 3 and 4

Water Treatment Level 3 and 4

Wastewater Treatment Level 3 and 4

Advanced Activated Sludge

Groundwater Protection

Water Conservation

Water Distribution Foreman

Safe Drinking Water Act Rules and Regulations

Clean Water Act Rules and Regulations

Reverse Osmosis/Point of Use

Storm Water Monitoring

Water/Wastewater Sampling

Task Analysis and Training Needs Assessment Process Information Gathering

Task Analysis and Training Needs Assessments have been conducted to determine or set Needs-To-Know for the basis of TLC's continuing education courses. The following is a listing of some of those who have conducted extensive valid studies from which TLC has based the continuing education program upon: the Environmental Protection Agency (EPA), the Arizona Department of Environmental Quality (ADEQ), the Texas Commission of Environmental Quality (TCEQ), Pennsylvania Department of Environmental Protection (PDEP) and the Association of Boards of Certification (ABC).

TLC has primarily used Training Provider Manual for the Pennsylvania Water and Wastewater System Operator Training Program for course goal setting and learning objectives for all three training formats; conventional classroom, distance paper based and web based training.

The titles or names of subjects (Learning Objectives) may be changed for readability purposes. Some of the terms used in this document may be part of a copyrighted adult learning assessment process and in these cases, we utilize generic terminology. The needs assessment/survey maintains our training and education materials criteria. Assessments and changes are performed based on changes in technology, evaluations of the students, regulatory changes and editorial corrections. Most of this information is considered intellectual property and may not be owned by TLC but by third parties.

ADDIE

TLC utilizes a five-phase instructional design model consisting of Analysis, Design, Development, Implementation, and Evaluation for our continuing education courses. Each course design step has an outcome that feeds into the next step in the sequence. The five phases of ADDIE are as follows:

ANALYSIS

During the Training Needs Assessment Process Information Gathering Analysis phase, the course designer(s) (see Subject Matter Experts and Contributing Editors) identifies the learning need, the goals and objectives, the student's needs, existing knowledge, Course Statement of Need, and any other relevant characteristics (State or Federal Need-to-Know) and to ensure that students are learning what is relevant for their job.

DESIGN

This is the systematic process of specifying learning objectives from the Training Needs with a focus on Bloom's Taxonomy. A detailed storyboard following the Needs Assessment/Survey and/or Course Statement of Need will determine the course content.

DEVELOPMENT

The actual creation (production) of the training content will begin based upon the Design phase using Bloom's Taxonomy. At this time, a decision is made to proceed or table the course.

IMPLEMENTATION

During implementation, the Alpha testing plan is put into action and a procedure for course and/or assessment revision is implemented. These course materials and assessments are delivered or distributed to the student group. After delivery, the effectiveness of the training materials is evaluated in Beta testing phase. All of our courses have extensive Alpha and Beta testing to ensure job relevancy, correct information and course learning objectives are met.

EVALUATION

This phase consists of (1) formative and (2) summative evaluation from Alpha and Beta testing. Formative evaluation is present in each stage of the ADDIE process. Summative evaluation consists of tests designed for criterion-related referenced items and providing opportunities for feedback from the students and proctor. Administrative and instructional staff will collect all student concerns (verbal, written and surveys) and distribute these to TLC Administrative personnel for evaluation and course corrections. Course and/or Assessment revisions are made as necessary.

Precept-Based (Micro-Learning) Training Course

TLC's training courses are based upon a form of induction training, made of topical and technical precepts that are discovered in the Needs Assessment/Survey and/or Training Needs Assessment Process Information Gathering. The training topics or learning objectives are made up of "micro-content" or "precepts"— or small chunks of information that can be easily digested. These bite-size pieces of technical information are considered to be one of the most effective ways of teaching students new or important information (regulatory or technical) because it helps the mind retain knowledge easier.

Micro-learning or precept-based training doesn't rely on the student to process a large amount of information before breaking it down. Our method includes short modules with clearly defined learning goals for each section. This method allows a student to hone in on a particular skill, then given the opportunity to exhibit their knowledge in the final assessment (assignment).

