



pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

Study Guide

for

Pennsylvania

Underground Storage Tank

Certification Exams

HOW TO USE THIS STUDY GUIDE

This study guide is intended to help individuals prepare for the technical portion of Pennsylvania's underground storage system tank handler certification examinations. There is a separate study guide to help applicants prepare for the administrative examination. The study guide consists of an extensive list of questions. All of the questions based on material in a specific document are grouped together in the study guide. After each question, the section or page in the reference document where the answer to the question can be found is given in parentheses. The process of reading the question, finding the answer in the reference document and writing the answer in your study guide will help individuals learn the necessary information to pass the certification examinations.

The certification exam will include the material covered in these study questions. The only difference is that the exam will be in multiple choice format. Be thoroughly familiar with the material in this study guide before entering the examination room. The study guide or any other reference material may not be referred to while taking the technical portion of the certification examination(s).

The number of underground storage system certification categories in Pennsylvania has been increased to five. The relationship between the examination modules that you must pass and the certification categories is as follows:

EXAM MODULE	CERTIFICATION CATEGORY
UX	UMX – INSTALLATION & MODIFICATION OF UNDERGROUND STORAGE SYSTEMS UMI – MINOR MODIFICATION OF UNDERGROUND STORAGE SYSTEMS
UR	UMR – REMOVAL OF UNDERGROUND STORAGE SYSTEMS
IU	IUM – INSPECTION OF UNDERGROUND STORAGE SYSTEMS
UT	UTT – TESTING OF UNDERGROUND STORAGE SYSTEMS

For a complete description of the certification categories and the certification requirements for each category, refer to Pennsylvania Code Title 25, Chapter 245.110-113.

This study guide contains questions that are applicable to all four certification examinations. The exam module code letters listed in the above table are printed to the left of each study guide question. The exam module code letters identify the certification examinations which may contain questions related to the study guide question. For example, if the letters UX and IU appear next to a study guide question, then the information covered in the study guide question may appear in the UX and the IU exam modules. If taking either of these exams, know the answer to this study guide question. If preparing for the UR examination, skip this question as the material is not relevant to the examination.

Study questions for the Storage Tank-Liner (TL) exam can be found in the “Study Guide for Pennsylvania Aboveground Storage Tank Certification Exams.”

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Petroleum Equipment Institute
PEI RP-100: Recommended Practices for Installation of
Underground Storage Systems

The following study guide questions are taken from the Petroleum Equipment Institute's "Recommended Practices for Installation of Underground Liquid Storage Systems" (PEI/RP100-2017).

- | | |
|---------------|--|
| UX, IU | 1. What is the proper way to move a tank? (PEI, Section 2.2) |
| UX, UR,
IU | 2. Cables or chains used to lift a tank should be at an angle from the vertical (included angle) of no more than _____ degrees. (PEI, Section 2.2) |
| UX, IU | 3. When is it permissible to use chains or cables around the tank shell in order to move the tank? (PEI, Section 2.2) |
| UX, UT,
IU | 4. At what point in the installation procedure should the air/soap test be performed? (PEI, Section 3.2) |
| UX, IU,
UT | 5. What should be done with factory installed plugs before conducting the pre-installation air/soap test? (PEI, Section 3.2) |
| UX, UT,
IU | 6. What is the maximum allowable internal pressure when performing the pre-installation test on eight foot diameter steel and fiberglass tanks? (PEI, Section 3.2) |

UX, UT, IU	7. What parts of a tank should be soaped when conducting a pre-installation tank test? (PEI, Section 3.2)
UX, IU	8. What is the maximum pressure allowed when air testing 12 ft. diameter fiberglass tanks? (PEI, Section 3.2)
UX, IU	9. What is necessary to make an air test conclusive? (PEI, Section 3.2)
UX, UT, IU	10. What is the recommended range for a pressure gauge used to conduct a tank air test? What can happen if a vacuum gauge is accidentally used instead of a pressure gauge? (PEI, Section 3.2)
UX, IU	11. What device is recommended to prevent over-pressurization when conducting a tank air test? (PEI, Section 3.2)
UX, IU, UT	12. What is the correct way to pressurize the interstice of a double-walled tank when conducting a pre-installation air test? (PEI, Section 3.3)
UX, UT	13. What should be done prior to disconnecting any gauges during pre-installation testing? (PEI, Section 3.3)
UX, UT, IU	14. What types of double-walled tanks do not need to have a pre-installation air/soap test? (PEI, Section 3.5)

NOTE: All double-walled tanks must have a pre-installation integrity test of some kind, but certain types of tanks may use methods other than an air/soap test.

UX, IU 15. What type of pre-installation test is acceptable for double-wall tanks with a liquid-filled interstice? (PEI, Section 3.6)

UX, IU 16. What type of pre-installation test is acceptable for double-wall tanks shipped from the factory with a vacuum in the interstice? (PEI, Section 3.7)

UX, IU,
UR, UT 17. What utilities should be located before excavating begins? (PEI, Section 4.1)

NOTE: *The Pennsylvania Underground Utility Line Protection Act (Act 287 of 1996) requires notification by excavators, designers or any person preparing to disturb the earth's surface anywhere in Pennsylvania. Contractors must call the One Call System (8-1-1) or (1-800-242-1776 outside PA) not less than three nor more than 10 working days in advance of beginning excavation or demolition work.*

UX 18. What are five factors to consider when determining the size, shape and depth of a tank excavation? (PEI, Section 4.1)

a)

b)

c)

d)

e)

UX, UT 19. Why do excavation cave-in situations require the use of additional backfill? (PEI, Section 4.1)

