LESSON ASSIGNMENT

LESSON 13	Controlling Toxic Industrial Materials (Non-NBC).
LESSON ASSIGNMENT	Paragraphs 13-1 through 13-8.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

13-1. Classify toxic industrial materials according to their physical states.

13-2. Identify the routes of entry of toxic industrial materials into the body.

13-3. Identify the biological effects of toxic industrial materials.

13.4. Identify the toxic industrial materials threat and their sources.

13-5. Identify the harmful effects of carbon monoxide, hydrogen chloride, bore/gun gases, and solvents, greases, and oils.

13-6. Describe the risk management process as it pertains to toxic industrial materials.

13-7. Describe the preventive medicine measures necessary to protect personnel from the exposure to toxic industrial materials.

13-8. Describe the individual preventive medicine measures necessary to protect personnel from the exposure to toxic industrial materials.

LESSON 13

CONTROLLING TOXIC INDUSTRIAL MATERIALS (NON-NBC)

13-1. PHYSICAL STATES OF TOXIC INDUSTRIAL MATERIALS (TIMs)

a. Gas.

(1) A state of matter in which the material is in a gaseous phase at room temperature.

(a) Carbon monoxide.

(b) Hydrogen chloride.

(c) Bore/gun gases.

(2) Gases expand and contract significantly in response to changing temperature and pressure. By increasing pressure and decreasing temperature, gases can be changed into either a liquid or solid state.

(3) Gases mix easily with other gases and uniformly distribute themselves throughout work areas or other contaminated areas.

b. Liquid.

(1) The state of matter in which a substance is free flowing and formless at room temperature.

(2) Capable of existing in three forms.

(a) Water.

(b) Vapor.

1 Finely separated particles of gas floating in air.

2 Normally seen as fog or smoke.

3 TIMs existing in the form of vapor can be inhaled deeply into the lungs.

(c) Mist

1 A suspension of liquid droplets generated by condensation from the gaseous to the liquid state.

2 Breaking up a liquid into a dispersed state can also cause mist.

NOTE: An example of mist would be spraying water from a household spray bottle.

c. Solids.

(1) Solids include fumes such as those from lead soldering, welding and brazing. These fumes consist of very small solid particles that are dispersed into the air.

(2) Dust is another form of a solid that is very common to most soldiers. Dust consists of very small solid particles that have been mechanically removed from a larger solid by handling, grinding, impacting, detonating and weathering.

13-2. ROUTES OF ENTRY INTO THE BODY

a. Inhalation.

(1) The most significant route of entry into the body.

(2) Frequency and duration of exposure effect onset of symptoms.

(3) Inhaled TIMs enter the bloodstream through the gas exchange region of the lungs.

(4) Symptoms of TIM inhalation.

(a) Instant effects.

1 Cough.

2 Burning in throat or chest.

(b) Delayed effects may develop in periods as short as 24 hours or as long as several years.

NOTE: An example would be asbestosis, from inhaling asbestos, or other chronic lung disorders.

b. Absorption. Chemicals absorbed through the skin can have local as well as systemic effects.

(1) Local effects. The most common local effect is dermatitis, which is indicated by reddening of the skin or the appearance of raised, blister like lesions on the skin.

(2) Systemic effects. Systemic poisoning, such as cancer, can result from absorption.

NOTE: An example is cancer of the liver caused by absorption of carbon tetrachloride.

c. Ingestion.

(1) The result of eating or smoking with contaminated hands or utensils.

(2) Accidental ingestion may occur if toxic materials are stored with food or beverages.

d. Injection.

(1) Normally accidental. May occur from the rupture of high-pressure air or liquid lines.

(2) Toxic materials may enter the body through a traumatic injury such as a puncture wound or laceration.

13-3. BIOLOGICAL EFFECTS OF TIMs

a. Irritation.

(1) Caused by irritants such as sulfur dioxide, acetic acid, formaldehyde, sulfuric acid, iodine, ozone and oxides of nitrogen.

(2) Symptoms include inflammation of the mouth, nose and lung tissue.

b. Asphyxiation.

