Postgraduate Certificate in Occupational Medicine and Health

Occupational Toxicology and Industrial Hygiene

Occupational Toxicology:
Occupational toxicology is the branch of toxicology that focuses on the study of the adverse effects of chemical, physical, or biological agents on workers in the workplace. It involves the assessment and management of potential risks to human health from exposure to hazardous substances encountered in the workplace. Occupational toxicologists play a crucial role in identifying, evaluating, and controlling workplace hazards to protect the health and safety of workers.

Industrial Hygiene:
Industrial hygiene is the science and art devoted to the anticipation, recognition, evaluation, and control of environmental factors or stresses arising in or from the workplace that may cause sickness, impaired health, or significant discomfort among workers or among the citizens of the community. Industrial hygienists work to prevent occupational illnesses and injuries by identifying and controlling workplace hazards through the application of various scientific principles and engineering controls.

Key Terms and Vocabulary:

1. Hazardous Substance:
Hazardous substances are chemicals, biological agents, or physical factors that have the potential to cause harm to human health or the environment. These substances may include toxic chemicals, carcinogens, irritants, allergens, and other dangerous materials commonly found in the workplace.

2. Exposure Assessment:
Exposure assessment is the process of determining the extent to which workers are exposed to hazardous substances in the workplace. This involves measuring or estimating the amount, frequency, and duration of exposure to identify potential health risks and develop appropriate control measures.

3. Risk Assessment:
Risk assessment is the systematic evaluation of the potential risks associated with exposure to hazardous substances in the workplace. It involves identifying hazards, assessing the likelihood of harm, and determining the severity of health effects to prioritize control measures and prevent occupational illnesses or injuries.

4. Permissible Exposure Limit (PEL):
The permissible exposure limit (PEL) is the maximum allowable concentration of a hazardous substance in the workplace air that most workers can be exposed to without experiencing adverse health effects over a specified period. PELs are set by regulatory agencies such as OSHA to protect workers from the harmful

effects of exposure to toxic substances.

5. Biological Monitoring:
Biological monitoring is the measurement of specific biomarkers or indicators in biological samples such as blood, urine, or breath to assess the internal dose or effects of exposure to hazardous substances. This method provides valuable information on the absorption, distribution, metabolism, and elimination of toxicants in the body.

6. Engineering Controls:
Engineering controls are physical modifications or design changes implemented in the workplace to reduce or eliminate exposure to hazardous substances. Examples include ventilation systems, enclosure of processes, and substitution of safer chemicals to protect workers from potential health risks.

7. Personal Protective Equipment (PPE):
Personal protective equipment (PPE) is specialized clothing, gear, or devices worn by workers to protect against exposure to hazardous substances in the workplace. PPE includes items such as respirators, gloves, goggles, and protective clothing designed to minimize the risk of occupational illnesses or injuries.

8. Toxicokinetics:
Toxicokinetics is the study of the absorption, distribution, metabolism, and excretion (ADME) of toxic substances in the body. Understanding toxicokinetics is essential for predicting the bioavailability and toxicity of chemicals in humans and animals exposed to hazardous substances in the workplace.

9. Mutagenicity:
Mutagenicity refers to the ability of a substance to cause changes in the genetic material (DNA) of cells, leading to mutations that may increase the risk of cancer or other adverse health effects. Mutagenic substances are of particular concern in occupational toxicology due to their potential to induce genetic damage in exposed workers.

10. Carcinogenicity:
Carcinogenicity is the ability of a substance to cause cancer in humans or animals. Carcinogens are classified based on their potential to initiate or promote tumor formation, and exposure to these substances in the workplace can increase the risk of developing various types of cancer over time.

11. Acute Toxicity:
Acute toxicity refers to the adverse effects of a hazardous substance that occur shortly after a single or short-term exposure. Acute toxicity can manifest as symptoms such as nausea, dizziness, respiratory distress, or even death, depending on the dose and route of exposure to the toxic agent.

12. Chronic Toxicity:
Chronic toxicity refers to the long-term adverse effects of repeated or continuous exposure to hazardous substances over an extended period. Chronic exposure can lead to cumulative health effects such as organ

damage, cancer, reproductive disorders, or other chronic diseases that develop slowly over time.

13. Bioaccumulation:
Bioaccumulation is the process by which hazardous substances accumulate in living organisms, particularly in fatty tissues, at levels higher than those found in the surrounding environment. Bioaccumulative substances pose a greater risk of toxicity as they can persist in the body and biomagnify through the food chain, leading to potential health hazards for humans and wildlife.

