**ENBUS 475/SUSM 674 Syllabus-Introduction to Life Cycle Assessment**

**Please review the syllabus carefully. The syllabus is a contract between the instructors and the students. You are responsible for understanding all its content. In addition, you are responsible for following all university policies, as laid out in the second webpage in this folder.**

**Territorial Acknowledgement**

We include the following acknowledgement as a way to work towards healing of our relationships with the Indigenous Peoples of Canada, as laid out in the work of the "Truth and Reconciliation Commission." This acknowledgement is also a show of respect, and dates back centuries, occurring in ceremonies long before settlers came to this land <https://csps-efpc.gc.ca/Tools/jobaids/terr-acknowledgement-eng.aspx>

***“We acknowledge that we live and work on the traditional territory of the Attawandaron (Neutral), Anishinaabeg, and Haudenosaunee peoples. The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes ten kilometres on each side of the Grand River.”***

**Contact Information**

| **Who and Why** | **Details** |
| --- | --- |
| **Instructors**   * *Steven B Young:* [*sb.young@uwaterloo.ca*](mailto:sb.young@uwaterloo.ca) * *Goretty Dias:* [*gdias@uwaterloo.ca*](mailto:gdias@uwaterloo.ca) | **Post your course-related questions** to the **Ask the Instructors** discussion topic\*. This allows other students to benefit from your question as well.  **Questions of a personal nature** can be directed to either Steve or Goretty  *When emailing me,* ***please indicate the course code*** *in the subject line, as well as an appropriate subject line.*  *We will check email and the* ***Ask the Instructors*** *discussion topic\* frequently and will make every effort to reply to your questions within 2 business days (Monday to Friday)*  \*Discussion topics can be accessed by clicking **Connect** and then **Discussions** on the course navigation bar. |
| **Mental Health Support** | All of us need a support system. We encourage you to seek out mental health supports when they are needed. Please reach out to [Campus Wellness and Counselling Services](https://uwaterloo.ca/campus-wellness/counselling-services).We understand that these circumstances can be troubling, and you may need to speak with someone for emotional support. [Good2Talk](https://uwaterloo.ca/campus-wellness/services/good2talk) is a post-secondary student helpline based in Ontario, Canada that is available to all students. |
| **Coronavirus Information** | This resource provides updated information on COVID-19 and guidance for accommodations due to COVID-19.  [Coronavirus Information for Students](https://uwaterloo.ca/coronavirus/academic-information) |
| **Technical Support**   * Technical problems with Waterloo LEARN | [learnhelp@uwaterloo.ca](mailto:learnhelp@uwaterloo.ca?body=Name:%20%0D%0AUser%20ID:%20%0D%0ACourse:)  Include your full name, WatIAM user ID, student number, and course name and number.Technical support is available during regular business hours, Monday to Friday, 8:30 AM to 4:30 PM (Eastern Time).  [LEARN Help Student Documentation](https://uwaterloo.ca/learn-help/students) |

**Announcements**

We will use the **Announcements** widget on the Course Home page during the term to communicate new or changing information regarding due dates, absence, etc., as needed. You are expected to read the announcements on a regular basis to stay up-to-date on course developments.

To ensure you are viewing the complete list of announcements, you may need to click **Show All Announcements**.

**Discussions**

*We have provided an* ***Ask the Instructor*** *discussion forum. Use the Ask the Instructor Forum when you have a question that may benefit the whole class. Also, check this forum to see if your question has already been answered before reaching out to me.*

*In the first week, say hello to the class by posting in the* ***Introduce Yourself*** *discussion forum. Discussions can be accessed from the Course Home page by clicking Connect and then Discussions on the course navigation bar.*

**Course Description and Learning Outcomes**

**Course Description**

This course builds students' technical competencies in life cycle assessment (LCA) and in critical analysis of products' environmental impacts. Course content covers the ISO life-cycle assessment framework, how to conduct technical LCA (including applying quantitative approaches using LCA software and databases, as available and appropriate), challenges of application of LCA to a range of product systems, limitations of LCA, and product life cycle management concepts. Students will use the knowledge gained to conduct their own technical LCA on a product of their choice in consultation with the course instructors.

**Learning Outcomes**

By the end of this course, you will be able to:

1. Describe the 4 phases in doing an LCA study and explain the limitations in applying the framework   
2. Critically analyze LCA studies using ISO guidelines   
3. Apply the technical skills required to conduct an ISO standard LCA   
4. Understand and articulate the appropriate use and limitations of LCA as a tool for sustainability assessment

**Course Schedule**

The course schedule can be found [here](https://learn.uwaterloo.ca/d2l/common/dialogs/quickLink/quickLink.d2l?ou=650013&type=content&rcode=uWaterloo-2544171).

