Dangers of Carbon Monoxide (CO) and Inhalation Hazards

1. **Overview**
    a. Definitions of terms
    b. Identify what carbon monoxide is
    c. Identify sources of carbon monoxide
    d. Identify the physical characteristics of CO.
    e. Illustrate the respiratory system
    f. Effects of carbon monoxide on the bloods hemoglobin
    g. Identify OSHA's PEL for carbon monoxide
    h. List signs of carbon monoxide poisoning
    i. Outline treatment for carbon monoxide poisoning
    j. State effects of long term effects of carbon monoxide poisoning
    k. Identify sources of diesel exhaust
    l. Control measures for diesel exhaust
    m. Discuss the inhalation hazards associated with Crystalline Silica.
    n. Define what crystalline silica is and how it evolves into silicosis.
    o. Discuss the inhalation hazards associated with crystalline silica.
    p. Identify the signs and symptoms associated with silica exposures
    q. Outline employees' rights

2. **Definitions**
    a. Carbon monoxide (CO) is a deadly, colorless, odorless, and tasteless poisonous gas. It is produced by the incomplete burning of various fuels products and equipment powered by internal combustion engines such as portable generators, cars, lawn mowers, and power washers also produce CO.
    b. DPM is a component of diesel exhaust (DE) that includes soot particles made up primarily of carbon, ash, metallic abrasion particles, sulfates and silicates. Diesel soot particles have a solid core consisting of elemental carbon, with other substances attached to the surface, including organic carbon compounds known as aromatic hydrocarbons.
    c. Silicosis is caused by exposure to respirable crystalline silica dust. Crystalline silica is a basic component of soil, sand, granite, and most other types of rock, and it is used as an abrasive blasting agent. Silicosis is a progressive, disabling, and often fatal lung disease.

3. **Sources of Carbon monoxide**
    a. Portable and Fixed Generators
    b. Space heaters
    c. Concrete saws
    d. Diesel Exhaust
    e. Welders
    f. Power washers/sprayers
    g. Power trowels

h. *Anywhere combustion takes place.*

4. Characteristics of carbon monoxide

a. Carbon Monoxide (CO)
   i. Is Invisible
   ii. Is Colorless
   iii. Is Odorless
   iv. Is Tasteless
b. Because it has no warning properties, it *appears* nonexistent.
c. CO is a common industrial hazard resulting from the incomplete combustion of natural gas or any material containing carbon such as gasoline, kerosene, oil, propane, coal, or wood.
d. Combustion with insufficient oxygen to complete the process will result in the production Carbon Monoxide.
e.

5. Respiratory system

a. Naso/Oro pharynx
b. Pharynx
c. Epiglottis
d. Larynx
e. Vocal cords
f. Trachea
g. Esophagus
h. Carina
i. L&R Bronchi
j. Cilia

6. Effects of carbon monoxide on the blood

a. When CO is inhaled into the lungs it combines with hemoglobin to form Carboxyhemoglobin (COHgb).
b. Once combined, that *hemoglobin is no longer available* to transport oxygen to the tissues.
c. The chemical bond attraction for CO to hemoglobin is 200 times stronger than that of oxygen's bond with hemoglobin.
d. Once established on the hemoglobin CO's bond is 50 times tighter to the hemoglobin than oxygen's

7. OSHA's PEL

a. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for carbon monoxide is 50 parts per million (ppm) parts of air as an 8-hour time-weighted average (TWA) concentration.

a.

9. **Symptoms of carbon monoxide poisoning**
    i. Headache
    ii. Confusion
    iii. Dizziness
    iv. Weakness
    v. Nausea
    vi. Vomiting
    vii. Chest pain
    viii. Cardiac Dysrhythmias
    ix. Hypotension
    x. Cardiac Arrest
    b. **REMEMBER**, it's often hard to tell if someone has CO poisoning, because the symptoms may be like those of other illnesses.
    c. People who are sleeping can die from CO poisoning before they have symptoms.