Course Training/Assessment Needs Methodology

Technical Learning College identified training/assessment needs by placing identifying them in two categories; internal and external.

Internal Methods include:

- ✓ Observation
- ✓ Interviews
- ✓ Instruments: Perception instruments and Knowledge based assessments
- ✓ Student records and reports
- ✓ Group problem analysis (Classroom or Seminars)
- ✓ Performance or Survey appraisals

External Methods include:

- ✓ Outside consultants (Completion)
- ✓ Government Certification Reviews (Training Needs)
- ✓ Records and reports from other agencies

The needs assessment/survey maintains our training and education materials criteria. Assessments and course material changes are performed based on changes in technology, evaluations of the participants and regulatory changes. Materials are assessed yearly or as needed to insure course integrity.

Primary Course Designers Melissa and Jeff Durbin

Melissa Durbin

This course was co-designed by Melissa Durbin; she has over 20 years of teaching water and wastewater treatment experience as a college instructor. Melissa has written the several nationally accepted water and wastewater treatment manuals. Melissa has taught approximately 10,000 students about water and wastewater treatment and related classes. She will be available to answer questions relating this course.

Jeff Durbin

This course was co-designed by Jeff Durbin, over 10 years of water and wastewater treatment experience as a backflow inspector for the City of Phoenix and 20 years of water and wastewater treatment experience. Jeff has taught approximately 10,000 students about water and wastewater treatment primarily in water distribution, and pollution control (water quality) related classes. Jeff will also be able to answer any question pertaining to water and wastewater treatment or related questions.

Extensive Academic Research

Technical Learning College's (TLC's) continuing education course material development was based upon several factors; field experience working in the water quality field, extensive academic research (teaching in the community college system), advice from subject matter experts (State officials and industry leaders), data analysis, task analysis and training needs assessment process information gathered from other states.

Both Melissa and Jeff Durbin are the two primary Instructors, Subject Matter Experts (S.M.E. and Technical Writers. See below for more information.

Advice from Subject Matter Experts

Both Melissa and Jeff Durbin are professional trainers and have been educated in current trends in professional education and continuing education needs.

Course Compiler

Peter Easterberg, Detail-oriented technical writer/technical editor/desktop publisher/copy editor. 20 years' experience editing and writing feasibility and trade-off studies, test procedures, specifications, user manuals, company policies, HR forms, and ISO-9000 documents. Exceptional grammatical/written communication skills. "Go-to" person for Microsoft Word, Outlook, and general computer questions. Internet Webmaster Certificate (including HTML)

Contributing Editors

James L. Six Received a Bachelor of Science Degree in Civil Engineering from the University of Akron in June of 1976, Registered Professional Engineer in the State of Ohio, Number 45031 (Retired), Class IV Water Supply Operator issued by Ohio EPA, Number WS4-1012914-08, Class II Wastewater Collection System Operator issued by Ohio EPA, Number WC2-1012914-94

Joseph Camerata has a BS in Management with honors (magna cum laude). He retired as a Chemist in 2006 having worked in the field of chemical, environmental, and industrial hygiene sampling and analysis for 40 years. He has been a professional presenter at an EPA analytical conference at the Biosphere in Arizona and a presenter at an AWWA conference in Mesa, Arizona. He also taught safety classes at the Honeywell and City of Phoenix, and is a motivational/inspirational speaker nationally and internationally.

James Bevan, Water Quality Inspector S.M.E. Twenty years of experience in the environmental field dealing with all aspects of water regulations on the federal, state, and local levels. Experience in the water/wastewater industry includes operation of a wastewater facility, industrial pretreatment program compliance sampling, cross-connection control program management, storm water management, industrial and commercial facility inspections, writing inspection reports for industry, and technical reports per EPA permit requirements. Teacher and Proctor in Charge for Backflow Certification Testing at the ASETT Center in Tucson for the past 15 years and I possess an Arizona Community College, Special Teaching Certificate in Environmental Studies. Extensive knowledge and experience in college course and assignment/assessment writing.

