CIV 1311 Advanced and Sustainable Drinking Water Treatment (2016)

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Calendar Description:

This course covers sustainability issues as they apply to the provision of safe drinking water. Water reclamation and reuse topics focus on strategies that allow wastewater to be treated for indirect potable reuse as well as many other purposes. Other major topics include: risk assessment associated with emerging pathogens and chemical constituents present in source waters, advanced drinking water treatment processes including membranes (UF, NF and RO), advanced oxidation and activated carbon. Throughout the course, case studies, application examples and numerical problems will be presented.

Detailed Course Description:

Within the last 5 to 10 years, advanced analytical equipment has led to the reporting of a wide range of trace organic compounds in drinking water. Many of these compounds originate from waste water sources and it is common knowledge that de facto reuse is occurring across North America. Unfortunately, traditional drinking water treatment processes have not been designed to remove many of the compounds that are present. However, the question must be posed as to whether or not these emerging contaminants represent a high degree of risk with respect to human health effects. As such, this course has been designed to examine the sustainability of drinking water treatment regimes given the knowledge that wastewater is being discharged to many source waters that, up to now, have been thought of as being high quality.

The course begins by examining working definitions of sustainability as they apply to drinking water. Water reclamation and reuse material focuses on both indirect potable reuse, and also strategies that will allow wastewater to be treated for many other purposes. To this end, the occurrence of microbial pathogens and chemical constituents present in untreated and treated wastewaters will be examined. Emerging contaminants including endocrine disrupting compounds and pharmaceutically active compounds will also specifically be discussed. Considering this knowledge as a base, methods of evaluating risks will be examined for both chemical and microbiological constituents present in drinking water sources. In particular, quantitative microbial risk assessment will be discussed as it represents a new approach to the application of appropriate treatment methodologies. Key

calculation steps that are required for this type of analysis will be examined. Examples presented will consider case studies in and around the GTA. Various water reclamation technologies will be described such that appropriate technologies may be considered in future engineering design to meet new regulations. Singapore's NEWater initiative will also be reviewed as a state-of-the-art example of water reuse.

The course will then move on to cover advanced drinking water treatment processes that are capable of addressing risk associated with emerging contaminants. These processes include membranes (UF, NF and RO), conventional and advanced oxidation, activated carbon and treatment optimization. Throughout the course case studies, application examples and numerical problems will be presented.

Course Objectives:

Upon completion of the course it is anticipated that students will have acquired a working knowledge of emerging issues pertaining to sustainable drinking water. In addition, they will be equipped with the tools that will be needed to assess the impacts and treatment of both emerging chemical and microbiological constituents.

Prerequisites: CIV342 and/or CIV1308, or other undergraduate/graduate course(s) dealing with water/wastewater treatment systems as approved by the instructor.

Schedule & Location: May 9th to May 31st, 2016; Lecture 2hrs/day (10:00am – 12:00noon) 5 days/week in GB303; 2 labs - dates, time and location TBA.

Course Readings:
Online links to be provided at start of course.

Course Notes:
Posted on Blackboard.

Evaluation:
2 Labs (5% each) + 2 Quizzes (12.5% each) + Final Exam (65%)