Given classroom instruction, FM 21-10 and FM 4-25.12, and FM 100-14, recommend actions to reduce your units exposure to toxic industrial materials (TIMs) IAW FM 21-10, FM 4-25.12 and FM 100-14.
Enabling Learning Objectives (1-4)

- Classify TIMs according to their physical states.
- Identify the routes of entry of TIMs into the body.
- Identify the biological effects of TIMs.
- Identify the TIMs threat and their sources.
Enabling Learning Objectives (5-8)

- Identify the harmful effects of carbon monoxide, hydrogen chloride, bore/gun gases, solvents, greases and oils.
- Describe the risk management process as it pertains to TIMs.
- Describe the PMMs necessary to protect personnel from exposure to TIMs.
- Describe the IPMMs necessary to protect personnel from exposure to TIMs.
PHYSICAL STATE OF TOXIC CHEMICAL SUBSTANCES

- Gas
- Liquid
- Vapor
- Mist
- Solids
- Fume
- Dust
Toxic Chemical Four Routes of Entry

- Inhalation
- Absorption
- Ingestion
- Injection
Most significant route of entry.

Frequency and duration of exposure affect onset of symptoms.

Enter bloodstream through gas exchange region of lungs.
Symptoms

Instant
- Cough
- Burning in throat or chest

Delayed
- Asbestosis
- Chronic lung disorders
Routes of Entry - Absorption

- **Local effects**
  - Dermatitis - reddening of the skin or raised, blister like lesions
- **Systemic effects**
  - Systemic poisoning - cancer
Routes of Entry - Ingestion

- Eating or smoking with contaminated hands or utensils.
- May occur if TIMs are stored with food or beverages.
Routes of Entry - Injection

- Normally accidental
  - Rupture of high-pressure gas or liquid line
  - May enter through traumatic injury
    - Puncture wound
    - Laceration
Five Biological Effects

- Irritants
- Asphyxiants
- Anesthetics
- Systemic Poisons
- Carcinogens
Biological Effects - Irritation

- Caused by irritants
  - Sulfur dioxide, acetic acid, formaldehyde, others

- Effects
  - Inflammation of the mouth, nose and lung tissue
Biological Effects - Asphyxiation

- Caused by asphyxiants
  - Nitrogen, hydrogen, carbon monoxide, others

- Effects
  - Displace oxygen or cause the body to become incapable of using oxygen
Biological Effects - Anesthesia

- Caused by exposure to solvents
  - Acetone, trichloroethylene

- Effects
  - Depressant effect on the brain and central nervous system (CNS)
Biological Effects - Systemic poisoning

- Caused by exposure to organic solvents
  - Methylene chloride, carbon tetrachloride

- Effects
  - Damage to internal organs
Biological Effects - Cancer

- Caused by exposure to carcinogens
- Chemicals suspected of causing cancer based on animal studies
Medical Threat - Carbon monoxide

- **Sources**
  - Internal combustion engines
  - Space heaters
  - Explosives

- **Hazard**
  - Presence is difficult to detect
  - May be too overcome to evacuate area
Medical Threat - Hydrogen chloride

Sources
- Exhaust from rocket systems

Hazard
- Produces hydrochloric acid when combined with water
Medical Threat - Bore/Gun Gases

- **Sources**
  - Tank guns
  - Artillery cannons

- **Hazards**
  - Carbon monoxide
  - Oxides of nitrogen
**Sources**

**Solvents**
- Carbon tetrachloride
- Trichloroethylene
- Weapons cleaning solvents

**Fuels**
- Gasoline (MOGAS)
- Diesel fuel

**Lubricants**
- Oil
- Grease
Medical Threat – Liquid Chemicals (2)

- Hazard
  - Widespread use in day-to-day operations
  - Exposure is often unexpected
  - May cause cancer or other harmful effects to body
Medical Threat - A true story
Harmful Effects - Carbon monoxide

- Carbon monoxide poisoning
  - Headache
  - Sleepiness
  - Coma
  - Death
Harmful Effects - Hydrogen chloride

- Hydrogen chloride exposure
- Irritation of eyes, throat & lungs
- Cough
- Acid burn
- Flu-like symptoms
Harmful Effects - Bore/gun gases

- Bore/gun gas exposure
  - Symptoms of carbon monoxide poisoning
  - Lung irritation
Harmful Effects - Solvents, greases & oils

- Solvent, grease and oil exposure
  - Skin irritation
    - Rash
    - Burns
    - Abnormally dry skin
    - Infection
  - Organ damage
    - Liver
    - Brain
Risk Management

- Identify the sources of TIMs in your unit
- Maintain an up to date list
- Maintain Material Safety Data Sheets (MSDS) for all TIMs
  - Health information
  - Hazardous properties
  - Control methods
Risk Management Process

- Incorporate risk management into all operations
- Risk management process
  - Identify hazards
  - Assess hazards to determine risks
  - Develop controls and make risk decisions
  - Implement controls
  - Supervise and evaluate
PMM for Carbon Monoxide

- Prevent accumulation of exhaust
- Run engines outside
- Use tailpipe extensions
- Provide ventilation of work/sleep areas
• Position soldiers upwind
• Provide respirators
PMM for Bore/Gun Gases

- Ensure use of on-board ventilation systems
- Ensure proper maintenance of bore evacuator systems
PMM for Solvents, Greases & Oils

- **Environmental controls**
  - Minimize exposure
  - Provide Stoddard solvents

- **Personal protective controls**
  - Gloves
  - Goggles
  - Respirators

- **Medical controls**
  - Periodic exams
  - Medical surveillance
PLAN FOR TOXIC CHEMICAL PROTECTION

- Identify sources of toxic chemicals in your unit.
PLAN FOR TOXIC CHEMICAL PROTECTION

- Identify sources of toxic chemicals in your unit
- Develop protective action plan to reduce sickness or injury
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

- Tune engines outside
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

- Tune engines outside
- Ventilate sleeping quarters
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

- Tune engines outside
- Ventilate sleeping quarters
- Don’t use engine for heat
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

- Tune engines outside
- Ventilate sleeping quarters
- Don’t use engine for heat
- Maintain ventilation systems
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

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- Ventilate sleeping quarters
- Don’t use engine for heat
- Maintain ventilation systems
- Maintain bore evac. systems
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

- Tune engines outside
- Ventilate sleeping quarters
- Don’t use engine for heat
- Maintain ventilation systems
- Maintain bore evac. Systems
- Use “safety” Stoddard solvent
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

- Tune engines outside
- Ventilate sleeping quarters
- Don’t use engine for heat
- Maintain ventilation systems
- Maintain bore evac. Systems
- Use “safety” Stoddard solvent
- Use PPE (gloves and goggles)
ENFORCE INDIVIDUAL PREVENTIVE MEDICINE MEASURES

- Tune engines outside
- Ventilate sleeping quarters
- Don’t use engine for heat
- Maintain ventilation systems
- Maintain bore evac. Systems
- Use “safety” Stoddard solvent
- Practice good personal Hygiene