Dr. Pete Greer S.M.E., Retired biology instructor, chemistry and biological review.

Jack White, Environmental, Health, Safety expert, City of Phoenix. Art Credits

Ongoing Course Evaluation

Administrative and instructional staff will collect all student concerns (verbal, written and surveys) and distribute these to the Course Editor or Copy-editors for evaluation and course corrections. Administrative and instructional staff will collect all student concerns (verbal, written and surveys) and distribute these to TLC Administrative personnel for evaluation and course corrections. Course and/or Assessment revisions are made as necessary.

Editor's Discretion

The Course Editor may change the course assessment (assignment), course text, objective, artwork and topical order as necessary for security, corrective, printing, readability or typesetting purposes. The assessment may be rotated for security purposes and the course material may be updated to reflect any regulatory updates and/or corrections. The overall course objective or topic guide may be in a different order than the course manual for the reason of typesetting or copy-editing purposes. Course materials, charts and artwork amendments, adjustments, modifications may be performed to reflect regulatory/safety text/artwork updates, Bloom's taxonomy changes, error adjustments and comprehension. These changes generally do not reflect major course material changes, but are minor in nature

Course Procedures for Registration and Support

All of Technical Learning College's distance learning courses have complete registration and support services offered. Delivery of services will include e-mail, web site, telephone, fax and mail support. TLC will attempt immediate and prompt service.

When a student registers for a distance or correspondence course, he/she is assigned a start date and an end date. It is the student's responsibility to note dates for assignments and keep up with the course work. If a student falls behind, he/she must contact TLC and request an end date extension in order to complete the course. It is the prerogative of TLC to decide whether to grant the request. All students will be tracked by a unique computer generated number assigned to the student. Some students will be tracked and reported by their operator ID for required state agencies.

Disclaimer and Security Notice

The student shall understand that it their responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. The student shall understand and follow State laws and rules concerning distance learning courses and understand these rules change on a frequent basis and will not hold Technical Learning College responsible for any changes. The student shall understand that this type of study program deals with dangerous conditions and will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury caused by this CEU education training course material. The student shall contact TLC if they need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

Student's Identity, Attendance, and Participation Verification

A proctoring report and/or computer-tracking program validates proper identity, attendance and participation. The student shall submit a driver's license for signature verification and track their time worked on the assignment. The student shall also sign an affidavit verifying they have not cheated and worked alone on the assignment. We follow up with telephone confirmation and/or quiz review assessment. All student attendance is tracked on TLC's student attendance database.

TLC's Teaching Techniques and Assessment Tools

Our training courses are based upon a form of induction training, made of topical and technical precepts. The training topics are made up of "micro-content" or "precepts"— or small chunks of information that can be easily digested. These bite-size pieces of technical information are considered to be one of the most effective ways of teaching people new information because it helps the mind retain knowledge easier. Micro-learning or precept-based training doesn't rely on the student to process a large amount of information before breaking it down. Our method includes short modules with clearly defined learning goals for each section with a post quiz and a final assessment (quiz). This method of pre-quiz allows a student to hone in on a particular skill, then given the opportunity to exhibit their knowledge in the final assessment.

TLC's Educational Learning Objective Topics

The general course descriptions or topic titles may be different from the detailed description of the course's outline or learning objectives. These terms may be an alternative expression or a substitute but essentially having the same meaning. This is done for reading or for editing purposes. The detailed alpha and beta-testing data is not available in this document and is proprietary information belonging to a third party.

Student Information Personal Data Security Procedures

All information regarding the student is strict and privileged only. This information is held in secure databases and is not sold or provided to any one unless the student requests a copy or a State agency does an audit. Even during audits, we restrict confidential information unless the Agency can provide a legitimate excuse. Some of this security information and data is priority and details are not provided. Students are not provided with any passwords at this time.

