



MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEERING, SCIENCE AND TECHNOLOGY

DEPARTMENT: CHEMICAL AND PROCESSING ENGINEERING

MODULE: HEALTH AND SAFETY IN INDUSTRIAL PLANTS

CODE: CHEP 324

SESSIONAL EXAMINATIONS

APRIL 2023

DURATION: 3 HOURS

EXAMINER: MR W. CHIPANGURA

INSTRUCTIONS

- 1. Answer ANY FOUR questions.*
- 2. Start a new question on a fresh page*
- 3. Total marks 100*

Additional material(s): Calculator

QUESTION 1

- a) Define occupational health and safety according to WHO [3]
- b) What is the impact of poor occupational health and safety on national economy? [8]
- c) Classify and give examples of workplace hazards [8]
- d) What are material safety data sheets and why are they important [2]
- e) Define the following terms illustrating with an example:
 - i. Hazard [2]
 - ii. Risk [2]

QUESTION 2

- a) What is job stress [2]
- b) List three symptoms of work-related stress [3]
- c) List and explain the causes of job stress [14]
- d) As a manager at a cement manufacturing plant, explain three ways you can use to reduce work related stress [6]

QUESTION 3

- a) What is an emergency [2]
- b) list any three emergencies that can occur at a chemical plant [3]
- c) Describe with relevant illustrations and examples the four phases of risk management. [8]
- d) Define occupational exposure limit (OEL) [2]
- e) Explain the approaches to setting occupational exposure limit (OEL) [6]
- f) Outline the aspects involved in risk assessment [4]

QUESTION 4

- a) What is shift work? [2]
- b) Describe the factors that must be considered when assessing risks associated with shift work. [6]
- c) Define Epidemiology. [2]
- d) Explain the uses of epidemiology in occupational health and hygiene [10]
- e) State any five safety measures one should take when working with conveyors [5]

QUESTION 5

- a) What is an Accident? [2]

(b)The following is an extract of the report on the Bhopal disaster:

Bhopal Gas Disaster

The Bhopal Gas Disaster occurred on December 2, 1984, when over 40 tonnes of highly poisonous methyl isocyanate gas leaked out of the Union Carbide pesticide factory at Bhopal in Madhya Pradesh. Thousands immediately died of poisoning. At least 20,000 have died in the years since, and ten more die every month due to exposure-related diseases.

In the scandal that followed the disaster, the company was taken over - Chairman, Robert Kennedy who had 35,000 shares in the company, profited by \$70,000. Union Carbide's policy at the plant was to switch off the refrigeration unit to save about Rs.700 (US \$50) per day. If the cooling unit had been switched on, a runaway reaction could have been delayed or prevented. The factory workforce had been halved to maximise profits, training was reduced from six months to 15 days, and routine maintenance was very slack. Equally over-confident was J. Mukund, Carbide's works manager, who said, "The gas leak just can't be from my plant. The plant is shut down. **Our technology just can't go wrong. We just can't have such leaks.**" As soon as it was confirmed that the gas was from the Union Carbide plant, the Chief Medical Officer denied that the gas was fatal; instead he described it as a minor irritant.

The 120,000 victims, who survived however, face a future of misery. They suffer from acute breathlessness, brain damage, menstrual chaos, and loss of the body's immune system leading it to be dubbed chemical AIDS.

The first claim against Union Carbide sued for damages of up to \$15 billion. Then without any consultation with victims' representatives, the government reduced the claim to just over \$3 billion. Four years later with no consultation, the government settled for \$470 million. A less damaging incident had occurred in 1982, but despite the warning this should have given the company, T S Niyogi, Labour Minister at the time said, "A sum of Rs. 25 crore [US\$17.8 million at 1982 exchange rates] has been invested in this unit. The factory is not a small stone, which can be shifted elsewhere. **There is no danger to Bhopal, nor will there ever be.**"

(Source: ALU Issue No. 39, April - June 2001)

‘Accidents do not just happen, they are a string of events eventually leading to a catastrophe.’ From the piece of literature above, identify and comment on the events that led to the Bhopal disaster. [10]

c) List the routes that chemicals can enter in the human body. [6]

d) Argue the order of the hierarchy of hazard control commenting on the effectiveness of one control method relative to the others. [7]

END OF EXAM