(1) Caused by asphyxiants such as nitrogen, nitrous oxide, hydrogen, helium, methane, ethane, carbon monoxide and cyanide.

(2) Asphyxiants do not damage the lungs; they displace oxygen or cause the body to become incapable of using oxygen.

c. Anesthesia.

(1) Results from exposure to chemical solvents such as acetone and trichloroethylene.

NOTE: Both of these chemicals are commonly used as degreasing agents in motorpool operations.

(2) Biological effect is a depressant effect on the brain and central nervous system.

(3) The degree of anesthetic effect depends on the type of contaminant as well as the concentration and amount you are exposed to.

d. Systemic poisoning.

(1) May occur from exposure to organic solvents such as methylene chloride and carbon tetrachloride.

NOTE: These chemicals are found in many paints, degreasers and propellants.

(2) Damage internal organs such as the liver, kidney, central nervous system and the cardiovascular system.

e. Cancer. Chemicals suspected of causing cancer, based on animal studies, are called carcinogens.

13-4. MEDICAL THREAT TO SOLDIERS

a. Carbon monoxide poisoning.

NOTE: Carbon monoxide is a by-product of the incomplete burning of carbon substances such as coal, gasoline and natural gas. Understanding where and how carbon monoxide is produced is a critical step in avoiding exposure to it.

(1) Sources of carbon monoxide.

(a) Internal combustion engines.

1 Vehicle engines – exhaust is a significant source.

2 Generators.

(b) Space heaters.

(c) Dynamite and other explosives.

(2) Carbon monoxide hazard.

(a) Because it is odorless, colorless and tasteless its presence may go undetected.

(b) By the time the presence of carbon monoxide is detected, you may be too overcome to remove yourself or your soldiers from the area.

b. Hydrogen chloride.

(1) Sources of hydrogen chloride. Hydrogen chloride is produced as an exhaust from rocket systems such as shoulder fired or vehicle mounted rockets.

NOTE: During recent years, the development and use of better rocket systems has increased the incidence of exposure to hydrogen chloride.

(2) Hydrogen chloride hazard. When hydrogen chloride is combined with water it produces hydrochloric acid.

c. Bore/gun gases.

(1) Sources of bore/gun gases.

(a) Tank guns.

(b) Artillery cannons.

NOTE: When conventional weapon systems are fired, the ammunition propellant produces toxic gases.

(2) Bore/gun gas hazard. Gases produced when weapons are fired include carbon monoxide and oxides of nitrogen.

NOTE: The ventilation systems on tanks and artillery cannons reduce the chances of exposure to these gases. When conducting PMCS on these weapon systems soldiers must ensure that the ventilation systems are working at peak efficiency.

d. Solvents, greases and oil. Used in the maintenance of vehicles and weapon systems, these are the most prevalent TIMs and pose a significant risk to soldiers.
NOTE: Most of these substances are used in liquid form. Due to their properties, these substances evaporate into vapor readily and the vapors can easily be inhaled into the body.

(1) Most substances in this category are organic compounds. Organic compounds pose a hazard due to their ability to cause cancer and other medical problems.

(a) Solvents.

1 Carbon tetrachloride.

2 Trichloroethylene.

3 Weapons cleaning solvents.

(b) Fuels.

1 Gasoline (MOGAS).

2 Diesel fuel.

(c) Lubricants.

1 Oil.

2 Grease.

NOTE: Other organic compounds commonly found are the pesticides used to control rodents and arthropods.

(2) Hazards. The widespread use of these substances in day-to-day military operations, both in peacetime and war, put soldiers at a significantly increased risk of exposure. Many times soldiers can be exposed to TIMs most unexpectedly.

13-5. HARMFUL EFFECTS CAUSED BY EXPOSURE TO TIMs

a. Symptoms of carbon monoxide poisoning.

(1) Headache.

(2) Sleepiness.

(3) Coma.

(4) Death.

NOTE: The symptoms of carbon monoxide poisoning do not reverse themselves quickly. If you remove yourself and your soldiers from the exposure source and your health conditions do not improve, you cannot assume that it is not carbon monoxide poisoning. Ventilate the area completely before returning.

b. Symptoms of hydrogen chloride exposure.