- UX, UR 20. In the absence of local building codes or regulations, what is the minimum distance an excavation should be located from the base of adjacent structures or property lines?(PEI, Section 4.2)
- UX 21. What are five factors to consider when determining the depth of a tank excavation? (PEI, Section 4.3)
- UX, IU 22. To provide a firm foundation, backfill material serving as bedding for the tank should extend how far beyond the actual dimensions (perimeter) of the tank? (PEI, Section 4.3)
- UX, IU 23. What is the recommended thickness of bedding material over a concrete hold-down pad when a steel tank is to be installed? (PEI, Section 4.3)
- UX 24. What is the maximum burial depth for fiberglass tanks? (PEI, Section 4.6)
- UX 25. What determines the maximum burial depth for steel tanks? (PEI, Section 4.6)
- NOTE:** Changes to UL Standard 58 that went into effect in October 1997 allow steel tank manufacturers to build tanks designed to withstand different burial depths. The maximum burial depth for steel tanks should now be indicated on a label affixed to each tank.*
- UX 26. At what point in the installation procedure should a tank be ballasted? (PEI, Section 5.2)
- UX 27. What type of testing should *not* be done after a tank has been ballasted with product? (PEI, Section 5.2)

- UX 28. What types of backfill material are acceptable for steel or composite (fiberglass-clad steel) tanks? (PEI, Section 5.4)
- UX 29. What should be the maximum particle size for backfill material for a steel or composite tank? (PEI, Figure 5-2)
- UX, UR 30. What is the minimum thickness of the bedding material for a steel or composite tank when a hold-down pad is not used? (PEI, Section 5.5)
- UX 31. What are the standard backfill materials for fiberglass tanks? (PEI, Section 5.6)
- UX, UR 32. What is the minimum thickness of the bedding material for a fiberglass tank whether or not a hold-down pad is used? (PEI, Section 5.7)
- UX 33. For what portion of the tank is special care in placement and compaction of backfill required? (PEI, Section 5.8, Figure 5-5)
- NOTE:** *The answer to this question is more clearly presented in Figure 5-5.*
- UX, UR, UT 34. What is the minimum spacing allowed between the tank and excavation walls? What is the minimum spacing allowed between adjacent tanks in the same excavation? (PEI, Figure 5-5)

- UX, IU 35. What is the purpose of measuring fiberglass tank deflection during installation? (PEI, Section 5.9)
- UX, IU 36. In what types of soils should filter fabric be used? (PEI, Section 5.10)
- UX, IU 37. What types of materials does filter fabric separate when installed? (PEI, Section 5.10)
- NOTE:** The text outlines two ways that filter fabric can be used. One is to separate backfill from native soils, the other to separate different types of backfill that might be used in the same excavation (for example, using sand as cover and grading material over pea gravel)*
- UX, IU 38. Why must extra caution be utilized when filter fabrics are used to line an excavation? (PEI, Section 5.10)
- UX, IU 39. What is a filter fabric and what does it do? (PEI, Section 5.10)
- UX 40. What must not be used to support cribbing, bracing or blocking used to support manholes and street boxes during storage system construction? (PEI, Section 5.11)
- UX, IU 41. In what types of locations should provisions be made to keep tanks from floating? (PEI, Section 6.1)

- UX, IU 42. Additional forms of anchoring are usually not required if the tank burial depth is at least what percent of the tank diameter? (PEI, Section 6.1)
- UX, IU 43. If the native soils are impervious, (that is, the soils do not allow water to pass through them very easily) what can happen that might cause a tank to float out? What is this effect called? (PEI, Section 6.1)
- UX 44. How do all tank anchoring methods offset buoyancy forces? (PEI, Section 6.4)
- UX, IU 45. What are deadman anchors? Where must deadman anchors be placed in relation to the tank being anchored? (PEI, Section 6.4)
- UX 46. Using the guidelines presented in this document, calculate the width, length and thickness of a concrete bottom hold down pad if the tank to be anchored is eight feet in diameter and 26 feet long? (PEI, Section 6.4)
- UX, IU 47. Under what circumstances should a tank be set directly on a concrete bottom hold-down pad? (PEI, Section 6.4)
- UX, IU 48. What things must be calculated for each tank installation? (PEI, Section 6.4)
- UX, IU 49. What should anchor straps for steel tanks be made of? What should *not* be used as anchor strap material for steel tanks? (PEI, Section 6.5)

- UX, IU 50. What must be done to steel straps used to anchor steel and composite tanks to ensure the proper operation of the corrosion protection system? (PEI, Section 6.6)
- UX, IU 51. What are the required dimensions (thickness, width, length) of insulating materials used to separate anchor straps from steel and composite tanks? (PEI, Section 6.6)
- UX, IU 52. What materials are NOT acceptable for isolating anchor straps from steel and composite tanks? (PEI, Section 6.6)
- UX 53. What type of anchoring device should be secured through reinforcing in the deadmen? (PEI, Figure 6-4)
- UX 54. When installing and attaching tank anchor straps, what should be considered regarding:
- Method of attachment? (PEI, Section 6.7)
 - Tightness? (PEI, Section 6.7)
 - Cleanliness? (PEI, Section 6.7)
 - Electrical isolation? (PEI, Section 6.7)
 - Corrosion protection? (PEI, Section 6.7)

