

12 FLAMMABLE AND COMBUSTIBLE LIQUIDS

ANSWERS—QUIZ 1

1. a
2. b
3. b
4. b
5. b
6. a
7. c
8. a
9. d
10. a
11. b
12. b
13. *Oxygen deficiency* is an atmosphere containing a lower percentage of oxygen by volume than is contained in free air at sea level. When oxygen concentration in air is reduced to approximately 16%, many individuals become dizzy, experience a buzzing in the ear, and have a rapid heart beat.
14. As defined by NFPA 30, *Flammable and Combustible Liquids Code*, a flammable liquid is any liquid having a closed-cup flash point below 100 F and having a vapor pressure not exceeding 40 psia at 100 F.
15. In addition to prohibiting smoking, personnel should also refrain from carrying strike-anywhere matches, lighters, or other spark-producing devices. The size of the restricted area will depend on the type of product handled, the design of the building, local codes, and local conditions.
16. To avoid a spark from the discharge of static electricity during flammable-liquid filling operations, provide a wire bond between the storage container and the container being filled. If a metallic pathway between the two containers is otherwise present, however, this procedure is unnecessary.
17. The following factors determine the degree of danger: (1) The flash point of the liquid. (2) The concentration of vapors in the air (whether the vapor-air mixture is in the flammable range or not). (3) The possibility of a source of ignition at or above a temperature or energy level high enough to cause the mixture to burst into flame. (4) The amount of vapors present.
18. Recirculation is permitted where it is monitored continuously using a fail-safe system that is designed to

automatically sound an alarm, stop recirculation, and provide full exhaust to the outside in the event that vapor-air mixtures in concentration over one fourth of the lower flammable limit are detected.

19. The proper safety equipment may include supplied-air hose masks with blowers, SCBA, suitable clothing, safety belts, safety lines, and tools.
20. Student essay may be similar to the following: If a spill or overflow occurs, immediately stop loading, shut off the valves, and clean up the overflow before resuming. Trap the liquid in containers, in an earthen or sand-diked area, or in a depression or pit, if possible. In case of a large spill, especially in urban areas, the best way to avoid endangering lives is to use portable hand pumps to discharge the product into approved drums or into another tank truck. Eliminate or control all sources of ignition in the area. Allow adequate time for all flammable vapors to dissipate before starting the truck engine.

ANSWERS—QUIZ 2

1. a
2. b
3. a
4. b
5. a
6. a
7. d
8. a
9. c
10. b
11. b
12. Local conditions will determine the design and use of dikes. Because of topography, if a flammable liquid spills it could flow toward other buildings or residential areas. Pumps should be located outside buildings and diked areas whenever possible. A pump should not contain a sunken pit because the danger of vapor concentration in such areas is too great.
13. Steaming, hot chemical washes, water filling, and use of inert gas are among the common methods for cleaning and vapor-freeing small tanks and drums.
14. Thoroughly clean tanks to be permanently abandoned and make them safe from flammable vapors.

Then dismantle and remove them from the premises where allowed and according to regulations. Consult U.S. EPA underground tank regulations for details on disposal. Cap and secure against tampering fill lines, gauge openings, and pump-suction lines of tanks taken out of service for less than 90 days. Leave the vent lines open.

15. Return unused, uncontaminated flammable liquids to the vendor, salvage them for resale, or use them in some other approved way. Mixtures of clean flammable liquids sometimes need to be separated before they are useable. It is best to have a recovery contractor do these separations. A recovery contractor can also handle used or dirty flammable liquids.
16. Health hazards associated with flammable and combustible liquids include skin irritation, intoxication or illness from inhaling their vapors and fumes, and oxygen deficiency in closed containers used to store these liquids.
17. It is important to give in mind that an indicator calibrated for the LFL will not give any reading while sampling a very high concentrated vapor and will give a negative reading while testing containers with a high concentration of inert gas.
18. The following situations will necessitate a tank truck driver to immediately phone the U.S. Department of Transportation:
 - There is fire, breakage, spillage, or contamination involving a radioactive material.
 - There is estimated property damage exceeding \$50,000.
 - A person is killed, injured, or requires hospitalization.
19. Use dry chemicals or carbon dioxide to extinguish a flammable liquid fire.
20. Student essay should provide an understanding of the proper way for cleaning storage tanks, as described in the chapter.

ANSWERS—CASE STUDY

1. An acceptable answer will touch upon most of the following points:
 - Remove from the vicinity of the tank all sources of ignition.
 - Empty as much product as possible through fixed

connections without opening the tank. Further empty the tank by pumping, draining, and floating the tank's contents with water or another compatible solvent. Introduce the water through a fixed connection.

- Disconnect and blank all product, steam, foam and similar lines. Do not rely on valves alone.
- Undo all but four bolts on one manway, slowly open the remaining bolts. If the product leaks, close the manway and continue to empty through fixed piping. After the product is below the level of the manway and where allowed by regulations, open the manway and either float out or pump out the remaining product to approved containers. The manway must be covered during this operation to prevent vapors from escaping into the air.
- The tank is ready for ventilation to remove vapors. Connect an air mover, or eductor, to the manway. Start the eductor on slow, then remove the second manway cover to provide for air intake. The eductor may then be put on full speed. Place the eductor at a low-level manway, near the vapors. Fresh air can enter from an opposite manway or from one on top of the tank. Vapors must be educted to a height of at least 12 feet above ground level.
- Various tank configurations require different methods and configurations for ventilation. Consult your supplier or refer to appropriate manuals for advice on ventilating and cleaning tanks.
- Ventilate or steam the tank. If steam is used, cool and ventilate the tank afterward. Bond steam lines and water-wash nozzle to the tank. Wash sludge, sediment, and scale from the tank. Let it drain, or remove it with a pump. Thoroughly flush out and overflow the tank with water.
- Make a gas-hazard test and, if the tank is found to have adequate oxygen and to be free of toxic or flammable vapors, check physical conditions inside the tank before allowing work to start. Otherwise, further clean and ventilate the tank as required.
- Have the required personal-protective equipment available.
- Test for oxygen and flammables with a calibrated and adjusted oxygen monitor and combustible-

gas indicator. Do not permit entry until the vapor concentration is 10% or less of the LFL.

- Wear a fresh-air hose mask, air supply tanks, and safety belt and lifeline for entering the tank. Have ample help available outside the tank.
 - Continue ventilation for the duration of the work in tank. Make periodic tests for the presence of hazardous gases or flammable vapors as the work progresses.
2. Unused, uncontaminated flammable liquids can be returned to the vendor, salvaged for resale, or used in some other approved way. When drummed and properly stored, most flammable liquids are stable and can be stored safely for years.
 3. Paris United should employ a recovery contractor who can also handle used or dirty flammable liquids.
 4. Small tanks and containers can be cleaned by steam and made temporarily safe by means of an inert gas. Tanks to be abandoned must be thoroughly cleaned, then dismantled and removed from the premises.