



Operating Experience Summary

Office of Environment, Safety and Health

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2006-08

Try this Safety Quiz! (answer key begins on page 3)

1: HAZARDOUS ENERGY CONTROL

Which of the following statements is *not* true regarding hazardous energy control?

- A. Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal.
- B. The only function a lockout/tagout serves is to provide overall control of equipment and system status.
- C. OSHA does not require lockout/tagout for activities such as minor tool changes and adjustments, as long as effective alternate protective measures are used.
- D. Only personnel who are qualified and authorized should be permitted to isolate equipment or install locks and tags.

2: ELECTRICAL SAFETY

When working on or near exposed electrical conductors or circuit parts that are or might become energized, personnel must:

- A. have a coworker standing by to assist in an emergency.
- B. always assume that everything has been de-energized.
- C. be protected from arc flash and from contact with energized parts.
- D. have electrical training.

3: FALL PROTECTION

At what minimum working height (i.e., distance from walking/working surface to a grade or lower level) would you require the use of a fall arrest system?

- A. 12 feet
- B. 20 feet

- C. Whatever the worker is comfortable with.
- D. 6 feet

4: LASER SAFETY

Which of the following statements is true regarding laser safety within DOE?

- A. There has never been a serious eye injury from a laser mishap.
- B. The wearing of laser eye protection is not required when performing equipment alignments.
- C. Laser injuries to the eyes resulted from a lack of engineering controls and a failure to use personal protective equipment (PPE).
- D. Laser Safety Officers (LSOs) are only responsible for the registration of lasers at their facilities — not for their operation.

5: INDUSTRIAL HYGIENE

What are the symptoms of heat stroke?

- A. Dry, hot skin with no sweating.
- B. Mental confusion or losing consciousness.
- C. Seizures or fits.
- D. All of the above.

6: INDUSTRIAL OPERATIONS

Which of the following statements is *not* true regarding safe handling and use of compressed-gas cylinders?

- A. Determine the contents of a gas cylinder by its color code, not the label.
- B. The cover cap should be securely in place to protect the cylinder valve during transport.
- C. Cylinders should only be used in an upright position.



- D. Cylinders should be secured at all times to prevent falling.

7: INDUSTRIAL OPERATIONS

When operating a forklift, the higher the load is raised, the:

- A. More the operator can see.
- B. Better the turning radius.
- C. Less stable the forklift becomes.
- D. Easier it is to control the load.

8: CONFINED-SPACE SAFETY

You and a coworker arrive at a confined-space job with an approved entry permit. After being lowered into the manhole, your coworker suddenly collapses where you can see him. Which one of the following is the correct response? Why?

- A. Don retrieval gear and enter the space to pull him out.
- B. Hold your breath and go in.
- C. Don a respirator and bring him out.
- D. Call 911 (or the plant emergency number) and wait for help.

9: LASER SAFETY

A student assumed that an alignment task was complete and removed his protective eyewear, but he continued working in the laser lab and was struck by a laser reflection. A researcher failed to wear his protective eyewear while manipulating a test sample with a pair of tweezers and was struck by light flashing off the test sample. A student followed her supervisor's example and looked directly into a laser beam. All suffered various levels of retinal damage. Based on these examples from DOE laboratories, what final engineering barrier was missing and resulted in the injuries?

- A. Lack of training.
- B. Failure to follow laser safety procedures.
- C. Lack of oversight by facility LSOs.
- D. Failure to wear required PPE.

10: ASBESTOS AWARENESS

DOE records show that there have been more than 40 incidents involving asbestos in the past 5 years, 20 percent of which resulted in worker exposures. What types of controls or pre-job planning are most effective at limiting worker exposures?

- A. Skill of the craft — that is, experience of the workers in the facility.
- B. Time, distance, and shielding.
- C. Pre-job hazards analysis, monitoring, using a wetting agent, wearing respiratory protection.
- D. Researching the age of the facility, type and age of tiles and materials to determine if they were manufactured after the Environmental Protection Agency (EPA) ban on the manufacture, importation, and processing of asbestos-containing building products.