Instructions for Written Assignments

The **BACTERIOLOGICAL DISEASES II** distance learning course uses a multiple-choice style answer key. You can find the answer key in the rear of the assignment. The Instructor may require you to complete an additional assignment, either the heterotrophic plate count, Method 1623 - Cryptosporidium and Giardia, or most EPA's data gathering and monitoring programs under the Unregulated Contaminant Monitoring Rule.

Course Assignment Material

Most of the EPA questions will come from the EPA summary, waterborne disease section identification, MCL listing, water sampling and laboratory procedures. Other detailed information will come from the Center of Disease Control. The EPA rules and laboratory procedures are also available online at the EPA Web site: www.epa.gov. You are expected to read and understand all these rules and laboratory procedures.

Required Texts

The **BACTERIOLOGICAL DISEASES II CEU** course comes complete with a short summary of the EPA's Rules and Regulations and related drinking water standards. If you need more information or a complete set of Rules, you can download them off the EPA's web page, www.epa.gov or contact your local state environmental agency. You may need to contact a laboratory or state agency for certain sampling information.

TLC Contact Information

All instructors and administrative staff are obligated to respond within 1 day by email, snail mail or telephone providing proper guidance to successfully complete the assignment. Email and telephone inquiries are handled quickly, generally within 2 hours of the call. We encourage students to complete their work with less frustration and fewer delays by calling or e-mailing us for any concern. We attempt to provide direct interaction similar to conventional classroom training.

Security and Integrity

All students are required to do their own work. All lesson sheets and final exams are not returned to the student to discourage sharing of answers. Any fraud or deceit and the student will forfeit all fees and the appropriate agency will be notified. A random test generator will be implemented to protect the integrity of the assignment.

Grading Criteria / Certificate of Completion

TLC will offer the student either pass/fail or a standard letter grading assignment. If TLC is not notified, the student will only receive a pass/fail notice. In order to pass your final assignment, you are required to obtain a minimum score of 70% on your assignment. The certificate of completion will have all text in capital letters and there is a water mark of the Technical Learning College in three colors along with anti-counterfeiting security measures on the edge of the certificate. An electronic copy is assigned to the student's electronic record with issue date.

Student Assistance

The student shall contact TLC if they need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

ADA Compliance

TLC will make reasonable accommodations for persons with documented disabilities. Students should notify TLC and their instructors of any special needs. Course content may vary from this outline to meet the needs of this particular group. There is an option course assignment available, please contact an Instructor for further assistance.

Feedback Mechanism (Examination Procedures)

Each student will receive a feedback or survey form as part of his or her study packet. The student will be able to find this form in the front of the assignment or lesson(assessment). The student can e-mail, snail mail or telephone TLC for any concern at any time.

Student Concerns

Most of student/training course related concerns are generally answered within 2 hours but not more than 24 hours. TLC has three support staff administrators with computers and telephones and have excellent communication and computer skills and able to respond and track all students and obtain or submit required forms and assignments. TLC has a dedicated computer student tracking system database that is backed-up on a daily bases and this information is secured and stored at a secure offsite location in case of fire or security problems. All student website information is tracked and documented for security measures.

Recordkeeping and Reporting Practices

TLC keeps all student records for a minimum of five years. It is the student's responsibility to give the completion certificate and/or paperwork to the appropriate government agencies. If necessary, we will electronically submit the required information to any required state agencies for your certification renewals.

TLC Record Storage

TLC's training records include the following elements:

1. Individual course training (assessment) and registration page (Customer Order Record) is recorded in Excel format and the hard copies are scanned and stored in a computer database for 5 years and include the following:
 - a. the instructor(s) who taught each session on that date the of the training session or grading was offered (in comments section registration page) as well as which instructor was considered to be the lead instructor(s) and by the Director.
 - b. the name of the instructor(s) and facilitator(s) who proctored and/or graded the examination for each training session if applicable (in comments section registration page);
 - c. the attendance sign-in sheet(s) (registration page) for each training course or session;
 - d. all graded and dated validated examination answer (Assessment) sheets for each examination attempt including an explanation (written in comments and/or Excel list) for any retests as well as a narrative explaining any assistance provided to the attendee before the re-test; and
 - e. session evaluation(survey)forms (in comments section registration page and or Excel list).