NOTE: *Coating with a dielectric material is a form of corrosion protection.*

UX, IU	55. What is the purpose of a containment manhole? What should happen to liquids that may accumulate in containment manholes? (PEI, Section 7.2)
UX, IU	56. What are the two types of overfill prevention that are commonly used? (PEI, Section 7.3)
UX, IU	57. What must double-walled piping be connected to in order to achieve full secondary containment? (PEI, Figure 8-1)
UX	58. What safety precaution should be taken before working in manways (as well as piping sumps, dispenser sumps and other enclosed spaces)? (PEI, Section 8.6)
UX, IU	59. What do Environmental Protection Agency (EPA) regulations require for all new underground storage tank systems? (PEI, Section 9.1)
UX, IU	60. Why is the use of vapor sensors in interstitial spaces not recommended? (PEI, Section 9.2.1.2)
UX, IU	61. What is hydrostatic monitoring? (PEI, Section 9.2.2.1)
UX, UT	62. On what types of piping systems is leak detection required? (PEI, Section 9.3)
UX, IU, UT	63. On what type of piping system should an automatic line leak detector be installed? (PEI, Section 9.5)

- UX, IU 64. What are five specific material requirements for storage system piping components? (PEI, Section 10.2)
- a)
- b)
- c)
- d)
- e)
- UX, IU, UT 65. What should be avoided when laying pipe? (PEI, Section 10.4)
- UX, IU 66. Why should pressurized piping be purged of air before it is tested or placed in service ? (PEI, Section 10.4)
- UX, IU, UR 67. Piping trench dimensions should allow for:
- At least _____ inches of bedding. (PEI, Section 10.4)
- In traffic areas, at least _____ inches of compacted backfill and paving between the top of the piping and grade. (PEI, Section 10.4)
- A uniform slope of at least _____ per foot. (PEI, Section 10.4)
- The distance between piping runs should be _____ times the pipe diameter. (PEI, Section 10.4)
- At least _____ inches clearance between the trench walls and the piping. (PEI, Section 10.4)
- IU 68. What may aid in later pipe location? (PEI, Section 10.5)

- UX, IU 69. What is the minimum required clearance between the bottom of a submersible pump and the tank bottom? (PEI, Figure 10-2)
- UX, IU 70. What type of pipe sealant (dope or cement) should be used with threaded piping connections? (PEI, Section 10.7)
- UX, IU 71. What is the minimum standard for metallic piping to be installed underground? For metallic fittings and couplings? (PEI, Section 10.8)
- UX, IU 72. When making a transition from steel to nonmetallic piping, join _____ steel threads to _____ nonmetallic threads. (PEI, Section 10.9)
- UX, IU 73. What can happen if dull pipe-cutting dies are used to thread metallic piping? (PEI, Section 10.7)
- UX 74. Where should vent outlets be located? (PEI, Section 10.12)
- UX, IU 75. When installing an emergency shutoff valve, where should the shear section be located? (PEI, Section 10.16 and Figure 10-4)
- UX, IU 76. Under what circumstances should unions be installed underground? What type of union should be used? (PEI, Section 10.8)

UX, IU	77. What should be done to dispensers, submerged pumps and other metallic components that are not intended to be protected by the cathodic protection system provided for the piping? (PEI, Section 10.8)
UX, IU	78. Where should all flexible piping connections be made? (PEI, Section 10.10)
UX	79. How should flexible piping be installed? (PEI, Section 10.10)
UX, IU	80. What should be done to avoid product leaks into the environment and groundwater or rainwater infiltration into sumps? (PEI, Section 10.11)
UX	81. What piping component offers a convenient means of providing flexibility in piping? (PEI, Figure 10-5)
UX, IU, UT	82. When conducting an air/soap test on new primary piping: (PEI, Section 11.1) <ul style="list-style-type: none"> - What is the minimum test pressure? - How long should the pressure be maintained? - Where should the soap solution be applied?
UX, IU, UT	83. What should be done with lines that have held product prior to testing them? (PEI, Section 11.1.2)

- UX, UT 84. Piping should be _____ from tanks and dispensers prior to pressure testing. (PEI, Section 11.1.2)
- UX, IU 85. What are the minimum test pressures when conducting an air/soap test on new secondary containment piping: (PEI, Section 11.2.1)
- For fiberglass piping that operates at atmospheric pressure and uses clamshell termination fittings?
 - For fiberglass piping that uses flexible termination fittings?
 - For flexible secondary piping?
- UX, IU 86. What must be used to protect steel underground tanks and steel piping from corrosion? Do tanks and piping constructed of corrosion resistant materials require this type of protection? (PEI, Section 12.1)
- NOTE:*** *This requirement does not apply to steel tanks clad with a thick coating of fiberglass*
- UX, IU 87. What must be maintained in order to prevent loss of protection in galvanic cathodically protected tank systems? (PEI, Section 12.5)
- UX, UT 88. On what type of cathodic protection system should components not be electrically isolated? (PEI, Section 12.5)

UX, IU

89. Why are factory installed corrosion protection coatings generally more effective than field applied coatings? To which components should the use of field applied coatings be limited? (PEI, Section 12.4)

NOTE: A “dielectric” material is one that does not allow the passage of direct current. Because corrosion involves the passage of direct current (electrons) from the metal to the soil, a “dielectric” coating will prevent corrosion from occurring. A dielectric coating used on petroleum storage tanks and piping should also be impervious to petroleum products and prevent moisture from contacting the structure being protected.

UX, IU

90. Why can small exposed surfaces on coated structures corrode rapidly? What are these small coating flaws called? (PEI, Section 12.4)

UX, IU

91. When installing galvanic anodes for corrosion protection: (PEI, Section 12.6)

- What metals are galvanic anodes usually made of?
- What must be done with the copper lead wire on a field installed anode?
- What must be done with the waterproof packaging?

NOTE: While waterproof packaging such as plastic wrapping must be removed, the packaging holding the anode backfill (a gray powdery material) must not be damaged.