14. Hazard Communication:
Hazard communication is the process of informing workers about the potential hazards of chemicals in the workplace and the necessary precautions to protect their health and safety. This includes labeling of containers, safety data sheets (SDS), training programs, and other means of communicating essential information on hazardous substances to employees.

15. Occupational Exposure Limit (OEL):
The occupational exposure limit (OEL) is the maximum allowable concentration of a hazardous substance in the workplace air, typically expressed as a time-weighted average (TWA) or short-term exposure limit (STEL). OELs are established by regulatory agencies to protect workers from adverse health effects associated with occupational exposure to toxic substances.

16. Sensitization:
Sensitization is the process by which an individual develops an allergic or hypersensitivity reaction to a particular substance after repeated exposure. Sensitizers can trigger immune responses in susceptible individuals, leading to symptoms such as skin rashes, respiratory distress, or other allergic reactions upon subsequent contact with the sensitizing agent.

17. Volatile Organic Compounds (VOCs):
Volatile organic compounds (VOCs) are a group of chemicals that easily evaporate into the air at room temperature, contributing to indoor air pollution and potential health risks in the workplace. VOCs are found in various products such as paints, solvents, cleaning agents, and building materials, and their exposure can cause respiratory irritation, headaches, or other health effects.

18. Threshold Limit Value (TLV):
The threshold limit value (TLV) is a recommended exposure limit developed by the American Conference of Governmental Industrial Hygienists (ACGIH) to guide the control of occupational exposures to hazardous substances. TLVs are based on current scientific evidence and aim to prevent adverse health effects in workers exposed to chemicals, physical agents, or biological hazards in the workplace.

19. Asphyxiant:
An asphyxiant is a gas or chemical substance that can displace oxygen in the air, leading to oxygen deficiency and suffocation in enclosed or confined spaces. Common asphyxiants include nitrogen, carbon dioxide, and inert gases, which pose a significant risk to workers if proper ventilation and monitoring

measures are not in place to prevent asphyxiation.

20. Hazardous Waste:
Hazardous waste is any material that poses a substantial threat to human health or the environment due to its toxicity, reactivity, flammability, or other hazardous characteristics. Proper management and disposal of hazardous waste are essential to prevent contamination of soil, water, and air, as well as to protect public health and the ecosystem.

21. Risk Communication:
Risk communication is the interactive process of exchanging information and opinions on risks associated with hazardous substances in the workplace among stakeholders, including workers, management, regulatory authorities, and the public. Effective risk communication strategies help promote awareness, understanding, and collaboration to address occupational health and safety challenges.

22. Environmental Monitoring:
Environmental monitoring involves the systematic collection and analysis of air, water, soil, or other environmental samples to assess the presence of hazardous substances and evaluate their potential impact on human health and the ecosystem. Monitoring data are used to track environmental trends, identify sources of contamination, and guide pollution control measures to protect environmental quality.

23. Toxicity Testing:
Toxicity testing is the experimental evaluation of the adverse effects of hazardous substances on living organisms, typically using in vitro or in vivo models to assess acute, chronic, or reproductive toxicity. These tests provide valuable data on the toxic properties, dose-response relationships, and mechanisms of action of chemicals to inform risk assessment and regulatory decision-making.

24. Hazard Identification:
Hazard identification is the process of recognizing and characterizing potential health hazards associated with exposure to specific substances, processes, or activities in the workplace. This step is essential for prioritizing risk management strategies, implementing control measures, and protecting workers from the adverse effects of hazardous agents in occupational settings.

25. Emergency Response:
Emergency response refers to the procedures and protocols established to address and mitigate immediate threats to health and safety resulting from accidental releases, spills, fires, or other emergencies involving hazardous substances in the workplace. Effective emergency response plans include evacuation procedures, first aid measures, and communication strategies to ensure a rapid and coordinated response to protect workers and the environment.

26. Exposure Control Banding:
Exposure control banding is a qualitative risk assessment approach used to categorize hazardous substances based on their toxicity, exposure potential, and control measures into specific control bands.

This simplified method helps employers and workers identify appropriate risk management strategies and control measures to minimize exposure risks and protect against adverse health effects in the workplace.

