CEU COURSE DESRIPTION

WATER CHEMISTRY CEU TRAINING COURSE

This 12-hour distance learning CEU training course will examine various general aspects of commonly found conventional water/wastewater chemistry procedures which are utilized for proper examination of common found contaminants or used water chemicals, pH, acid-bases, and the periodic table. This course was designed to provide continuing education credit to water and/ or wastewater treatment operators.

Course Purpose

The main purpose of this course is to provide continuing education in understanding various water chemistry related laboratory procedures utilized in determining various water quality-water chemistry related concerns and MCL determinations.

Target Audience

The target audience for this course is primarily for operators who work inside a water laboratory but includes water treatment operators, and wastewater operators. Also included are people/operators interested in working in a water treatment/wastewater treatment or distribution facility and/or wishing to maintain CEUs for a certification license or to learn how to perform their job safely and effectively, and/or to meet education needs for promotion. There are no prerequisites, and no other materials are needed for this course.

Course Statement of Need

All water and wastewater operators who work inside a water laboratory or preform sampling procedures need to be able to describe proper basic water chemistry techniques/procedures/ reactions and properly demonstrate proper and safe operation of various laboratory equipment utilized for general water and wastewater examination and water quality concerns.

Prerequisite

Basic math and chemistry knowledge on at a high school level is recommended for successful completion of this course.

CEU Course Learning Objectives and Timed Outcomes

Knowledge obtained by this CEU Course and the approximately average times the student will spend on each subject. This includes assignment reading, glossary review, practice questions and final examination.

CEU Course Principle Learning Goals

1. The student will be able to understand and describe basic techniques/procedures/reactions terms, atomic chemistry, periodic table and basic chemical uses.
2. The student will be able to understand and describe basic water/wastewater treatment principles and understand related required sampling procedures.
3. The student will be able to understand and describe basic principles of water treatment coagulation techniques.
4. The student will be able to understand and describe inorganic chemistry related to conventional water/wastewater treatment.
5. The student will be able to understand and describe various metals in relationship with water/wastewater treatment.
6. The student will be able to understand and describe various SOC, VOC inorganic chemicals in relationship with water/wastewater treatment.

7. The student will be able to understand and describe various metalloids connected with water/wastewater treatment.
8. The student will be able to understand and describe various laboratory safety procedures connected with water/wastewater treatment.

CEU Course Detailed Learning Objectives and Timed Outcomes

1. The student will be able to understand and describe basic techniques/procedures/reactions terms, atomic chemistry, periodic table and basic chemical uses. 20 Minutes
a. Acronyms
b. Common Water Treatment Chemicals
c. Common Water Quality Problems
d. Water Quality Key Words

2. The student will be able to understand and describe basic water/wastewater treatment principles and understand related required sampling procedures. 15 Minutes
a. Water Treatment Basic Principles
b. Solubility of Substances
c. Drinking Water Analyses Chart
d. Sample Containers
e. Sampling Statements

3. The student will be able to understand and describe basic principles of water treatment coagulation techniques. 20 Minutes
a. Principles of Coagulation
b. Coagulation Influencing Factors
c. Common Coagulants

4. The student will be able to understand and describe inorganic chemistry related to conventional water/wastewater treatment. 320 Minutes
a. Inorganic Chemical Introduction
b. Subdivisions of Inorganic Chemistry
c. Bioinorganic Compounds
e. Chemical Monitoring
f. Antimony
g. Arsenic
h. Arsenic Applications
i. Asbestos
j. Barium
k. Beryllium
l. Cadmium
m. Chromium
n. Copper
o. Cyanide
p. Fluoride
q. Lead
r. Mercury
s. Nitrate
t. Nitrite
u. Selenium
v. Thallium

5. The student will be able to understand and describe various metals in relationship with water/wastewater treatment. 30 Minutes
a. Transitional Metal Complexes
b. Inorganic Compound Characterizations
c. Synthetic Inorganic Chemistry

6. The student will be able to understand and describe various SOC, VOC inorganic chemicals in relationship with water/wastewater treatment. 20 Minutes
a. Inorganic Compound Characterizations
b. Synthetic Inorganic Chemistry

7. The student will be able to understand and describe various metalloids connected with water/wastewater treatment. 260 Minutes
a. Near Metalloids
b. Metal Health
c. Astatine
d. Arsenic
e. Boron
f. Germanium
g. Polonium
h. Silicon
i. Tellurium
j. Allotropes
k. Aluminum
l. Calcium
m. Oxygen
n. Phosphorus
o. Selenium
p. Sulfur
q. Tin

8. The student will be able to understand and describe various laboratory safety procedures connected with water/wastewater treatment. 250 Minutes
a. Laboratory Safety Information
b. Employee's Right to Know
c. Chemical Hygiene Plan
d. Chemical Inventory
e. Chlorine Charts

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 primary 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.

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.

1 page of text = 2 minutes of student time.
1 Math practice problem = 1 minute of student time.
1 word quiz/exam question = 2 minute of student time.

Math question = 2 minutes of student time. Some math questions may qualify for twice or three times this standard time, depending on the amount of different math conversions utilized to solve the answer. For example, in a math question that utilizes two different conversions to solve the answer, the average time would be adjusted to 6 minutes.
The above time averages may change with certain audiences.