11: CONDUCT OF OPERATIONS

Conduct of operations principles support safety and efficiency and result in improved quality and uniformity of operations. The investigations that followed the BP Texas City refinery explosion, where 15 workers were killed and more than 150 were injured, pointed out many deficiencies in what the DOE Complex calls conduct of operations. Which two of the following contributors to the accident at the infrequently-performed refinery startup operation are *not* violations of a conduct of operations principle?

- A. Failure to follow procedures: operators used the wrong procedure, omitted procedure steps, did not sign steps when completed, and allowed their process knowledge to replace procedural compliance.
- B. Temporary office and work trailers were not sited in accordance with minimum safety setback requirements and thus were directly impacted by the explosion and fires.
- C. Shift turnover was less than adequate; for example, the superintendent and other site personnel were not notified of the startup.
- D. Command and control was unclear; that is, there was no clear picture of who was in charge during the operation and the ensuing upset condition.
- E. Hazard analysis was less than adequate and failed to consider multiple failures within the same event.



ANSWER KEY**1. Correct response: B**

Reason: B is false because a lockout/tagout actually performs three functions. The primary function is to protect personnel from injury by effectively controlling hazardous energy. The other two functions are stated in the following guidance.

[DOE-STD-1030-96](#), *Guide to Good Practices for Lockouts and Tagouts*, section 4.1 states:

“Lockout/tagout in a DOE facility may serve three functions. The first function, defined by both OSHA and [DOE Order 5480.19](#), is to protect personnel from injury. The second function closely related to that, is to protect systems and equipment from damage. The third function of lockout/tagout is part of the overall control of equipment and system status.”

Answer A is true because:

[DOE-STD-1030-96](#), section 4.3 states: “Locking devices must be substantial so they cannot be removed or bypassed while workers are depending on them for protection.”

[OSHA Standard 29 CFR 1910.147](#), *The control of hazardous energy (lockout/tagout)*, paragraph (c)(5) states: “Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.” Also stated in [DOE Order 5480.19](#), *Conduct of Operations Requirements for DOE Facilities*, chapter IX, section 3.b.(3).

Answer C is true because:

[DOE-STD-1030-96](#), section 4.1.4 states: “OSHA does not require lockout/tagout for activities that are performed as part of normal operations, such as minor tool changes and adjustments, as long as effective alternate protective measures are used. Lockout/tagout is also not applicable to hot tap operations involving work on pressurized transmission and distribution pipelines for gas, steam, water, or petroleum products; however hot taps should be used only when continuity of service is essential, and procedures and equipment that provide proven effective protection for personnel are used. Equipment that presents no danger to personnel or other equipment during maintenance does not require lockout/tagout. For example, electrical equipment whose maximum voltage is less than 30 volts will not normally require lockout/tagout if there will be no increased exposure to electrical burns or to explosion due to electric arcs. Equipment that can be de-energized by

unplugging it from its energy source does not require lockout/tagout, if the unplugged power cord is under the exclusive control of the person performing the maintenance. Lockout/tagout is required for all other equipment.” Also stated in [OSHA Standard 1910.147](#), paragraph (c)(4)(i).

Answer D is true because:

[DOE-STD-1030-96](#), section 4.5.1 states: “Only personnel who are qualified and authorized should be permitted to isolate equipment or install locks and tags. This is necessary to ensure that the operator responsible for the equipment or process is aware of its status and is able to verify all requirements for personnel and equipment safety. It also helps ensure that adequate protection is provided to the worker, even when the worker is not familiar with system operation.”

[DOE Order 5480.19](#), chapter IX, section 6.d. states: “Lockout or Tagout devices should be affixed to each isolation device by qualified personnel...”

References:

- [OE Summary 2006-03](#), *Challenging a Locking Device Inadvertently Energizes 480-Volt Line*
- [DOE-STD-1030-96](#), *Guide to Good Practices for Lockouts and Tagouts*
- [DOE Order 5480.19](#), *Conduct of Operations Requirements for DOE Facilities*
- [OSHA Standard 29 CFR 1910.147](#), *The control of hazardous energy (lockout/tagout)*

2. Correct response: C

Reason: The most important safety concern when working in proximity to energized electrical circuits is that the worker is protected from contact with the energized parts and protected from the dangers of arc flash or blast. Response B is never true. Workers must verify that a safe (zero) energy condition exists. Having electrical training is certainly important. In order for personnel to safely work on electrical equipment, they should be experienced and qualified/certified to do so. Having a coworker available to render emergency assistance is an extra safety measure, but not always necessary.