10. **Treatment for carbon monoxide poisoning**
    a. Warning: You may be exposed to fatal levels of CO poisoning in a rescue attempt.
        i. ENSURE you and others are safe!
        ii. Move the victim immediately to fresh air in an open area.
        iii. Call 911 or another local emergency number for medical attention or assistance.
        iv. Administer 100-percent oxygen using a tight-fitting mask if the victim is breathing.
        v. Administer cardiopulmonary resuscitation if the victim has stopped breathing.
    b. Half-life of Carbon Monoxide is approximately 5 hours
        i. CO Half-life on 21% room air Oxygen = 4-6 hrs.
        ii. CO Half-life on 100% Oxygen – approx. 80 min.
        iii. CO Half-life with Hyperbaric Oxygen = approx. 22 min.

11. **Long term effects of carbon monoxide exposure**
    a. The long term effects of poisoning by carbon monoxide can be extremely serious.
    b. The long term neurological effects of breathing in carbon monoxide can affect:
        i. Brain function
        ii. Memory loss
        iii. Moods/Behavior
        iv. Cognition/Thoughts
    c. It is thought that the section of the brain that deals with new memories, can be particularly susceptible to long term damage from CO poisoning
    d. Heart muscle damage from lack of oxygen to the cardiac cell can lead to cardiac pump complications.
        i. Cardiac Ischemia
        ii. Hypertension
        iii. Pump failure
    e. Later development of cardiac complications (similar to an engine and its components)

f. The heart and brain continuously talk to each other influencing the other's functioning.
g. Neuro-Cardiology suggest the signals that the heart sends to the brain can influence perception, emotional processing, and cognition.

12. Identify sources of diesel exhaust

a. The diesel engine was patented in 1892 to provide improved fuel efficiency as compared to gasoline engines.
    i. NIOSH estimates that more that 1.3 million workers are exposed to DE in more than 80,000 work places
    ii. Diesel Exhaust contains thousands of chemical compounds.
    iii. Awareness due to the potential health effects that can occur as a result of overexposure to diesel exhaust is needed.
b. What is Diesel Particulate Matter (DPM)?
    i. Diesel exhaust is a mixture of gases and particulates produced during the combustion of diesel fuel.
    ii. DPM is a component of *diesel exhaust (DE)* that includes soot particles made up primarily of carbon, ash, metallic abrasion particles, sulfates and silicates.
    iii. *Diesel soot particles* have a solid core consisting of elemental carbon, with other substances attached to the surface, including organic carbon compounds known as aromatic hydrocarbons.
c. Most heavy and medium-duty trucks are equipped with diesel engines
d. Heavy equipment such as bulldozers, graders, bucket loaders, and tractors are diesel powered.
e. Other types of equipment such as bucket lifts and generators are also often powered by diesel engines

13. Control measures for diesel exhaust

a. Engineering
    i. Engineering controls are the most effective strategy for minimizing worker exposure to DE/DPM.
        1. A combination of controls is often required. Examples include:
        2. Performing routine preventive maintenance of diesel engines to minimize emissions,
        3. Installing engine exhaust filters.
        4. Installing cleaner burning engines.
        5. Installing diesel oxidation catalysts.
        6. Using special fuels or fuel additives (e.g., biodiesel).
        7. Providing equipment cabs with filtered air.
    ii. Installing or upgrading main or auxiliary ventilation systems, such as tailpipe or stack exhaust vents to capture and remove emissions. (e.g., repair shops or other indoor locations.)
b. Administration
    i. Administrative controls refer to changes in the way work tasks are performed to reduce or eliminate the hazard.

ii. Examples include:
    1. Limiting speeds and using one-way travel routes.
    2. Prohibiting and/or restricting unnecessary idling.
    3. Restricting the amount of diesel-powered equipment and total engine horsepower operating in a given area
iii. Ensure that the number of vehicles operating in an area does not exceed the capacity of the ventilation system.
iv. The Occupational Safety and Health Administration does not have a permissible exposure limit (PEL) for DPM.
v. However, OSHA has PELs for other components of diesel exhaust. Monitoring for these gases can provide an indication of the presence of DE, and can be of help in evaluating the effectiveness of engineering and administrative controls.