Final Assignment

The final examination assignment is determined by the examination administrator or the instructor and there are generally three versions that are readily available. There are also three levels of the examination from average, (5 Answers) Difficult (5 +All of the above) and very difficult (Six answers and All of the above). The student is provided the average rated examination unless there is a condition or concern that requires a more difficult examination. Example, two or more students at the same address or any suspicion of cheating or potential fraud. We try to ensure the security and learning experience. Assignments/answer keys are only accessible to instructors and administrative staff that have a need to know clearance.

Failure

If the student fails the examination, they are provided with two more chances to successfully pass the exam with a score of 70% or better. The student may receive a different and randomly generated exam. Upon failure of an exam, the student can submit their concerns in writing or submit a survey form and has the option to receive instructor assistance that would be equivalent to conventional classroom assistance in discovering the areas that are deficient. The instructor has the option in describing the assistance method or procedure depending upon the student's deficiencies.

Forfeiture of Certificate (Cheating)

If a student is found to have cheated on an examination, the penalty may include--but is not limited to--expulsion; foreclosure from future classes for a specified period; forfeiture of certificate for course/courses enrolled in at TLC; or all of the above in accordance with TLC's Student Manual. A letter notifying the student's sponsoring organization (State Agency) of the individual's misconduct will be sent by the appropriate official at TLC. No refund will be given for paid courses. An investigation of all other students that have taken the same assignment within 60-day period of the discovery will be re-examined for fraud or cheating. TLC reserves the right to revoke any published certificates and/or grades if cheating has been discovered for any reason and at any time. Students shall sign affidavit agreeing with all security measures. The student shall submit a driver's license for signature verification and track their time worked on the assignment. The student shall sign an affidavit verifying they have not cheated and worked alone on the assignment.

Proctoring Instructions

Students enrolled in Technical Learning College's CEU courses that require proctored testing and **who do not live in the physical service area** of the Technical Learning College Test Center must nominate and gain prior approval of a proctor who will monitor course tests. A new proctor nomination form is required for each term and for each class.

PROCTORS, If Necessary...

A proctor is an individual who agrees to receive and administer a student's test(s) from Technical Learning College at the proctor's business email address. The test(s) will be ethically and professionally administered in a suitable testing environment (e.g., college/library or professional office). The proctor will return the test(s) to the Technical Learning College Test Center via fax immediately after administration, and the proctor will mail the exam within one (1) work day of administration to the Technical Learning College Test Center.

Proctors certify in writing to the Technical Learning College Test Center that the student completed the test according to all of the specific directions provided in the proctor guidelines

letter. As the Proctor Nomination Form indicates, the student will identify the specific test(s) the proctor will monitor.

Any proctor the student nominates must be acting in the official capacity in one of the following positions:

- **College or University Personnel:** Dean, Department Chair, Student Records, Professional Staff Member of an adult/continuing education office or counseling center, Librarian, Professor, or any official testing center personnel if the tests are administered in the center.
- **Armed Forces Education Office Personnel**
- **Public or Private School Personnel:** Superintendent, Principal, Guidance Counselor, or Librarian.
- **Other:** Civil Service Examiner, Librarian for City/County, HR Professional, or Education/Training Coordinator.

The following persons do not qualify as proctors:

- **Co-workers, someone who reports to you or your immediate supervisor**
- **Friends**
- **Neighbors**
- **Relatives**

Nominating a Proctor

Students are responsible for identifying, nominating, and making all of the arrangements for the proctoring of their course tests, including the payment of any fees for services and the return of test materials to Technical Learning College Test Center (cost of FAX or postage). The proctor must be able to receive the student's test(s) via email as attachments. The Technical Learning College Test Center does not accept Yahoo, AOL, G-mail, Hotmail, or etc. email addresses.

If the student is unable to find a suitable proctor, they must contact the Technical Learning College Test Center for assistance immediately via email.