References:

- [OE Summary 2005-01](#), *Accident Investigation of Electrical Arc Flash Injury*



- [OE Summary 2003-13](#), *Electrical Safety Problems Continue in First Half of 2003*
- NFPA 70E-2004, *Electrical Safety in the Workplace*
- [OSHA Standard 29 CFR 1910 Subpart S](#), *Electrical*
- [OSHA Standard 29 CFR 1910.333\(c\)\(2\)](#), *Selection and use of work practices*

3. Correct response: D

Reason: A fall arrest system is required if any risk exists that a worker may fall from an elevated position any time a working height of 6 feet or more is reached.

References:

- [OE Summary 2005-04](#), *Good Practice—Properly Tied-Off Fall Protection Prevents Injury*
- [OE Summary 2004-01](#), *Multiple Fall Protection Violations at Demolition Project*
- [OSHA Standard 29 CFR 1910.66, Appendix C](#), *Personal Fall Arrest System*
- [OSHA Fall Protection Information](#)
- [OSHA Standard 29 CFR 1926 Subpart M](#), *Fall protection*
- [OSHA Standard 29 CFR 1926.760](#), *Fall protection [for steel erection]*

4. Correct response: C

Reason: Analysis of DOE laser events has shown that laser eye injuries resulted from the lack of engineering controls and the failure to use PPE, such as laser eye protection. Response B is not true because the analysis also shows that many eye injuries occurred during laser alignments. Response A is not true because a student at LANL suffered permanent loss of central vision in her left eye when she looked directly into the path of a Class 4 laser beam while performing an unauthorized experiment. Response D is not true because a critical component of a successful laser safety program is the authority and role of the LSO. This position is vital for ensuring safe operation of lasers, especially for Class 3b and Class 4 lasers, which can potentially cause permanent physiological damage. ANSI Z136.1-2000, *Safe Use of Lasers*, describes in detail the roles and functions that an LSO is required to perform, which includes the safe operation of lasers.

References:

- [OE Summary 2004-06](#), *Personnel Error Causes Laser Eye Injuries*

- ANSI Z136.1-2000, *Safe Use of Lasers*
- EH Special Operations Report [2005-01](#), *Laser Safety*, February 2005

5. Correct response: D

Reason: Responses A, B, and C are all symptoms of heat stroke. It is important to know the signs and symptoms of heat-related illnesses and to monitor yourself and coworkers when working in areas of high temperature and humidity. In the event of heat stress, heat exhaustion, or heat stroke, call 911 or a local emergency number. While waiting for help to arrive, move the worker to a cool, shaded area and loosen or remove heavy clothing. Provide cool drinking water and fan and mist the person with water.

References:

- [OE Summary 2005-10](#), *Awareness of Heat Stroke Dangers Can Prevent Tragedy*
- [OSHA Quick Card 3154-071R-05](#), *Protect Yourself — Heat Stress*
- OSHA Technical Manual, Section III, [Chapter 4](#), *Heat Stress*
- National Action Guide Safety Database, *Outdoor Action Guide to Heat-Related Illnesses & Fluid Balance*, www.cdc.gov/nasd/docs/d001201-d001300/d001215/d001215.html

6. Correct response: A

Reason: The color of the cylinder should never be relied on for identification because cylinder colors may vary with the supplier. The contents of a compressed gas cylinder must be clearly identified and stenciled or stamped on the cylinder or on a label. Additionally, labels on caps have little value because caps are interchangeable. Responses B, C, and D are all true. Valve protection caps should always be on cylinders except when connected to dispensing equipment. Cylinders should always be used upright, especially those containing acetylene, because they are packed with porous rock that is saturated with acetone. Cylinders should always be secured to prevent falling using chains, plastic-coated wire cable, or commercial cylinder straps.