14. Inhalation hazards associated with crystalline silica

a. permissible exposure limit (PEL) for respirable crystalline silica to 50 micrograms per cubic meter of air

15. Define crystalline silica is and how it evolves into silicosis

a. Crystalline silica is a basic component of soil, sand, granite, and many other minerals.
b. Quartz is the most common form of crystalline silica. Cristobalite and tridymite are two other forms of crystalline silica.
c. All three forms may become respirable size particles when workers chip, cut, drill, or grind objects that contain crystalline silica.

16. Discuss inhalation hazard with crystalline silica

a. Respirable crystalline silica – very small particles at least 100 times smaller than ordinary sand is created during work operations involving stone, rock, concrete, brick, block, mortar, and industrial sand.
b. Health hazards associated with silica exposure is demonstrated by the fatalities and disabling illnesses that continue to occur in workers.
c. Crystalline silica has been classified as a human lung carcinogen.
d. Breathing crystalline silica dust can cause silicosis, which in severe cases can be disabling, or even fatal.
e. The respirable silica dust enters the lungs and causes the formation of scar tissue, thus reducing the lungs' ability to take in oxygen.

17. Discuss signs and symptoms associated with silica exposures

a. Chronic/classic silicosis
b. This is the most common and occurs after 15–20 years of moderate to low exposures to respirable crystalline silica.
c. Symptoms associated with chronic silicosis may or may not be obvious; therefore, workers need to have a chest x-ray to determine if there is lung damage.
d. As the disease progresses,
    i. Shortness of breath upon exercising

ii. Clinical signs of poor oxygen/carbon dioxide exchange

e. In the later stages
    i. The worker may experience fatigue
    ii. Have extreme shortness of breath
    iii. Chest pain
    iv. Respiratory failure
f. Accelerated silicosis
g. Occurs after 5–10 years of high exposures to respirable crystalline silica.
h. The onset of symptoms takes longer than in acute silicosis.
i. Symptoms include
    i. Severe shortness of breath
    ii. Weakness
    iii. Weight loss

18. Recap

a. Carbon Monoxide
    i. Carbon monoxide (CO) is a deadly, colorless, odorless, and tasteless poisonous gas. It is produced by the incomplete burning of various fuels products and equipment powered by internal combustion engines such as portable generators, cars, lawn mowers, and power washers also produce CO.
b. Diesel Exhaust/Diesel Particulate Matter
    i. DPM is a component of diesel exhaust (DE) that includes soot particles made up primarily of carbon, ash, metallic abrasion particles, sulfates and silicates. Diesel soot particles have a solid core consisting of elemental carbon, with other substances attached to the surface, including organic carbon compounds known as aromatic hydrocarbons.
c. Crystalline Silica
    i. Silicosis is caused by exposure to respirable crystalline silica dust. Crystalline silica is a basic component of soil, sand, granite, and most other types of rock, and it is used as an abrasive blasting agent. Silicosis is a progressive, disabling, and often fatal lung disease.

19. Outline employee rights

a. Employee rights and responsibilities
    i. To assure safe and healthful working conditions for working men and women
    ii. By authorizing enforcement of the standards developed under the Act
    iii. By assisting and encouraging the States in their efforts to assure safe and healthful working conditions
    iv. By providing for research, information, education, and training in the field of occupational safety and health
b. A right to
    i. A safe and healthful workplace
    ii. Know about hazardous chemicals
    iii. Information about injuries and illnesses in your workplace
    iv. Complain or request hazard correction from employer

v. File a confidential complaint with OSHA to have their workplace inspected.
vi. Receive information and training about hazards, methods to prevent harm, and the OSHA standards that apply to their workplace. The training must be done in a language and vocabulary workers can understand.
vii. Get copies of their workplace medical records.
viii. Participate in an OSHA inspection and speak in private with the inspector.
ix. File a complaint with OSHA if they have been retaliated or discriminated against by their employer as the result of requesting an inspection or using any of their other rights under the OSH Act.
x. File a complaint if punished or discriminated against for acting as a "whistleblower" under the additional 20 federal statutes for which OSHA has jurisdiction.

c. Whistleblower Protection
    i. OSHA's Whistleblower Protection Program enforces the whistleblower provisions of more than twenty whistleblower statutes protecting employees who report violations of various workplace safety.