- What must be tested for continuity?
- How should galvanic anodes be installed?
- Should the anode lead wire be used to lower the anode into a hole?

- UX, IU 92. What information does the anode current output measurement provide? (PEI, Section 12.8)
- UX, IU 93. Buried wiring for underground storage tanks must be coated with _____. (PEI, Section 12.9)
- IU 94. How do impressed current cathodic protection systems work? (PEI, Figure 12-2)
- UX, IU 95. In the absence of a specific plan, where should galvanic anodes be located in relation to the piping they are protecting? (PEI, Section 12.11)
- UX, IU 96. Why should two anodes be used to protect buried piping, even when one is probably enough to provide the required protection? (PEI, Section 12.11)
- UX, IU 97. When testing galvanic cathodic protection systems, what voltage relative to a copper-copper sulphate reference electrode is usually sufficient to provide corrosion protection? (PEI, Section 12.14 and Appendix B, Section B.5)

- UX, IU 98. What are five ways that electrical work can cause environmental problems? (PEI, Section 13.1)
- a)
- b)
- c)
- d)
- UX, IU 99. How much distance should separate electrical conduit and underground piping? (PEI, Section 13.2)
- UX, IU 100. Before placing a storage system in service, what testing should be performed: (PEI, Section 14)
- To the cathodic protection system?
- To a single-walled tank and piping?
- To a double-walled tank and piping system?

Containment Solutions

Fiberglass Storage Tank Installation Instructions & Operating Guidelines

The following questions are based on Containment Solutions publication entitled “Fiberglass Storage Tank Installation Instructions & Operating Guidelines” (5/2015).

- | | | |
|--------|----|---|
| UX | 1. | Can the truck driver delivering a Containment Solutions tank manually unload the tank by himself? (Containment Solutions, Section 2.1) |
| UX | 2. | How many of the lifting lugs on a tank must be used when the tank is lifted? (Containment Solutions, Section 2.3) |
| UX | 3. | Under what circumstances can a tank be rolled? (Containment Solutions, Section 2.1) |
| UX, IU | 4. | What are the only materials that can be used to replace all the native soil that has been excavated? (Containment Solutions, Section 3) |
| UX | 5. | Who should certify that backfill meets all required specifications? (Containment Solutions, Section 3) |
| UX, IU | 6. | What is the range of particle sizes allowed when gravel is used for a backfill material? When crushed stone is used? (Containment Solutions, Section 3) |

UX, IU	7. What is the minimum dry gravel density permitted for Containment Solutions tank backfill? (Containment Solutions, Section 3)
UX, IU	8. What is the suggested recipe for a soapy water solution to use when soaping the tank in warm weather? (Containment Solutions, Section 4)
UX, UT	9. When conducting a pre-installation air/soap test in freezing conditions, what is the suggested recipe for the soap solution? (Containment Solutions, Section 4)
UX, UT	10. What parts of the tank should be covered with the soap solution? (Containment Solutions, Section 4)
UX, IU, UT	11. What must be done if pre-installation testing uncovers a leak in a Containment Solutions tank? (Containment Solutions, Sections 4)
UX, UT	12. What must be done to fitting plugs prior to pressurizing the tank for the pre-installation air test? (Containment Solutions, Section 4)
UX, IU, UT	13. What is the maximum test pressure allowed for four foot through 10 foot diameter tanks? For 12 foot diameter tanks? (Containment Solutions, Section 4)
<i>NOTE:</i> Tank should not be left unattended while under pressure. Release pressure as soon as test is completed.	
UX, IU, UT	14. What device is recommended to prevent over-pressurizing the tank? (Containment Solutions, Section 4)

- UX, UT 15. How long should the test pressure be maintained? (Containment Solutions, Section 5)
- UX, IU 16. How large should the increments be on the air gauge used to monitor the pressure on the tank? (Containment Solutions, Section 4)
- UX, IU,
UT 17. What parts of the tank should you keep your distance from while the tank is under pressure? (Containment Solutions, Section 4)
- UX, UT 18. Should a tank be lifted while it is pressurized? (Containment Solutions, Section 4)
- UX, UT 19. Fittings, plugs, and gaskets should be tightened and retested when what are observed? (Containment Solutions, Section 4.8)
- NOTE:** “Annular space,” “interstitial space,” and “cavity between the inner and outer tank,” all refer to the space between the inner and outer walls of a double-walled tank.*
- UX 20. How many air pressure gauges should be installed to monitor the pressure when testing a double-walled tank with a dry interstitial space? (Containment Solutions, Section 5.3)
- UX 21. When pressurizing a double-walled tank with a dry annular space for the pre-installation air/soap test, to which type of tank fitting (primary tank fitting or monitoring fitting) should the hose from the air supply (compressor) be connected? (Containment Solutions, Section 5.3)
- UX 22. What is the procedure for pressurizing the interstitial space of a double-walled tank with a dry annular space? (Containment Solutions, Section 5.3)

- UX 23. What is the procedure for detecting leaks in the outer wall of a double-wall tank with a dry annular space? (Containment Solutions, Section 5.3)
- UX 24. Why should you not connect the air supply directly to the annular space monitoring fitting? (Containment Solutions, Section 5.4)
- UX 25. What should an individual look for when the plug from the reservoir fitting in a hydrostatically monitored tank is removed? (Containment Solutions, Section 5.5)
- NOTE:** *The “reservoir” is a dome shaped fitting on the top of the tank.*
- UX, IU 26. How can a person tell if there is a leak in the outer wall of a hydrostatically monitored tank before it is installed? (Containment Solutions, Section 5.5)
- UX, IU 27. For a 12 foot diameter tank, what is the minimum clearance required between tank sides and ends and the banks of the excavation? (Containment Solutions, Section 6.1)
- UX, IU 28. What types of soil are considered to be unstable? How are unstable soils technically defined? (Containment Solutions, Section 6.2)
- UX, IU 29. What is the minimum depth of the backfill bed for a tank in a dry hole? (Containment Solutions, Section 8)

