

COMMON COURSE NUMBER: EVR 2805

COURSE TITLE: Hazardous Materials Toxicology

CREDIT HOURS: 3

CONTACT HOURS BREAKDOWN:

Lecture/Discussion	<u> 48 </u>
Lab	<u> 00 </u>
Other	<u> 00 </u>
Contact Hours/Week	<u> 3 </u>

CATALOG COURSE DESCRIPTION:

Prerequisite: CHM 1025, BSC 1005 or BSC 1010C

Co requisite: NONE

This course will provide hazardous materials technicians with an understanding of potential health effects which may result from exposure to various hazardous materials. Topics to be covered will include biological interactions with toxic substances, metabolism of toxic substances, genetic toxicology, systemic toxicology, toxic agents, environmental toxicology, radiation health effects and common chemical hazards.

General Education Requirements - Associate of Arts Degree, meets Area(s):

General Education Requirements - Associate in Science Degree, meets Area(s):

UNIT TITLES:

1. Introduction to Toxicology
2. Biological Interaction
3. Metabolism of Toxic Substances
4. Genetic Toxicology
5. Systemic Toxicology
6. Toxic Agents
7. Environmental Toxicology
8. Radiation Health Effect
9. Common Chemical Hazards

I. Course Overview:

Upon successful completion of this course, the students should be able to recognize health problems that may be associated with exposure to hazardous materials, describe the mechanisms by which toxic substances produce health problems, and implement control measures to reduce exposure to hazardous materials.

II. Units:

Unit 1. Principles of Toxicology

General Outcome:

1.0 The students should be able to discuss general principles of toxicology.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 1.1 Define the meaning of and describe the common approaches to the subject of toxicology.
- 1.2 Explain the influence of the following aspects of toxicity:
 - 1.2.1 Sites and routes of entry
 - 1.2.2 Chemical concentration
 - 1.2.3 Dose
 - 1.2.4 Duration
 - 1.2.5 Frequency
- 1.3 Identify and discuss the different factors that affect the total concentration of chemicals in the body.
- 1.4 Identify and discuss the personal differences that affect the toxicity of chemicals on the individual.
- 1.5 Describe and discuss the differences among:
 - 1.5.1 Additive effects

- 1.5.2 Antagonistic effects
- 1.5.3 Synergistic effects
- 1.5.4 Potentiation
- 1.6 Identify the various levels of tolerance to hazardous chemicals.
- 1.7 Determine the appropriate response to a given dosage of a hazardous material.
- 1.8 Explain the concept of risk assessment, safety factors, and risk extrapolation.

Unit 2. Biological Interaction

General Outcome:

- 2.0 The students should be able to identify the body's various protective barriers to toxic substances and mechanisms used to remove toxic chemicals from the body.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 2.1 Describe the protective barrier known as the epithelium.
- 2.2 Plot the pathway for the transport of chemicals through or across the epithelium.
- 2.3 Identify and discuss the different primary routes of chemical absorption into the body.
- 2.4 Describe how chemicals are distributed through the body and localized in tissues and organs.
- 2.5 Describe the pathways for removal of foreign materials via integumentary, excretory, digestive, and respiratory systems.

Unit 3. Metabolism of Toxic Substances

General Outcome:

3.0 The students should be able to recognize the various methods of biotransformation of toxic substances.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 3.1 Describe how biotransformation aids in the detoxification of foreign chemicals.
- 3.2 Describe phase I and phase II enzyme reactions.
- 3.3 Explain briefly the meaning of extrahepatic biotransformation.
- 3.4 Describe how various factors affect the rates of biotransformation.
- 3.5 Describe how bioactivation is dangerous to the body.
- 3.6 Describe the role of the kidney in detoxification.

Unit 4. Genetic Toxicology

General Outcome:

4.0 The students should be able to recognize the agents and effects of genetic toxicology.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 4.1 Describe the function of DNA and RNA.
- 4.2 Explain how DNA transfers the genetic code.
- 4.3 Summarize the effect of mutations and how they are caused.
- 4.4 Distinguish between malignant and benign cancers and relate these cancers to their causative agents.
- 4.5 Recognize different types of cancer and cancer causing substances.
- 4.6 Define teratogen.
- 4.7 Distinguish how different toxic substances can affect human reproduction.
- 4.8 Delineate the governmental responsibility to reduce the risk of exposing the public to toxic substances.

Unit 5. Systemic Toxicology

General Outcome:

5.0 The students should be able to recognize the pathways toxins follow and the target organs affected.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

5.1 Define the meaning of systemic toxicology and its relationship to the primary target organs of the body.

5.2 Describe the following conditions and substances:

5.2.1 Hypoxia

5.2.2 Anemia

5.2.3 Cardiotoxins

5.2.4 Hematoxins

5.2.5 neurotoxins

5.2.6 reprotoxins

5.3 Describe the function and relationship to systemic toxicology for the following systems:

5.3.1 integumentary

5.3.2 cardiovascular

5.3.3 endocrine

5.3.4 central nervous

5.3.5 reproductive

5.3.6 respiratory

5.3.7 excretory

5.3.8 immune

5.4 Describe the function and relationship to systemic toxicology for the blood.

5.5 Describe the function and relationship to systemic toxicology for the eye.

Unit 6. Toxic Agents

General Outcome:

6.0 The students should be able to recognize various toxic substances and the target organs of the toxins.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

6.1 Distinguish between and cite significant examples of each of the following groups of chemicals:

6.1.1 pesticides

6.1.2 fumigants

6.1.3 metals

6.1.4 solvents

6.1.5 animal toxins

6.1.6 plant toxins

6.2 Briefly describe the organs, or organ systems, targeted by each of the chemicals listed in 6.1.

Unit 7. Environmental Toxicology

General Outcome:

7.0 The students should be able to recognize various environmental sources of toxic substances.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

7.1 Describe how environmental pollutants can threaten human populations.

7.2 Identify main groups of direct food additives.

7.3 Identify main groups of indirect food additives.

7.4 Compare and contrast reducing type and oxidizing type air pollutants.

7.5 Explain the interaction of soil and water and how pollutants interact in the subsurface.

7.6 Identify the variable that influences the fate and distribution of chemicals in the environment.

Unit 8. Radiation Health Effects

General Outcome:

8.0 The students should be able to recognize potential sources of radioactive substances and hazards and their resultant effect of the body.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 8.1 Solve problems using units of roentgen, curie, becquerel, rad, gray, rem, and sievert.
- 8.2 Describe the acute and chronic effects of ionizing radiation.
- 8.3 Describe the concept of natural background radiation.
- 8.4 Discuss the radiation protection standard and its function.
- 8.5 Identify the agencies regulating radioactive materials.
- 8.6 List the sources of ionizing radiation that are found in the environment and describe the various biological responses and different factors that influence those responses in humans.

Unit 9. Common Industrial Hazards

General Outcome:

9.0 The students should be able to recognize what measures to take to counter common industrial hazards.

Specific Learning Outcomes:

Upon successful completion of this unit, the students should be able to:

- 9.1 Describe the effects on the human body of blast wave injuries.
- 9.2 Identify some irritant gases and discuss their toxic effects of the body.
- 9.3 Identify some toxic gasses and discuss their toxic effects of the body.
- 9.4 Describe the differences between the effects of irritant and toxic gases.
- 9.5 Identify some of the producers of methemoglobin and describe their effects of the body.
- 9.6 Describe the health hazards posed by corrosives.
- 9.7 Describe the health risks of exposure to solvents.
- 9.8 Describe how people can be exposed to harmful levels of metals and identify some harmful metals.