References:

- [OE Summary 2004-12](#), *Compressed Gas Cylinder Safety*



- [OSHA Standard 29 CFR 1910.101](#), *Compressed gases (general requirements)*
- NFPA 55, *Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders and Tanks*

7. Correct response: C

Reason: The stability of a forklift is determined by the location of its center of gravity (CG), or, if loaded, the combined CG. A stability triangle is formed by the points in the center of each drive wheel and the pivot point of the rear steering wheels. This imaginary triangle works in conjunction with the forklift CG, which is in the center of the triangle. If the load is raised and the mast is tilted forward, or the wheels are turned sharply in either direction, the forklift CG will move closer to the lines of the triangle and become less stable. In addition, there is the stability pyramid, which is the continuation of the stability triangle by connecting these three points together. As the load is raised, the stability pyramid becomes smaller and smaller. When this happens, the CG is closer to the lines of the triangle, making the forklift most unstable when the load is high. Figure 1 below shows a training model used to demonstrate the stability pyramid (courtesy Ives Training Group).



Figure 1. Forklift training model

References:

- [OE Summary 2004-09](#), *Careless Forklift Operation can be Hazardous and Result in Damage*
- [OE Summary 2003-18](#), *Review of Forklift Events Reported in 2003*

- *Forklift Operator Training Program*, Hanford Course No. 044470
- NFPA 505, *Powered Industrial Trucks*
- [OSHA Standard 29 CFR 1910.178](#), *Powered industrial trucks*
- DOE-STD-1090-04, *Hoisting and Rigging Standard (Formerly Hoisting and Rigging Manual)*, [Chapter 10](#), "Forklift Trucks"

8. Correct response: D

Reason: Confined spaces may hold gases that can be fatal or that can ignite if metal hooks or equipment spark. Respiratory protection may be inadequate for the toxic gas at hand. Holding one's breath is ineffective because tension and exertion increase heart and respiration rates, requiring the body to consume oxygen more quickly. Emergency response teams use a confined-space rescue protocol to retrieve the victim, ensuring that additional workers do not die while attempting rescue.

References:

- [Is it Safe to Enter a Confined Space?](#) Published by the California State Department of Industrial Relations
- DOE Occupational Safety and Health Technical Reference, Chapter 4, Appendix A, [Confined Space Preentry Checklist](#)
- [OE Summary 2004-22](#), *Confined Space Can Kill*
- [OSHA Standard 29 CFR 1910.146](#), *Permit-required confined spaces*

9. Correct response: D

Reason: A combination of training, engineered controls, adequate supervision, and personal responsibility in wearing protective equipment is essential to prevent eye injuries during work with high-energy laser systems. Because visual disorientation from retinal damage may not be apparent until after considerable damage has occurred, it is critical that laser operators wear PPE or protective eyewear at all times while in the laser lab.

References:

- ANSI Z136.1-2000, *Safe Use of Lasers*
- EH Special Operations Report [2005-01](#), *Laser Safety*, February 2005

10. Correct response: C

Reason: Responses A and D rely on human knowledge and dangerous assumptions: that certain types of tile do not contain asbestos; that the 1970 Clean Air Act and the 1989 EPA ban on the manufacture, importation, and processing of asbestos-containing products guaranteed the elimination of asbestos-containing material; and that buildings constructed after 1980 are free from asbestos dangers and safe to dismantle or work on without precautions. Response B is incorrect because it applies to radiological work controls. Response C is correct because pre-job hazards analyses, monitoring, wetting agents, and proper PPE constitute a prudent approach to mitigating worker exposures.

References:

- EH Safety Bulletin [2005-13](#), *Asbestos Awareness*, December 2005
- [OSHA 29 CFR 1910.1001](#), *Asbestos*
- [OSHA 29 CFR 1926.1101](#), *Toxic and hazardous substances*

11. Correct responses: B and E

Reason: Responses A, C, and D are failures of conduct of operations principles, as promulgated in [DOE Order 5480.19](#). Response B (placement of trailers) violates the site/refinery rules for safe siting of workplaces, but does not violate conduct of operations principles. Response E (inadequate hazard analysis) demonstrates poor planning, but does not violate specific conduct of operations principles.

References:

- EH Safety Bulletin [2005-09](#), *Vigilance in New or Infrequent High-Hazard Operations*, July 2005
- EH Advisory [2006-01](#), *Texas City Refinery Update: The Price of Safety Complacency*, January 2006
- [DOE Order 5480.19](#), *Conduct of Operations Requirements for DOE Facilities*