Proctor Nomination Form

Students will use the Proctor Nomination Form for nomination and approval of a proctor. The student will complete the top part of the form for each course s/he is taking, even if the same proctor is used for all tests. The student must click on the submit button for the data to be electronically transmitted to the Technical Learning College Test Center.

Disclaimer Notice

It is ultimately the student's responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. The student shall understand State laws and rules change on a frequent basis and believe this course is currently accepted in their State for CEU or contact hour credit, if it is not, the student shall will not hold Technical Learning College responsible. The student shall also understand that this type of study program deals with dangerous conditions and that the student shall will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable for any errors or omissions or advice contained in this CEU education training course or for any violation or injury caused by this CEU education training course material. The student shall will call or contact TLC if help or assistance is needed and double-check to ensure the registration page and assignment has been received and graded.

Affidavit of Exam Completion

The student shall affirm that they alone completed the entire text of the course. The student shall affirm that they completed the exam without assistance from any outside source. The student shall understand that it is their sole responsibility to file or maintain their certificate of completion as required by the state.

Mission Statement

Our only product is educational service. Our goal is to provide you with the best education service possible. TLC will attempt to make your learning experience an enjoyable opportunity.

Educational Mission

The educational mission of TLC is:

To provide TLC students with comprehensive and ongoing training in the theory and skills needed for the environmental education field,

To provide TLC students opportunities to apply and understand the theory and skills needed for operator certification,

To provide opportunities for TLC students to learn and practice environmental educational skills with members of the community for the purpose of sharing diverse perspectives and experience,

To provide a forum in which students can exchange experiences and ideas related to environmental education,

To provide a forum for the collection and dissemination of current information related to environmental education, and to maintain an environment that nurtures academic and personal growth.

At the end of this course, the student should be able:

To identify and explain the function and purposes of halogens and halogens which are highly reactive, and understand these are harmful or lethal to biological organisms in sufficient quantities. To select the right disinfection weapon requiring an understanding of the factors governing the particular site and the water or wastewater to be treated. To describe the correct procedures to follow while collecting bacteriological samples. To describe various bacteria, viruses, and protozoans that cause disease which are known to be pathogens. To describe the diverse assemblage of organisms that carry out all of their life functions within the confines of a single, complex eukaryotic cell are called protozoa. To describe and classify bacteria according to their shape: spherical, rod-shaped, and spiral-shaped. To describe various public water systems and Safe Drinking Water Act (SDWA) rules and regulations. To describe fecal coliform bacteria and other microscopic organisms that live in the intestines of warm-blooded animals. To describe various EPA rules, Disinfection Byproduct Rule (DBPR) and students are expected to minimize exposure to disinfection byproducts (DBPs) at individual locations in the distribution system and to shave the peak values of DBPs in the system.

Student is required to submit the following information for assignment grading...

1. 70 PERCENT ON FINAL ASSESSMENT
2. DRIVER'S LICENSE
3. SCHEDULE OF TIME WORKED ON ASSIGNMENT
4. AFFIDAVIT OF EXAM COMPLETION
5. PROCTOR CERTIFICATION
6. TELEPHONE CONFIRMATION

CUSTOMER SERVICE RESPONSE CARD

NAME: _____

E-MAIL _____ PHONE _____

PLEASE COMPLETE THIS FORM BY CIRCLING THE NUMBER OF THE APPROPRIATE ANSWER IN THE AREA BELOW.

1. Please rate the difficulty of your course.

Very Easy 0 1 2 3 4 5 Very Difficult

2. Please rate the difficulty of the testing process.

Very Easy 0 1 2 3 4 5 Very Difficult

3. Please rate the subject matter on the exam to your actual field or work.

Very Similar 0 1 2 3 4 5 Very Different

4. How did you hear about this Course? _____

5. What would you do to improve the Course?

How about the price of the course?

Poor _____ Fair _____ Average _____ Good _____ Great _____

How was your customer service?

Poor _____ Fair _____ Average _____ Good _____ Great _____

Any other concerns or comments.