- UX, IU 30. When a concrete or asphalt pad is used at grade as part of the tank cover material, how far beyond the tank outline in all directions must the pad extend? (Containment Solutions, Section 8)
- UX, IU 31. What is the maximum burial depth (measured from the tank top to grade) allowed for a fiberglass tank in both traffic and non-traffic conditions? (Containment Solutions, Section 8)
- UX 32. What are two options for meeting the cover requirements of four through 10 foot diameter O/C tanks that do not have mechanical anchoring in non-traffic conditions? (Containment Solutions, Section 8)
- UX, IU 33. What does filter fabric do? (Containment Solutions, Section 7)
- UX, IU 34. What are four soil conditions where Containment Solutions requires the use of filter fabric? (Containment Solutions, Section 7)
- UX, IU 35. Why is plastic not considered to be an effective filter fabric material? (Containment Solutions, Section 7)
- UX, IU 36. What is the purpose of anchoring a tank? (Containment Solutions, Section 9)
- UX, IU 37. What are two common methods of mechanically anchoring a tank? (Containment Solutions, Section 9)

- UX 38. If water is likely to enter the tank hole, but you do not wish to mechanically anchor the tank, what alternative procedure can you use to keep four through 10 foot diameter Containment Solutions tanks from floating? (Containment Solutions, Section 10)
- UX 39. What type of anchor straps are required for use with Containment Solutions tanks? (Containment Solutions, Section 9.7)
- UX 40. What is the proper distance between anchor points when deadmen are used? When a concrete anchor pad is used? (Containment Solutions, Section 9.7)
- UX 41. How closely must anchor points in concrete pads or deadmen line up with the anchor strap locations on the fiberglass tank? (Containment Solutions, Section 9.7)
- UX, IU 42. At what locations on a fiberglass tank must the anchor straps be placed? (Containment Solutions, Section 9.7)
- UX 43. What dimension of the tank should be measured before and after tightening anchor straps to see if anchor straps have been over tightened? (Containment Solutions, Section 9.7)
- UX, IU 44. What should be the dimensions (length and width) of a concrete anchor pad for an Containment Solutions tank that is 25 feet long and eight feet in diameter? (Containment Solutions, Section 9.14)

- UX 45. What should be the height and width dimensions of deadmen used to anchor six through eight foot diameter tanks with a minimum burial depth as specified by the manufacturer? (Containment Solutions, Section 9.13)
- UX 46. What must be done to the first and second 12-inch lifts of backfill placed around a fiberglass tank? What is the recommended tool for doing this? (Containment Solutions, Section 11.3)
- UX, IU 47. At what point in the backfilling process should a tank be filled (ballasted) with water or product? (Containment Solutions, Section 11.3)
- UX, IU 48. What is the minimum bedding thickness for a fiberglass tank installation in a wet hole? (Containment Solutions, Figure 11-3)
- UX, IU 49. Fiberglass tanks must be vented so that the maximum pressure or vacuum in the tank does not exceed _____ psig. (Containment Solutions, Section 14)
- UX, IU 50. What must be independent of tank vents? (Containment Solutions, Section 14)
- UX, IU 51. If the monitoring cavity (interstitial space) of a double-walled tank is vented, how must this be accomplished? (Containment Solutions, Section 14)
- UX, IU 52. What should be installed on the tank and delivery truck if deliveries are to be pumped into an underground fiberglass tank? (Containment Solutions, Section 15)

- UX, IU 53. What will happen to a fiberglass tank if it is overfilled during a pressurized delivery?
(Containment Solutions, Section 15)
- UX, IU 54. Is it necessary to vent the interstitial space (monitoring cavity) of a fiberglass tank with a
hydrostatic (liquid filled interstitial space) monitoring system? (Containment Solutions,
Section 17)
- UX, IU 55. How can the joint between the containment collar and the sump be tested to see if it is
liquid tight? (Containment Solutions, Section 18)

American Petroleum Institute

API 1615: Installation of Underground Petroleum Storage Systems

The following study guide questions are taken from the American Petroleum Institute's Recommended Practice 1615, "Installation of Underground Petroleum Storage Systems" (Sixth Edition, April, 2011).

UX, IU 1. What is an extractor fitting? (API 1615, Section 2.29)

UX, IU 2. What is an interstice? (API 1615, Section 2.42)

UX, IU,
UT 3. What are some of the functions of a sump? (API 1615, Section 2.87)

UX, IU 4. What things should be included in a preconstruction site-specific plan? (API 1615, Section 6.1.1)

UX, IU 5. Why is it important to install a property designed corrosion protection system when installing new steel tanks next to an existing steel UST system? (API 1615, Section 7.2.2)

- UX, IU 6. Tanks should be located at least how many feet from the property line of any adjacent property on which a structure can be built? (API 1615, Section 8.3.2)
- UX 7. Where should underground tanks being stored temporarily at a construction site be located? (API 1615, Section 9.1.4)
- UX, IU 8. What type of chock should be used to prevent a tank from moving during storage? (API 1615, Section 9.1.5)
- IU 9. If significant damage has occurred to a tank when it arrives at the installation site, what should be done? (API 1615, Section 9.2.2)
- UX, IU 10. What measurement should be taken prior to installation of an underground tank? (API 1615, Section 9.2.4)
- UX 11. Prior to pressurization in a preinstallation tank test the tank should be _____. (API 1615, Section 9.5(b))
- UX, IU, UT 12. What does the term “interstitial space” or “annular space” refer to? (API 1615, Section 9.6.1)

