A Life Cycle Approach to Chemistry Laboratories at the University of New Haven

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Abstract
The Chemistry Department, housed in the Tagliatela College of Engineering at the University of New Haven, offers numerous courses for chemistry and non-chemistry majors. Most of the courses offered by the Chemistry Department include both lecture and laboratory sections. Laboratories have various configurations regarding student capacity, use of groups in the laboratory, and the range of chemicals and equipment used during experimentation. This in turn means that the cost of supplies, as well as the amount of waste generated by a given laboratory, will vary. The goal of this research was to delve into the economic and environmental impacts of chemistry laboratories on the UNH campus. A life cycle approach was used in order to quantify both of these impacts. Results indicate that Synthetic Methods have much higher impacts when compared to other laboratory courses.

1. Introduction

Professors in chemistry programs across the U.S. are responsible for teaching students from all disciplines, including engineering students as well as students from other sciences. Every student in a science related majornrolls in one or more chemistry laboratory courses throughout their undergraduate education. From a big picture perspective, the economic and environmental impacts of chemistry laboratory courses across the U.S. are huge. Therefore, there is potential to make significant improvements in reducing both environmental and economic impacts of such courses. The goal of this research was to delve into the impacts of chemistry laboratories as a whole on the University of New Haven campus, as well as on a course-by-course basis. A life cycle approach was used in order to quantify both of these impacts, which reveals more realistically the effects of chemistry laboratory

environmental impact of the product can then be quantified (Hendrickson, Lave & Matthews, 2006).

LCA is comprised of four different stages: goal and scope definition, life cycle inventory (LCI) analysis, life cycle impact assessment (LCIA), and improvement and interpretation. The goal and scope of a study describes the intended use of the analysis, boundary, functional unit and other items (including temporal aspects). Inventory analysis or LCI involves performing a thorough data collection that quantifies the material, energy, and emissions that occur over the life cycle for the selected functional unit. LCIA expresses the LCI data in terms of environmental impacts. The LCI data is classified into impact categories, such as global warming potential, ecotoxicity, or eutrophication. The interpretation and improvement analysis stage is where conclusions and recommendations are expressed in regard to the goal and scope definition (ISO 2006). All phases are iterative and feedback loops often occur as shown in Figure 1.

Figure 1. Stages of an LCA (ISO 2006)

Use of LCA offers the possibility of identifying weak points over the life cycle of products and suggests improvements for environmental performance. Governmental institutions, private firms, consumer

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