

ENGINEERING 9630: Pollution Prevention

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Communication *It will be easiest to meet in person after class or by using the above email.*

COURSE DESCRIPTION:

Overview of pollution prevention, contaminant sources, characteristics and fate, impacts of industrial activities, wildfire management, improving manufacturing processes, life cycle assessment of processes, sustainable ethics and economics, financial incentives, fossil fuels divestment and carbon tax, pollution prevention (P2) planning alternatives, design for after life, conservation of rinse water flows and pinch analysis, managing residuals and fugitive emissions, sustainable society, industrial ecology, and circular economy

SCHEDULE: LECTURES: Monday and Wednesday, 2:00 – 3:15 pm in EN 4008

CREDIT VALUE: 3 credits

RESOURCES:

TEXT BOOK

- *Pollution Prevention: Fundamentals and Practice, 2000, Paul L. Bishop, McGraw-Hill (Hard copy on reserve in QEII Library, TD897 .B49 2000. Also published by Waveland Press Inc.)*

REFERENCE FOR WILDFIRE MANAGEMENT

- *Firestorm: How Wildfire Will Shape Our Future, 2017, Edward Struzik, Island Press*

REFERENCES FOR FOSSIL FUEL DIVESTMENT

- *Green America's Guide to Fossil Fuel Divestment, produced by Korfhage, A., www.greenamerica.org/PDF/FossilFree.pdf*
- *Hale, I., Hale, D., Howard, C., Bell, W., 2014, Time to divest from the fossil fuel industry, Canadian Medical Association Journal, 186(12), DOI:10.1503/cmaj.141008*

- Longstreth, B., 2014, *The financial case for divestment of fossil fuel companies by endowment fiduciaries*, Huff Post Politics, 23 January 2014, Accessed 21 May 2015. <http://www.huffingtonpost.com/bevis-longstreth/the-financial-case-for-divestment-b-4203910.html>
- Rusbridger, A., 2015, *Scientists must speak up on fossil-fuel divestment*, Nature, 520:265.
- Takacs, D., 2015, *Introduction: Changing Law for a changing climate*, Hastings Law Journal, February 2015, pp. 513-518.
- Jacqz, H., 2015, *Henry Jacqz: A student of climate change*, Bulletin of the Atomic Scientists, 71(2):1-8, DOI:10.1177/0096340215571896, <http://thebulletin.sagepub.com>

REFERENCE FOR ETHICAL CHALLENGES

- Nolt, J., 2015, *Environmental Ethics for the Long Term: An Introduction*, Routledge, Taylor & Francis Group, London and New York

MAJOR TOPICS:

- Introduction to P2, properties of contaminants, contaminant concentrations, contaminant transport processes, partitioning, and transformation (Ch. 1 and 2)
- Industrial activities and the environment, air pollution, solid wastes and their management, hazardous wastes, energy use (Ch. 3), wildfire risk, pollution and management
- Improvements to manufacturing, batch flow and continuous flow chemical reactors, heat exchange, evaporation and drying, crystallization, distillation, absorption/stripping, extraction/leaching, and adsorption processes, process development and design improvements (Ch. 5)
- Life cycle assessment, life cycle impact assessment phases and applications, (Ch. 6), P2 economics, regulations, and financial incentives, engineering economics (Ch. 7)
- Ethical challenges, sustainable ethics and economics, terminology, measures to reduce GHG emissions, fossil fuel divestment, revenue-neutral carbon tax (Ch. 1 and other references)
- P2 planning, P2 design, green chemistry, alternative synthetic pathways, alternative reaction conditions, design of safer chemicals, design for disassembly and de-manufacturing, packaging (Ch. 8 and 9)
- Water, energy and reagent conservation, rinse water flow analysis examples, pinch analysis examples (Ch. 10)
- Residuals management, wastewater treatment processes, sludge management, air pollution control measures, gas removal (Ch. 11)
- Fugitive emissions, measuring fugitive emissions, controlling fugitive emissions, fugitive emissions from storage tanks (Ch. 12)

- Sustainable society, brief history and highlights, framework for sustainability, industrial ecology, sustainability of selected minerals, gold, platinum group metals, phosphorus (Ch. 14 and other references)

ASSESSMENT:

		Proposed Due Dates	
Paper or Project Report	30%	Summary	3%
		Paper/Report	27%
Presentation	15%		
Two assignment in class	10%		
Class test	20%		
Final exam period	25%		

The class test and final exam will have numerical problems and theoretical questions. For the numerical problems class notes in your own handwriting, printed pages from the textbook, and a scientific calculator only are permitted and the theoretical part will be closed book.

Posted practice problems are available to help in exam preparation as are problems that are solved in the notes. Weather could potentially delay a final exam (or class test).

During class time, personal laptops, phones and other electronic devices should be turned off. However, phones may be used to photograph figures and tables from the class notes.

The two assignments will be based on a book chapter and a journal paper as indicated below.

- 1) Chapter 1, "Everything. Everywhere. Always.", in "Eleven", by Paul Hanley, published by Friesen Press, Victoria, B.C., Canada, 2014
- 2) Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B.L., ..., 2018, Options for keeping the food system within environmental limits, *Nature*, 562:519-525.

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

The highest level of academic integrity is expected from students. Please consult Memorial University's Code of Student Conduct at <https://www.mun.ca/student/supports-and-resources/respectful-campus/student-code-of-conduct.php>

Any student found to commit an academic offence will be dealt with according to the practices as outlined by the School of Graduate Studies. The related calendar information is available at <http://www.mun.ca/regoff/calendar/sectionNo=GRAD-0029>

INCLUSION AND EQUITY:

Students requiring physical or academic accommodations may speak privately to the instructor

so that appropriate arrangements can be made. All conversations will remain confidential. Diversity of viewpoints, values, and backgrounds that each class participant possesses enrich the university experience. Insightful and comprehensive class discussion will be possible when dialogue is collegial and respectful across disciplinary, cultural, and personal boundaries.

STUDENT ASSISTANCE: Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at www.mun.ca/student

One specific resource is the Writing Centre at <https://www.mun.ca/writingcentre/>