27. Nanotoxicology:
Nanotoxicology is the study of the potential health hazards associated with exposure to engineered nanomaterials, which have unique physicochemical properties that may pose risks to human health and the environment. Nanotoxicologists investigate the toxicity mechanisms, bioavailability, and safety implications of nanomaterials to inform risk assessment and regulatory decisions on their safe use in various applications.

28. Exposure Pathway:
An exposure pathway is the route by which a hazardous substance enters the body and interacts with biological systems, leading to potential health effects. Exposure pathways may involve inhalation, ingestion, dermal contact, or injection of toxicants, and understanding these routes of exposure is crucial for assessing risks, implementing controls, and protecting workers from harm in occupational settings.

29. Risk Management:
Risk management is the process of identifying, assessing, and controlling risks associated with hazardous substances in the workplace to protect the health and safety of workers. This involves implementing control measures, monitoring exposures, training employees, and evaluating the effectiveness of risk reduction strategies to prevent occupational illnesses, injuries, or environmental contamination.

30. Hazardous Atmospheres:
Hazardous atmospheres refer to air conditions in the workplace that contain hazardous substances at levels exceeding permissible exposure limits, posing risks to the health and safety of workers. Common hazardous atmospheres include those contaminated with toxic gases, vapors, dust, or fumes, which require effective ventilation, monitoring, and personal protective measures to prevent exposure-related health effects.

31. Occupational Disease:
An occupational disease is a health condition or disorder resulting from exposure to hazardous substances or unsafe working conditions in the workplace. Occupational diseases may manifest as respiratory illnesses, skin disorders, neurological disorders, cancer, or other health effects caused by prolonged or excessive exposure to occupational hazards.

32. Exposure Registry:
An exposure registry is a database or system used to collect and maintain information on workers exposed to hazardous substances in the workplace for monitoring health outcomes, conducting epidemiological studies, or identifying potential occupational risks. Exposure registries help track and assess the health effects of exposures, facilitate early intervention, and inform preventive measures to protect worker health.

33. Occupational Epidemiology:
Occupational epidemiology is the study of the distribution and determinants of occupational diseases,

injuries, and health outcomes in worker populations to identify risk factors, trends, and prevention strategies. Occupational epidemiologists analyze occupational exposures, health surveillance data, and disease patterns to inform policy decisions, workplace interventions, and public health initiatives aimed at reducing occupational health risks.

34. Hazard Recognition:
Hazard recognition is the ability to identify and assess potential hazards in the workplace, including unsafe conditions, practices, or exposures that may pose risks to worker health and safety. Effective hazard recognition skills are essential for implementing preventive measures, conducting risk assessments, and promoting a culture of safety to prevent accidents, injuries, or illnesses in occupational settings.

35. Health Risk Assessment:
Health risk assessment is the process of evaluating the potential health risks associated with exposure to hazardous substances in the workplace based on scientific evidence, exposure data, toxicity information, and risk characterization. Health risk assessments help quantify the likelihood and severity of adverse health effects, prioritize control measures, and guide decision-making to protect workers from occupational hazards.

36. Occupational Exposure History:
Occupational exposure history is a record of an individual's work activities, tasks, job responsibilities, and potential exposures to hazardous substances or physical agents in the workplace over time. A comprehensive exposure history helps occupational health professionals assess the risks, identify patterns of exposure, and determine the likelihood of work-related illnesses or injuries to develop appropriate preventive measures and interventions.

37. Control Banding:
Control banding is a risk management strategy that assigns hazard levels and corresponding control measures to hazardous substances based on their toxicity, exposure potential, and physical properties. This simplified approach helps employers and workers select appropriate control strategies, such as engineering controls, administrative controls, or personal protective equipment, to reduce exposure risks and protect against adverse health effects in the workplace.

38. Occupational Hygiene:
Occupational hygiene is the multidisciplinary field that focuses on the recognition, evaluation, and control of workplace hazards to protect the health and safety of workers. Occupational hygienists assess exposure risks, monitor environmental conditions, recommend control measures, and promote best practices to prevent occupational illnesses, injuries, or diseases related to chemical, physical, or biological agents in the workplace.

39. Exposure Scenario:
An exposure scenario is a description of the conditions, activities, and pathways through which workers may

come into contact with hazardous substances in the workplace. Exposure scenarios outline potential sources of exposure, routes of entry, duration of contact, and control measures to assess risks, communicate hazards, and develop effective prevention strategies to minimize occupational health risks.