- UX 13. When should piping be isolated and tested? (API 1615, Section 9.7.1)
- UX, UR,
IU, UT 14. What are the API recommendations for depth of cover over tanks that are located in traffic areas? (API 1615, Section 11.4)
- UX, IU 15. What conditions can cause a tank to float? (API 1615, Section 10.2.1)
- UX 16. If _____ can be expected, tanks should be anchored. (API 1615, Section 10.3.1)
- UX, UR 17. How should anchor straps used with concrete anchor pads or deadmen be installed? (API 1615, Section 10.3.3)
- UX 18. How should tanks of different diameters be aligned? (API 1615, Figure 11)
- UX, IU 19. Who can provide professional assistance in determining anchoring requirements? (API 1615, Section 10.3.1)

- UX 20. What should occur prior to installation of submersible pumps? (API 1615, Section 10.4.3)
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- UX, IU 21. What are the Environmental Protection Agency's corrosion protection requirements for new tanks and product piping? (API 1615, Section 15.1)
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- IU 22. What types of tanks can be used to meet the regulatory requirements for corrosion protection? (API 1615, Section 15.1)
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- IU 23. How does a sacrificial anode system protect steel equipment from corrosion? (API 1615, Section 15.2)
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- IU 24. What is the important isolation area when a sacrificial anode system is used on piping? (API 1615, Section 15.2.3)
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- UX, IU 25. How should metallic anchor straps be isolated from a steel tank? (API 1615, Section 10.3.5)

- UX, IU 26. How should underground piping be sloped? (API 1615, Section 13.2.2)
- UX, UT 27. What should be avoided in order to decrease problems when tightness testing? (API 1615, Section 13.2.4)
- UX, IU 28. What material should be used to assemble the aboveground portion of vent piping? What materials should not be used? (API 1615, Section 13.3.3)
- UX, IU 29. What should be the minimum height of vent outlets above the adjacent ground surface? In what direction should vapors be discharged? (API 1615, Section 13.3.3)
- UX, IU 30. What should be the minimum rating of tees, elbows, and unions used in underground steel piping? What type of iron should these fittings be made of? (API 1615, Section 13.5)
- UX, IU 31. Any FRP pipe used in an underground petroleum installation should be _____. (API 1615, Section 13.4.1)

NOTE: See section 2.50 for the specific meaning of “listed.”

- UX, IU 32. Fiberglass pipe and fittings connections should conform to the following: (API 1615, Section 13.4)
- a)
- b)
- c)

- UX, IU 33. What can be used to minimize the breakage of underground piping and vent lines? (API 1615, Section 13.7.1)
- UX, IU 34. In an underground steel or FRP piping system, where should flexible joints be installed? (API 1615, Section 13.7.1)
- UX, IU,
UT 35. Fiberglass piping can be used to create its own flexible joint provided that there is a straight run of at least _____ feet between directional changes. (API 1615, Section 13.7.3)
- UX, IU,
UT 36. What must overfill prevention equipment do? (API 1615, Section 14.2.2)
- UX, UT 37. Prior to backfilling, the piping must be isolated and _____. (API 1615, Section 11.2)
- IU, UT 38. If piping is installed and operational, which type of piping tightness test may be required by codes? (API 1615, Section 13.8)
- UX, IU 39. How thick should backfill be between piping and the sides and floor of the piping trench? (API 1615, Section 11.3.2 and Figure 14)

- UX, IU 40. What should be the backfill bedding thickness for underground steel and fiberglass tanks? (API 1615, Section 11.3.3.1 and 11.3.3.2)
- UX 41. Why must care be taken when stakes, used in final grading and paving of the site, are driven into the ground? (API 1615, Section 11.5)
- UX, UT 42. Prior to placing a tank in operation, what testing should be completed? (API 1615, Section 19)
- UX, UT 43. When should final tightness testing be conducted on the piping? (API 1615, Section 19)
- UX, IU 44. What can decrease the efficiency of suction pumping systems? (API 1615, Section 12.3.2)
- UX, IU 45. For what type of pumping system does depth of the tank or length of the piping not affect the performance of the pump? (API 1615, Section 12.2.2)
- UX, IU 46. How far above the bottom of the tank should remote pumps be installed? (API 1615, Section 12.4)

NOTE: *Containment Solutions requires 6 inches of clearance for 12 foot diameter tanks.*

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| UX, IU | 47. What should be installed by the tank manufacturer under fill and gauge openings in a tank? (API 1615, Section 12.5.4) |
| UX, UT | 48. What is the standard size of underground tank openings? (API 1615, Section 12.5.2) |
| UX | 49. What type of design should all fill connection have? (API 1615, Section 12.5.5) |
| UX, IU | 50. What identifying information should be present at each fill pipe? (API 1615, Section 12.6) |
| UX, UT | 51. What type of vapor recovery may be required when a tanker truck makes a delivery into an underground tank? (API 1615, Section 17.1.2) |
| UX, IU, UT | 52. What type of vapor recovery traps the vapor in the vehicle for eventual reuse? (API 1615, Section 17.1.4) |
| UX, IU | 53. What happens to the vapors in a balance type vapor recovery system? (API 1615, Section 17.2.1) |