**CEU was awarded based on guidelines established by the International Association of Continuing Education and Training (IACET).
450 pages times 2 equals 900 divided by 60 minutes = 15.00 hours

200 post examination questions divided by 60 = 3.33 hours

Total time 18.33 hours ***We are asking for 12 hours of credit.***

Final Examination for Credit
Opportunity to pass the final comprehensive examination is limited to three attempts per course enrollment.

Specific Course Goals and Timed Outcomes (Beta Testing) Short Summary
29 students were successfully tested and the average time necessary to complete each task was recorded stated in the above objectives and timed outcome section. 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. 50 students were originally 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. Only 29 were successful and passed the final assignment with the highest passing score of 99 and the lowest score of 70 percent with 21 students failing by not completing the assignment or scoring less than 70 percent.

Beta Testing Group Statistics
50 students at the Powell Unit were selected for this assignment. None of the test group received credit for their assignment. 8 students did not complete the reading assignment for one reason or another, 13 other failed the assignment. The average times were based upon the outcome of 29 students. All students utilized a Scantron style answer key to complete their assignment. Average high score was 92, with the average passing score of 83 percent. Average time for completion was 13.2 hours. There appeared to be a huge discrepancy between students who have mastered chemistry as an experience operator with more than 3-4 years of experience verses students who lack basic water/wastewater treatment experience and this made this assignment either very simple for some and very difficult for others. The majority of students found this assignment difficult to complete without assistance. It appears that approximately half the students were unsuccessful or lacking water chemistry knowledge or skill from wither a lack of training or from a lack of use. Rusty Randall Proctor, June 2012 Powell Unit

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 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.

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 Verification
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. All student attendance is tracked on the student attendance database.

Feedback Mechanism (examination procedures)
Each student will receive a feedback or survey form as part of his or her study packet. You will be able to find this form in the front of the assignment lesson. The student can e-mail, snail mail or telephone TLC for any concern at any time. Most of these concerns will be answered in 2 hours but not more than 24 hours. TLC has three support staff administrators with modern computers and all have excellent communication and computer skills able to respond and track all students and required forms and assignment. We have a dedicated computer student tracking system database that is backed-up on a daily based and this information is secured and stored at a secure offsite location.

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.

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.

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.

Final Assignment
The final examination assignment is determined by the examination administrator or the instruction and there are generally three versions that are readily available. There is 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 exanimation. 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.

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.

Instructions for Written Assignments
The Water Chemistry training CEU course uses multiple choice questions. Answers may be written in this manual or typed out on a separate answer sheet. TLC prefers that students type out and e-mail their answer sheets to info@tlch2o.com, but they may be faxed to (928) 468-0675.
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

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 changes are performed based on changes in technology, evaluations of the participants and regulatory changes. Materials are assed yearly or as needed to insure no significant changes are made. If this has occurred, the course would be re-evaluated.

Course Author
Melissa Durbin
This course was co-authored by Melissa Durbin; she has over 30 years of water/wastewater treatment teaching experience as a college instructor. Melissa has written the several nationally accepted wastewater treatment manuals since 2001. This course has been accepted in most States for continuing education credit. Melissa has taught approximately 10,000 students about water/wastewater treatment, disinfection and related classes, including mathematic and calculation principles. She will be available to answer questions relating this course.

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 Mater Experts and Technical Writers have trained and/or certified more than ten thousand students. These two Instructors teach on a daily basis in a classroom setting throughout Arizona and on-line to students nationwide. 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.

Primary Course Designers Melissa and Jeff Durbin
Melissa Durbin
This course was co-designed by Melissa Durbin; she has over 30 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 this course.

Course Complier
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
Martin Biscotti PhD. received a BS in Electrical Engineering magna cum laude in 1972 from Wyoming University and three degrees from Dartmouth University: an MA and MS (1976) and a PhD (1984), all in Electrical Engineering and Computer Science. From 1974 to 2008, he was with the Department of Electrical and Systems Engineering.

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.

Dr. Eric Pearce S.M.E. PHD., Chemist, chemistry and biological review. State College of Technology, Environmental, Health and Safety Technology, Water/ Wastewater Operator Training Course Instructor.

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 Jeff Durbin and Bubba Jenkins for evaluation and course corrections.

Final Examination for Credit
Opportunity to pass the final comprehensive examination is limited to three attempts per course enrollment.

Required Texts
This course comes complete and does not require any other materials.

Feedback Mechanism (Examination Procedures)
A feedback form is included in the front of each study or assignment packet.

Environmental Terms, Abbreviations, and Acronyms
TLC provides a glossary in the rear of this manual that defines, in non-technical language, commonly used environmental terms appearing in publications and materials, as well as abbreviations and acronyms used throughout the EPA and other governmental agencies.

Record Keeping 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 to the appropriate agencies.

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 these particular students.

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, s/he 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
I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I also understand that this type of study program deals with dangerous conditions and that I 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. I will call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded.

AFFIDAVIT OF EXAM COMPLETION
I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

Note to Students
Keep a copy of everything that you submit! If your work is lost, you can submit your copy for grading. If you do not receive your certificate of completion or other results within two to three weeks after submitting it, please contact your instructor.

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 with 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.

When the Student finishes this course…
At the conclusion of this course:

The student will be able to describe basic water chemistry principles related to pH, acid-bases, periodic table, water/wastewater treatment (IOC, SOC, VOCs sample requirements, chlorination, detention time, chemical dosage).

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.