40. Occupational Health Surveillance:
Occupational health surveillance is the systematic collection, analysis, and interpretation of health data on workers exposed to occupational hazards to monitor trends, detect emerging health issues, and assess the effectiveness of preventive measures. Occupational health surveillance helps identify occupational diseases, injuries, or exposures, track health outcomes, and inform targeted interventions to protect worker health and well-being in the workplace.

41. Risk Communication:
Risk communication is the process of exchanging information, opinions, and advice on risks associated with hazardous substances in the workplace among stakeholders, including workers, management, regulatory authorities, and the public. Effective risk communication strategies help build trust, promote transparency, improve decision-making, and facilitate collaborative efforts to address occupational health and safety challenges.

42. Occupational Exposure Monitoring:
Occupational exposure monitoring is the systematic measurement and evaluation of hazardous substances in the workplace environment, worker breathing zones, or biological samples to assess the levels of exposure and potential health risks. Exposure monitoring helps identify sources of exposure, verify control measures, track compliance with exposure limits, and guide interventions to minimize occupational health hazards and protect worker health.

43. Hazard Control Measures:
Hazard control measures are preventive actions or interventions implemented in the workplace to eliminate, reduce, or mitigate exposure to hazardous substances and prevent occupational illnesses, injuries, or environmental contamination. Control measures may include engineering controls, administrative controls, personal protective equipment, training programs, and monitoring strategies to minimize risks and promote a safe work environment for employees.

44. Occupational Health Program:
An occupational health program is a comprehensive initiative designed to protect and promote the health and well-being of workers by addressing occupational hazards, conducting risk assessments, implementing control measures, providing health surveillance, and promoting a culture of safety in the workplace. Occupational health programs aim to prevent work-related illnesses, injuries, or exposures, enhance employee wellness, and ensure compliance with regulatory requirements to support a healthy and safe work environment.

45. Occupational Exposure Limit (OEL):

The occupational exposure limit (OEL) is the maximum allowable concentration of a hazardous substance in the workplace air, typically expressed as a time-weighted average (TWA) or short-term exposure limit (STEL). OELs are established by regulatory agencies to protect workers from adverse health effects associated with occupational exposure to toxic substances, and compliance with OELs is critical to safeguard worker health and safety in the workplace.

46. Hazardous Chemicals:
Hazardous chemicals are substances that pose potential risks to human health, safety, or the environment due to their toxicity, flammability, reactivity, or other hazardous properties. Examples of hazardous chemicals include corrosive substances, carcinogens, neurotoxicants, and sensitizers commonly used in industrial processes, laboratories, or other work settings where exposure control measures are necessary to prevent adverse health effects.

47. Risk Assessment Matrix:
A risk assessment matrix is a visual tool used to evaluate and prioritize risks based on the likelihood and severity of potential health effects associated with exposure to hazardous substances in the workplace. Risk assessment matrices categorize risks into low, moderate, high, or extreme risk levels to guide decision-making, control measures, and risk communication strategies to protect workers from occupational hazards.

48. Hazardous Waste Management:
Hazardous waste management is the systematic control, collection, handling, storage, transportation, treatment, and disposal of hazardous waste materials to prevent environmental contamination, protect public health, and comply with regulatory requirements. Proper hazardous waste management practices include waste characterization, labeling, containment, and disposal methods to minimize risks and ensure safe handling of hazardous substances in the workplace.

49. Occupational Health and Safety (OHS):
Occupational health and safety (OHS) is a multidisciplinary field that focuses on promoting and protecting the health, safety, and well-being of workers in the workplace. OHS programs aim to prevent work-related injuries, illnesses, or exposures by identifying hazards, implementing control measures, providing training, conducting health surveillance, and fostering a culture of safety to ensure a healthy and safe work environment for employees.

50. Hazardous Material Handling:
Hazardous material handling refers to the safe and proper management of hazardous substances in the workplace, including storage, transportation, use, and disposal of chemicals, biological agents, or physical hazards to prevent accidents, spills, or exposures. Effective hazardous material handling practices involve risk assessment, labeling, containment, emergency response planning, and employee training to minimize risks and protect worker health and safety in occupational settings.

51. Occupational Exposure Risk:

Occupational exposure risk refers to the likelihood and potential severity of adverse health effects associated with exposure to hazardous substances, physical agents, or biological hazards in the workplace. Assessing