- UX, IU 54. What are the three most common designs for Stage I vapor recovery systems? (API 1615, Section 17.2.1)
- IU 55. For vapor recovery, where is the vapor pick-up adaptor installed? (API 1615, Section 17.2.2.2)
- UX 56. If tanks are manifolded, what must be provided for Stage I vapor recovery to work? (API 1615, Section 17.2.2.3)
- UX, IU 57. What is the primary difference between single-point manifold and two point Stage I vapor recovery systems? (API 1615, Section 17.2.3)
- UX, IU 58. How many tank openings are required for a coaxial Stage I vapor recovery system to be installed? (API 1615, Section 17.2.4)
- UX 59. What has Onboard Refueling Vapor Recovery (ORVR) led to the decommissioning of? (API 1615, Section 17.1.4)
- UX, IU 60. What are some types of leak detection methods? (API 1615, Section 18.3)
- UX 61. How can the interstitial space of a tank be monitored? (API 1615, Figure 28)

American Petroleum Institute

API 1632: Cathodic Protection of Underground Storage Systems

The following study guide questions are taken from the American Petroleum Institute's Recommended Practice 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems" (Third Edition, May 1996, Reaffirmed 2002).

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| UX | 1. | What are the four components of an electrochemical corrosion cell? (API 1632, Section 2.1) |
| UX | 2. | What happens at the anode of the corrosion cell? (API 1632, Section 2.1) |
| UX | 3. | What does not happen at the cathode of a corrosion cell? (API 1632, Section 2.1) |
| UX | 4. | What happens along the metallic path connecting the anode and cathode? (API 1632, Section 2.1) |
| UX | 5. | What is the electrolyte in the case of buried structures such as underground tanks and piping? (API 1632, Section 2.1) |
| UX | 6. | Which component of a corrosion cell is generally created in an area of relatively low oxygen concentration? In an area of relatively high oxygen concentration? How does this affect buried tanks? (API 1632, Section 2.2.1.3) |
| UX | 7. | What are four soil characteristics that can influence the rate of corrosion on buried steel structures? (API 1632, Section 2.2.1.4) |

- UX 8. What are the most damaging stray currents? Where do they typically come from? (API 1632, Section 2.2.2.2)
- UX 9. Under what conditions does bimetallic corrosion occur? (API 1632, Section 2.2.2.3)
- UX 10. In a bimetallic corrosion cell, where does the most severe corrosion attack occur? (API 1632, Section 2.2.2.3)
- UX 11. How does cathodic protection work? (API 1632, Section 2.3.1)
- UX 12. What are two methods of applying cathodic protection to underground metal structures? (API 1632, Section 2.3.1)
- UX 13. In a galvanic cathodic protection system, all the elements of a corrosion cell are intentionally created. What type of metal is used for the anode (the place where corrosion occurs)? (API 1632, Section 2.3.2.1)
- UX 14. As a corrosion cell develops on an underground storage tank where a galvanic cathodic protection system has been established, what happens at the anode? What happens at the cathode? (API 1632, Section 2.3.2.1)

- UX 15. What are seven advantages of galvanic cathodic protection systems? (API 1632, Section 2.3.2.2)
- a)
 - b)
 - c)
 - d)
 - e)
 - f)
 - g)
- UX 16. What metal has the most negative potential (greatest negative voltage) when measured relative to a copper/copper sulfate reference electrode? (API 1632, Table 1)
- UX 17. What are four disadvantages of galvanic cathodic protection systems? (API 1632, Section 2.3.2.3)
- a)
 - b)
 - c)
 - d)
- UX 18. What materials are used to manufacture anodes in an impressed current cathodic protection system? (API 1632, Section 2.3.3.1)

- UX 19. What are five advantages of impressed current cathodic protection systems? (API 1632, Section 2.3.3.2)
- a)
- b)
- c)
- d)
- e)
- UX 20. What are five disadvantages of impressed current cathodic protection systems? (API 1632, Section 2.3.3.3)
- a)
- b)
- c)
- d)
- e)
- UX 21. Which type of cathodic protection system is normally required for existing underground tank installations? (API 1632, Section 2.3.4.1)
- UX 22. A plot plan of a cathodically protected facility should identify which components of the cathodic protection system? (API 1632, Section 2.3.5)

- UX 23. What are sacrificial anodes usually made of? (API 1632, Section 3.1.1)
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- UX 24. In what type of soils are zinc anodes best utilized? (API 1632, Section 3.1.1)
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- UX 25. In what types of soils are magnesium anodes frequently used? (API 1632, Section 3.1.1)
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- UX 26. Because of low driving voltage and low current output, what type of structure is sacrificial anode cathodic protection usually limited to? (API 1632, Section 3.1.2)
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- UX 27. Will a cathodic protection system protect metal piping attached to the tank - but isolated from the tank by nonconductive bushings - when the tank has factory installed galvanic anodes? (API 1632, Section 3.2.1)
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- UX 28. Magnesium and zinc anodes are usually supplied in a prepackaged chemical backfill. What are three functions of this chemical backfill? (API 1632, Section 3.4.2)

- UX 29. What are two reasons why galvanic anodes should be installed near the bottom of the structure they are protecting? (API 1632, Section 3.4.3)
- a)
- b)
- UX 30. Why must a structure that is galvanically cathodically protected be electrically isolated from other buried metal, including piping and electrical conduit? (API 1632, Section 3.5.2)
- UX 31. What measurement is the most common criterion for ensuring adequate sacrificial anode protection for buried tanks and piping? (API 1632, Section 3.6.1)
- UX 32. Where should soil access manholes used for making structure-to-soil potential measurements be located? (API 1632, Section 3.6.2)
- UX 33. Where should long-life reference cells used for cathodic protection monitoring be located? (API 1632, Section 3.6.3)
- UX 34. What type of voltmeter is required for making a structure-to-soil potential measurement? To what are the two leads from the voltmeter connected? (API 1632, Section 3.6.5)