**Materials and Resources**

**Textbook(s)**

**Required**

*E-text (free):  Matthews S, Hendricks and Matthews D. 2015. LCA: Quantitative approaches for decisions that matter.*[*https://www.lcatextbook.com/*](https://www.lcatextbook.com/)

*Go here to get English Version directly* [*https://app.boxcn.net/s/5mnzyq1y3gcyjrveubf4/folder/52228826119*](https://app.boxcn.net/s/5mnzyq1y3gcyjrveubf4/folder/52228826119)

**Other Materials**

***Supporting Readings***

The following readings will supplement or clarify course lectures and supporting material. The weekly content shows which readings to review for particular topics.

Finnveden, G., Hauschild, M. Z., Ekvall, T., Guinée, J., Heijungs, R., Hellweg, S., Koehler, A., Pennington, D., & Suh, S. (2009). Recent developments in Life Cycle Assessment. Journal of Environmental Management, 91(1), 1–21. https://doi.org/10.1016/j.jenvman.2009.06.018

Pennington, D. W., Potting, J., Finnveden, G., Lindeijer, E., Jolliet, O., Rydberg, T., & Rebitzer, G. (2004). Life cycle assessment Part 2: Current impact assessment practice. Environment International, 30(5), 721–739. https://doi.org/10.1016/j.envint.2003.12.009

Reap, J., Roman, F., Duncan, S., & Bras, B. (2008a). A survey of unresolved problems in life cycle assessment: Part 1: goal and scope and inventory analysis. The International Journal of Life Cycle Assessment, 13(4), 290–300. https://doi.org/10.1007/s11367-008-0008-x

Reap, J., Roman, F., Duncan, S., & Bras, B. (2008b). A survey of unresolved problems in life cycle assessment. Part 2: Impact assessment and interpretation. Int J Life Cycle Assess, 13, 374. https://doi-org.proxy.lib.uwaterloo.ca/10.1007/s11367-008-0009-9

Rebitzer, G., T. Ekvall, R. Frischknecht, D. Hunkeler, G. Norris, T. Rydberg, W. -P. Schmidt, S. Suh, B. P. Weidema and D. W. Pennington. 2004. Life cycle assessment: Part 1: Framework, goal and scope definition, inventory analysis, and applications, Environ. Int. 30 (5), 701-720. https://doi.org/10.1016/j.envint.2003.11.005.

Weidema, B.P. and Wesnaes MS. 1996. Data quality management for life cycle inventories-an example of using data quality indicators. J. Cleaner Prod. 4 (3-1), pp. 167-174. https://doi.org/10.1016/S0959-6526(96)00043-1

***Case study***

Montalbo T, Gregory J, Kirchain R. 2011. Life Cycle Assessment of Hand Drying Systems. Materials systems Laboratory Massachusetts Institute of Technology, 51 pp. (available on Learn)

***Critical Review***

Ellingsen, H., and S. A. Aanondsen. 2006. Environmental Impacts of Wild Caught Cod and Farmed Salmon – A Comparison with Chicken. Int J LCA 11(1): 60-65. (available on Learn)

Pelletier, N., Tyedmers, P., Sonesson, U., Scholz, A., Ziegler, F., Flysjo, A., Kruse, S., Cancino, B., & Silverman, H. (2009). Not All Salmon Are Created Equal: Life Cycle Assessment (LCA) of Global Salmon Farming Systems. Environ. Sci. Technol. 2009 43, 8730–8736. (available on Learn)

**Resources**

[Library COVID-19: Updates on library services and operations](https://uwaterloo.ca/library/covid-19-updates-library-services-and-operations).

