

Ultraviolet (UV) Disinfection

Course Outline

Course Description

This 1 day course is designed to increase a water and wastewater operator's knowledge in the basic understanding, application, proper operations, and maintenance of an ultraviolet disinfection reactor.

Course Pre-requisites

There are no specific pre-requisites for this course. However, Grade 12 (or equivalent) math skills are an asset. Math upgrades are available –contact us.

CEU Credit

This course is registered with EOCP and offers 0.6 CEUs.

Course Duration

- 1 day
- 8:30 am to 4:00 pm
- 1 hour lunch break
- Morning and afternoon breaks (15 minutes each)

Course Agenda and Objectives

UV Light Spectrum

- Light wavelengths of UV radiation
- Germicidal wavelength

Inactivation of pathogens

- What are pathogens?
- The effects of UV radiation on pathogens
- UV dosages versus log removal (inactivation)
- Pre-filtration requirements
- Primary and secondary disinfection

Description of the components of a UV reactor

- UV chamber
- Different types of UV lamps
- Lamp sleeves
- Lamp sleeve wipers
- UV sensor
- Lamp power supply

- UV control unit
- UV transmittance online analyser
- Program logic controller
- Temperature sensor

UV Dosage

- UV dosage calculation
- UV dosage requirements for different log removal requirements
- Examples of UD dosage calculations

Factors Effecting UV Dosages

- Water flow rates
- UV transmittance
- Water quality issues
- Suspended solids

Types of UV Systems

- Open channel systems
- Closed pipe systems
- Single lamp reactor
- Multiple lamp reactor

UV System Considerations

- Peak water flows
- Log removal requirements for pathogens
- Pre-filtration requirements
- NSF standard 55 class A
- Good mixing requirements
- UV as primary disinfectant

UV: Advantages

- List of advantages

UV: Disadvantages

- List of disadvantages

Regulatory and Guideline Requirements

- Review some sections of the Yukon Government Drinking Water

Regulations Part 1 & 2

- Health Canada's Guidelines for Canadian Drinking Water Quality
- Reference to the US Environmental Protection Agency related documents

UV System Safety Issues

- UV light exposure
- Electrical safety
- Burns and cuts safety
- Lamp breakage concerns
- Off line lamp breaks
- On line lamp breaks
- Yukon Occupational Health Regulations Section 31: Mercury
- Yukon Occupational Health Regulations Schedule 4: Mercury in Urine

Facility Start-up

- O&M manuals on site and what they include
- Staff requirements
- O&M costs
- Commissioning a new UV system
- Testing the performance of the UV system

Operations and Maintenance

- Operating within validated limits
- Conditions outside of the validated limits (“off-specification”)
- Conditions to ensure UV systems is “on-specification”
- Recommended O&M tasks (from USEPA)
- Calibration of the duty UV sensor

Monitoring & Recording Frequency

- Suggested continuous monitoring requirements (from USEPA)

Delivery Method/Format

Instructional Method	Percentage of Class Time
Hands-on/Q & A	10%
Examples/Case Study	10%
Presentation/Lecture	
Slides	60%
Demonstration	15%
Tutoring	5%

Material/Handouts (supplied)

- Student Binder: Yukon University. Ultraviolet (UV) Disinfection; an elective technical skills development course. Whitehorse, Yukon.
- EOCP Course Completion and Evaluation Form.
 - every student needs to complete and return this form for any CEU allocation
- Calculators are provided but students are welcome to use their own.
 - please return

Course Requirements

Attendance and participation in class are required. It is the student's responsibility to attend all classes. CEUs will be allocated based on attendance and course completion; Yukon College records will show a pass or fail result. If the participant doesn't attend the class, Yukon College records will show a "no show" result and no CEUs will be allocated.

Evaluation

There will be a quantifiable evaluation at the end of this course with a passing mark of 70%. Please note that this evaluation is for self-assessment purpose only.

The final evaluation for this course is NOT an EOCP certification exam. To challenge a certification exam, register separately with EOCP at least 3 weeks in advance: 1-866-552-3627 or crm.eocp.ca.

Appropriate Language

In all areas of the college environment, students are responsible for showing respect for others. Swearing, or language that is discriminatory or derogatory in relation to race, sex, ethnic background, religious beliefs, age, and physical condition is not appropriate.

Electronic Devices

In order to be successful in classes and minimize distractions for others, cell phones, iPods, and other electronic devices must be turned off while students are in class. In an emergency situation, the instructor may give a student permission to use a cell phone or pager.

Academic and Student Conduct

Information on academic standing and student rights and responsibilities can be found in the current Academic Regulations that are posted on the Student Services/Admissions & Registrations web page.

Plagiarism

Plagiarism is a serious academic offence. Plagiarism occurs when students present the words of someone else as their own. Plagiarism can be the deliberate use of a whole piece of another person's writing, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material. Whenever the words, research or ideas of others are directly quoted or paraphrased, they must be documented according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Resubmitting a paper which has previously received credit is also considered plagiarism. Students who plagiarize material for assignments will receive a mark of zero (F) on the assignment and may fail the course. Plagiarism may also result in dismissal from a program of study or the College.

Academic Accommodation

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this class. These accommodations are available for students with a documented disability, chronic condition or any other grounds specified in section 8.0 of the Yukon University Academic Regulations (available on the Yukon University website). It is the student's responsibility to seek these accommodations. If a student requires an academic accommodation, they should contact the Learning Assistance Centre (LAC) at LearningAssistanceCentre@yukonu.ca.

One Day Outline

- UV Light Spectrum
- Inactivation of Pathogens
- Components of a UV Reactor
- Components of a UV Reactor (cont.)
- UV Dosage
- Factors Effecting UV Dosages
- Types of UV Systems
- UV System Considerations
- UV Advantages & Disadvantages
- Regulatory and Guideline Requirements
- UV System Safety Issues
- Facility Start-Up
- Operations and Maintenance
- Monitoring & Recording Frequency
- Hands-on Lab