

ENVECO CONTINUING PROFESSIONAL EDUCATION COURSES
for
TEXAS PROFESSIONAL ENGINEERS

COURSE GUIDE

for

Course TX-PE-62
Life Cycle Environmental Impacts of Plastics
Recommended PDH - 5

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Introduction

This course guide has been prepared for your use in completing the subject course **TX-PE- Life Cycle Environmental Impacts of Plastics**. It has been designed to help the professional engineer in Texas gain an understanding of the life-cycle impacts of plastics entering the environment.

The companion reading material for this guide includes:

- “Life Cycle Environmental Impacts of Plastics: A Review”, NIST GCR 22-032, March, 2022, 43 pages, accessible at: <https://nvlpubs.nist.gov/nistpubs/gcr/2022/NIST.GCR.22-032.pdf>

We suggest that you do the following to complete the course:

For each section:

- read the learning objectives for a section of this guide
- complete the reading assignment for that section as indicated in this guide
- answer the questions for that section as found in this guide on the answer sheet

When completed:

- make note of the “pass code” indicating successful completion of this course; complete additional course(s) as appropriate, recording “pass codes” for those courses, then use those codes and your Texas PE number and return to <http://jamikus.com/enveco/pecourses/index.html> to pay the enrollment fee and print out your certificates of completion

Section 1 - Introduction

Learning Objectives

The following are the learning objectives for this section:

- to understand the basics of plastics life cycle analysis (LCA)

Reading Assignments

- read the **Abstract** (Life Cycle Environmental Impacts of Plastics: A Review, single page i preceding the Table of Contents page), **Introduction** (p. 1), and **2. Review of Plastics LCA 2.1 Method** and **2.2 LCA Databases** (pp. 2-4)

Questions

1. Global life-cycle greenhouse gas (GHG) emissions from plastics, for example, is estimated to be around _____, which is substantially larger than the GHG emissions from global aviation.
 - A. 0.7 Gt CO₂e yr⁻¹
 - B. 1.0 Gt CO₂e yr⁻¹
 - C. 1.5 Gt CO₂e yr⁻¹
 - D. 1.7 Gt CO₂e yr⁻¹
 - E. 2.7 Gt CO₂e yr⁻¹
2. North America is the major plastic-producing region
 - A. True
 - B. False
3. The first man-made plastic was created in 1862.
 - A. True
 - B. False
4. It is estimated that _____ of plastics waste has been generated since the 1960s.
 - A. 5,300 Mt
 - B. 6,000 Mt
 - C. 6,300 Mt
 - D. 7,000 Mt
 - E. 7,300 Mt
5. LCA is a science-based approach that quantifies the environmental impacts of products across their life cycle including extraction of raw materials, manufacturing, transportation, consumption, and disposal.
 - A. True
 - B. False

Section 2 - LCAs on Plastic Feedstock Types, Materials, Products, and Additives, and Overall Trend Summary

Learning Objectives

The following are the learning objectives for this section:

- to learn how plastic feedstock types, materials, products and additives affect plastic LCAs

Reading Assignments

- read **2.3. LCAs on Plastics by Feedstock Types**, **2.4. LCAs on Plastic Materials and Products**, **2.5. LCAs on Plastics Additives**, and **2.6. Overall Trend Summary** (pp. 5-20)

Questions

6. Currently there are three types of feedstock categories used for producing plastics commercially: (1) _____, (2) _____, and (3) _____
- A. coal, petroleum, and biomass
 - B. coal, petroleum, and captured CO₂
 - C. petroleum, biomass, and captured CO₂
 - D. petroleum, natural gas, and captured CO₂
 - E. petroleum, biomass, and natural gas
7. A majority of plastics are made of petroleum-based polymers.
- A. True
 - B. False
8. The slow degradation of petroleum-based plastics characteristics is favorable for transportation, storage, and _____, but not for _____
- A. packaging, disposal
 - B. strength disposal
 - C. fire protection, disposal
 - D. use, disposal
9. Bio-based feedstocks, especially large-scale agricultural products, are usually dependent on fossil-derived _____, which create higher impacts in eutrophication and acidification.
- A. pesticides
 - B. fertilizers
 - C. stabilizers
 - D. A and B
 - E. A and C

10. The _____ sector utilizes the biggest portion of primary plastics produced.
- A. insulating
 - B. construction
 - C. medical
 - D. printing
 - E. packaging
11. One of the most common uses of plastics in construction materials is fiber reinforced plastics (FRP).
- A. True
 - B. False
12. Compared to using metals such as steel, using fiber reinforced plastics offers weight reduction potential in the range of 50 % to 60 %.
- A. True
 - B. False
13. Generally, there are four main categories of additives: (1) _____, (2) _____, (3) _____, and (4) _____.
- A. functional additives, stiffeners, fillers, reinforcements
 - B. functional additives, colorants, bulking agents, reinforcements
 - C. functional additives, colorants, fillers, UV blockers
 - D. functional additives, colorants, fillers, reinforcements
 - E. functional additives, colorants, hardeners, reinforcements

Section 3 - Discussion and Recommendations

The following are the learning objectives for this section:

- to learn the conclusions of what the status of knowledge on plastics LCA are

Reading Assignments

- read **3. Challenges and Gaps in Plastics LCA** and **4. Discussion and Recommendations** (pp. 20-24)

Questions

14. Weathering proceeds along multiple synergistic pathways that would be difficult to model in an LCA study due to the variety of pollution-caused damages that occur, including those to _____, _____, _____, and _____.
- A. the carbon and nutrient cycles, genetic changes, changes to ecotoxicity, societal impacts.
 - B. the carbon and nutrient cycles, habitat changes, changes to ecodiversity, societal impacts.
 - C. the carbon and nutrient cycles, habitat changes, changes to ecotoxicity, economic impacts.
 - D. the carbon and nutrient cycles, habitat changes, changes to ecotoxicity, cultural impacts.
 - E. the carbon and nutrient cycles, habitat changes, changes to ecotoxicity, societal impacts.
15. Additives, especially _____, may also limit the EOL options for plastics products
- A. colorants
 - B. fillers
 - C. hardeners
 - D. stiffeners
 - E. UV blockers

When you are ready to have your quiz scored,
click on this button (you can do this more than once) ->

Results and Correct Answers

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Correct Answer															

When you have passed, enter your Texas PE number below to get an automatically generated PassCode:

PE Number _____ Your **PassCode** for course **TXPE62** is _____

(When you complete final enrollment at our website by paying the fee you will be prompted for Pass Codes to confirm successful completion of courses.)