# Course Schedule

| **Week/Date** | **Topic** |
| --- | --- |
| 1- Jan. 11-15 | Introduction to course, case study and Major LCA Project  Introduction to LCA AND ISO Framework |
| 2- Jan. 18-22 | Goal and Scope- Part 1: SDPs and Functional Units |
| Goal and Scope- Part 2: Boundaries and data quality requirements |
| 3- Jan. 25-29 | LCI -Part 1: Quantitative methods for LCA- Estimations and assumptions |
| LCI -Part 2: Flow diagrams and Data collection |
| 4- Feb. 1-5 | LCI -Part 3: Normalizing data to functional unit |
| LCI -Part 4: Allocation |
| 5- Feb. 8-12 | No new material-work on LCA Project: Goal, Scope and LCI assignment |
| **Reading Week** | |
| 6- Feb. 22-26 | Life Cycle Impact assessment |
| 7- Mar. 1-5 | Life Cycle Interpretation AND Life Cycle Management/ Sustainability |
| 8- Mar. 8-12 | Excel skills and calculations for your project  openLCA workshop/tutorial |
| **8.5**- Mar. **17-19** | No new material – work on LCA project with team and advisor |
| 9- Mar. 22-26 | No new material – work on LCA project with team and advisor |
| 10- Mar. 29-Apr. 2 | No new material – work on LCA project with team and advisor |
| 11- Apr. 5 -9 | Project presentations- In Seminar timeslot |
| 12- Apr. 12-14 | No new material- Work on final report |

**Course and Department Policies**

*Purpose: for students to understand policies specific to your course and your department.*

**Content**

The course content will be delivered mostly through video links and websites that cover the relevant concepts for each week. In addition to reviewing this content, you will also be responsible for reading the assigned weekly readings. The content and readings are the foundation for the weekly discussions, where you can reflect and apply your knowledge using a trigger question that I will provide as a starting point. For more information on weekly discussions, see [Discussions-Weekly](https://learn.uwaterloo.ca/d2l/common/dialogs/quickLink/quickLink.d2l?ou=585754&type=content&rcode=uWaterloo-2298618).

**Readings**

Readings will be assigned each week to provided foundational knowledge for the discussions, essays, and final team project. You can find these readings under Course/Content/Week X. Most of the readings listed are either open access (links provided) or available through UW library while on campus, but also remotely by logging onto the library system. As graduate students, you are expected to search and download these readings yourself. If some of the readings listed are not available online or through the UW library (book chapters, publication in press, etc.), these will be uploaded on LEARN prior to the class. You are also encouraged to look for additional literature and include them in your assignments. If you encounter problems in accessing the readings, please let me and/or our liaison librarian know. Her name is Agnes Zientarska-Kayko and she can be reached at azientarskakayko@uwaterloo.ca

**Resources**

[Library COVID-19: Updates on library services and operations](https://uwaterloo.ca/library/covid-19-updates-library-services-and-operations).

**Course Policies**

**Electronic communication policy**

If we need to communicate with the class, we will only use your UW email account to send out messages. Please check your UW account frequently, or set up a forwarding system to an account you use most. New announcements on LEARN will automatically be notified to you via email. You can choose to deactivate this function if you do not wish to be notified of new announcements automatically. However, in case of individual queries, we will respond (within 2 working days) by using the reply function to the email id you are writing from.

**Policy on late submissions**

***Late submissions are allowed if you have compassionate grounds for lateness*.** Should you not be able to meet a deadline due to compassionate reasons (e.g. illness or death in the family), you must try to contact me and let me know BEFORE the deadline, or as soon as possible thereafter. It is unacceptable to wait to contact me more than a couple of days after a deadline. In the event you require an extension due to compassionate reasons, you may **be asked for documentation**. Technology failures are NOT acceptable reasons for lateness.

Submissions are due by the times and dates indicated.  Submissions received after this time will be penalized 5 per cent per day, or any part thereof, including weekends (i.e. 5% of an assignment that is worth 10% of your course grade would be penalized 0.5% of your final grade per day). Only in exceptional cases will this penalty be waived!

**Policy on Remarking of Assignments**

If you feel a mistake has been made in marking on assignments you can request a remark **within 1 week of your grade being posted on LEARN**.

**For remarking:**

In an email, using the subject line "Assignment name"- Remarking request, provide us with the reason for the specific request for remarking. In the email, you must specify the sections you want addressed, a rationale for why it deserves consideration, with specific reference to the rubric and assessment criteria. General requests for remarking are not acceptable. We will **remark the entire submitted work** for consistency with the rubric, with special attention to the specific request noted by the student. The mark **may increase or decrease as a result.**

**Intellectual Property**

Students should be aware that this course contains the intellectual property of their instructor and/or the University of Waterloo. Intellectual property includes items such as:

* Content, spoken and written (and any audio/video recording thereof);
* Presentations, and other materials prepared for the course (e.g., PowerPoint slides);
* Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student’s educational experience. However, sharing this intellectual property without the intellectual property owner’s permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructors or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).