

**ENGG*4340 SOLID & HAZARDOUS WASTE MANAGEMENT
FALL 2009**

Faculty: Professor L. Otten - Room 211

Prerequisites: ENGG*2560 Env. Eng. Systems (CHEM*105; MATH*2270)
OR
ENGG*2260 Bio. Eng. Systems (ENGG*2400; MATH*2270; MICR*1200)

Students without a prerequisite must have the instructor's approval.

Schedule: a) *lectures:* Tuesday and Thursday, 10:00 – 12:00 pm; MACK 234
b) *tutorial:* Tuesday: 2:30 - 4:20 pm; MACK 238

Objectives: Objectives of the course are to provide students with an understanding of

- 1) waste generation and composition of solid waste;
- 2) physical and chemical properties of solid waste;
- 3) solid waste treatment and disposal alternatives;
- 4) positive and negative impacts associated with treatment and disposal alternatives; and
- 5) cross-media issues related to solid and hazardous waste treatment and disposal.

Students will also become familiar with the technical literature dealing with solid and hazardous waste management, and will be required to practice their technical writing skills through projects involving reviews and critiques of technical articles and reports.

Course Content: - the course is designed to cover the following topics:

1. Introduction: solid wastes as a consequence of life; evolution of solid waste management; legislation and governmental agencies.
2. Generation of solid wastes.
3. Handling, storage and processing.
4. Collection of solid wastes: transfer and transport.
5. Physical, biological and thermal waste treatment processes and equipment.
6. Recovery of resources, conversion products and energy.
7. Disposal of solid wastes and residual matter.
8. Hazardous wastes.

Approach:

Solid waste management, especially municipal solid waste, is one of the most significant problems in the world with major environmental, political, economic and public health implications. It is also subject to a great deal of confusion, misinformation, inconsistent regulations and laws, corruption and political mismanagement. Therefore, in addition to the engineering aspects of waste management, the course will consider a number of related issues which are often more challenging than the engineering ones.

An excellent example of the complexities of municipal solid waste management in Canada is the current problem in dealing with the waste generated in the Greater Toronto Area. The course website has a list of references of websites related to Toronto situation, including specific

references to websites of various task force committees and studies. In particular, the *Task Force 2010* and the *New Emerging Technologies, Policies and Practices Advisory Group* websites are important for the course; www.city.toronto.on.ca/ select *city hall*, then *taskforces*).

Text:

Integrated Solid Waste Management - Engineering Principles and Management Issues. George Tchobanoglous, Hilary Theisen and Samuel A. Vigil. McGraw-Hill, New York. (Unfortunately the book is expensive but it is an excellent reference book for career environmental engineers.)

Evaluation:

Student evaluation will be weighted as:

- a) Individual problem assignments - 20%
- b) Team (3 persons) work – 20% each
 - i) Analysis of current SWM practice of selected cities
 - ii) Literature review of recent advances in ISWM
 - iii) MRF/Composting Plant/AD Plant design term project
- c) Examination: 20%

References:

1. Compost Engineering. Roger Tim Haug. Ann Arbor Science. Ann Arbor, MI 48106
2. The Handbook of Environmental Compliance in Ontario. John David Phyper and Brett Ibbotson. McGraw-Hill Ryerson Limited. Scarborough.
3. Standard Handbook of Hazardous Waste Treatment and Disposal. Ed. Harry M. Freeman. McGraw-Hill. New York.
4. Standard Handbook of Environmental Engineering. Robert A. Corbitt. McGraw-Hill. New York.
5. Handbook of Incineration Systems. Calvin R. Brunner. McGraw-Hill. New York.
6. Municipal Solid Waste Incinerator Residues. Studies in Environmental Science 67. Chandler *et al.* Elsevier. Amsterdam. (1997).
7. Hazardous Waste Management. LaGrega. Buckingham and Evans. McGraw-Hill, New York.
8. Library contains some 50 journals dealing with environmental engineering and related sciences. (e.g. BioCycle and Resource Recycling are useful practical journals)

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ONE OF THE OLDEST REFERENCES TO A SANITARY LANDFILL:

"And you shall have a place outside the camp, where you may go out; and you shall have an implement among your equipment, and when you sit down outside, you shall dig with it and turn and cover the refuse." **Deuteronomy 23:12-13.**

RECYCLING:

In discussing the industriousness and resourcefulness of Chinese workers in nineteenth Century California, Mark Twain notes:

"What is rubbish to a Christian, a Chinaman carefully preserves and makes useful in one or another.

*He gathers up all old oyster and sardine cans that white people throw away, and procures marketable tin and solder from them by melting". In **Roughing It.** (1872)*