(1) Irritation of the eyes, throat and lungs. (Caused by the action of hydrochloric acid on the mucous membranes.)

(2) Cough.

(3) Acid burn.

(4) Flu-like symptoms.

NOTE: These flu-like symptoms may actually indicate the presence of lung disease.

c. Symptoms of bore/gun gas exposure.

(1) Watch for symptoms of carbon monoxide poisoning.

(2) Lung irritation (oxides of nitrogen).

d. Symptoms of exposure to solvents, greases and oils.

(1) The most common symptoms are skin irritations.

(a) Rashes

(b) Burns

(c) Abnormally dry skin

(d) Infections

(2) Occupational skin diseases account for the greatest number of reported occupational diseases.

(a) May temporarily limit ability to work.

(b) Normally not severe enough to cause permanent disability.

(c) Healthy skin cells provide natural protection from injury due to exposure to many chemicals.

(d) Cracked, dry or otherwise irritated skin provides less protection.

(e) Type and severity of skin disorders due to exposure to TIMs depends on the chemical involved and the duration of exposure.

(3) Other effects.

(a) Organ involvement such as liver and/or brain.

(b) Permanent damage including cancer.

13-6. MANAGING RISKS ASSOCIATED WITH TIMs

a. Identify the sources of toxic chemicals in your unit and maintain an up to date list of all chemicals used in the unit for quick reference.

b. Maintain Material Safety Data Sheets (MSDS) for all chemicals used.

(1) Up to date health information.

(2) Hazardous properties.

(3) Control methods.

c. Include risk assessment in planning at all levels.

(1) Incorporate risk management into all operations including training.

(2) 5-steps of risk management (FM 100-14).

(a) Identify hazards.

(b) Assess hazards to determine risks.

(c) Develop controls and make risk decisions.

(d) Implement controls.

(e) Supervise and evaluate.

13-7. PREVENTIVE MEDICINE MEASURES (PMM) FOR TOXIC CHEMICALS

a. Carbon monoxide.

(1) Prevent accumulation of engine exhaust.

(a) Run engines outside.

(b) When engines must be run inside, use tailpipe extensions.

(2) Provide adequate ventilation of work/sleep areas in which space heaters are being used.

b. Hydrogen chloride (from rocket systems).

(1) Position soldiers upwind from rocket systems.

(2) Use respirators designed to protect personnel from these gases.

c. Bore/gun gases (tanks, cannons).

(1) Use on-board ventilation systems.

(2) Ensure proper maintenance and function of bore evacuators.

d. Solvents, greases and oils (liquid chemicals).

(1) Environmental controls.

(a) Minimize exposure of soldiers.

(b) Substitute a safer, less toxic substance for the more toxic substance being used.

NOTE: The use of stoddard solvents is recommended. A stoddard solvent is a chemical preparation that gives you the advantage of a solvent without the hazards present in gasoline, kerosene, etc.

(2) Ensure personal protective devices/clothing are available.

(a) Gloves.

(b) Goggles.

(c) Respirators.

NOTE: Ensure soldiers are fit tested for respirators.

(3) Medical controls. Medical controls refer to programs such as periodic physical exams and/or medical surveillance of soldiers to detect early signs of occupational disease.

13-8. INDIVIDUAL PREVENTIVE MEDICINE MEASURES (IPMM) FOR TOXIC CHEMICALS

a. Identify source of toxic chemicals in your unit.

b. Develop a protective action plan to reduce sickness or injury.

c. Adhere to the following guidelines.

(1) Run engines outside or use tailpipe extensions.

(2) Ventilate work/sleeping areas when space heaters are in use.

(3) Do not use vehicle engines as a heat source.

(4) Use/maintain vehicle ventilation systems.

(5) Properly maintain bore evacuator systems.

(6) Substitute harmful solvents with safer ‘stoddard solvents.’

(7) Use protective equipment/clothing.

b. Practice good personal hygiene.