- UX 35. What information should be included in the permanent cathodic protection monitoring records for a location? (API 1632, Section 3.6.6)

NOTE: *The paragraph describing the frequency of cathodic protection monitoring is not consistent with federal and state regulations. Federal and state regulations specify a routine inspection interval of three years rather than five years.*

- UX 36. What is usually the most economical means of controlling corrosion on *existing* underground bare steel petroleum storage tanks and piping systems? (API 1632, Section 4.1.1)

NOTE: *Impressed current cathodic protection systems must be designed by a corrosion expert. Certified installers may work with a corrosion expert to install these systems properly.*

- UX 37. What is the source of the direct current in an impressed current cathodic protection system? (API 1632, Section 4.1.2)

- UX 38. Where should rectifiers for impressed current cathodic protection systems be mounted? (API 1632, Section 4.2.4)

- UX 39. What materials are generally used to make impressed current cathodic protection anodes for use in soil installations? (API 1632, Section 4.3.1)

- UX 40. What type of backfill is generally used with impressed current anodes? (API 1632, Section 4.3.4)

- UX 41. Which lead of the rectifier (positive or negative) in an impressed current cathodic protection system must be attached to the structure(s) to be protected from corrosion? What will happen if the leads are reversed? (API 1632, Section 4.3.4)
- UX 42. Why must special care be taken in insulating all buried wires attached to the positive terminal of the rectifier in an impressed current cathodic protection system? (API 1632, Section 4.3.6)

NACE International

NACE SP0285: Corrosion Control of Underground Storage Tank Systems by Cathodic Protection

The following study guide questions are taken from the NACE International publication number SP0285-2011 “Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.” (March 2011)

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| IU | 1. | What is the definition of cathodic protection? (NACE SP0285-2011, Section 2) |
| IU | 2. | What is the function of coatings in corrosion control systems? (NACE SP0285-2011, Section 3.4.2) |
| IU | 3. | When making voltage measurements on cathodically protected systems, where should the reference electrode be located? (NACE SP0285-2011, Section 5.1.4) |
| IU | 4. | What are three criteria that can be used to demonstrate that adequate cathodic protection has been achieved? (NACE SP0285-2011, Section 5.2.1) |
| | | 5.2.1.1 |
| | | 5.2.1.2 |
| | | 5.2.1.3 |
| IU | 5. | How often should sources of impressed current be checked for proper operation? (NACE SP0285-2011, Section 8.2.3.1) |

- IU 6. How often should impressed current protective facilities be inspected as part of a preventive maintenance program? (NACE SP0285-2011, Section 8.2.3.2)
- IU 7. How often should cathodic protection test equipment be checked for accuracy? (NACE SP0285-2011, Section 8.2.4)

Pennsylvania Department of Labor and Industry

Title 34: Flammable and Combustible Liquids; Preliminary Provisions

The following study guide questions are taken from Pennsylvania Department of Labor and Industry's "Flammable and Combustible Liquids; Preliminary Provisions", Title 34, Chapter 14 of the Pennsylvania Code. Also, Philadelphia and Pittsburgh have their own flammable and combustible liquid codes which should be consulted before doing work in these cities.

UX, IU 1. What is the definition of a Class I flammable liquid? (Flammable & Combustible Liquids, Section 14.6)

UX, IU 2. What is the distance required between an underground tank storing a Class I liquid and the nearest wall of any basement, pit or cellar or adjoining property line? (Flammable & Combustible Liquids, Section 14a.21)

UX, IU 3. How far apart must underground tanks be set? (Flammable & Combustible Liquids, Section 14a.22)

NOTE: *This requirement is also generally interpreted to mean that the same amount of clearance should be allowed between a tank and the excavation wall, as well as over the tank.*

UX, IU 4. Tanks not subject to traffic loading may be covered with not less than _____ of backfill topped with a slab of reinforced concrete not less than _____ thick. (Flammable & Combustible Liquids, Section 14a.22)

- UX, IU 5. What are the minimum requirements for underground tank cover in traffic areas? (Flammable & Combustible Liquids, Section 14a.22)
- UX, IU 6. How far beyond the outline of a tank must concrete or asphalt paving used as part of the cover of an underground tank extend? (Flammable & Combustible Liquids, Section 14a.22)
- UX, IU 7. What are two requirements for underground tank fill lines? (Flammable and Combustible Liquids, Section 14a.24a)
- UX, IU 8. What are three requirements for filling and vapor recovery connections? (Flammable and Combustible Liquids, Section 14a.24a)
- UX, IU 9. The design and location of vent pipe systems shall take into consideration _____. (Flammable and Combustible Liquids, Section 14a.25)
- UX 10. Before being covered or placed in use, tanks and piping shall _____. (Flammable and Combustible Liquids, Section 14a.26)

UX, IU,
UR

11. What three procedures are required when an underground tank is taken out of service for a period of three months or less? (Flammable and Combustible Liquids, Section 14a.221)
- a.)
 - b.)
 - c.)

UR

12. If a tank is to be disposed of as junk, it shall be _____. (Flammable and Combustible Liquids, Section 14a.222)

UR

13. If a tank is to be closed in place, it must be filled with _____. (Flammable and Combustible Liquids, Section 14a.222)

National Fire Protection Association

NFPA 30: Flammable and Combustible Liquids Code

The following study guide questions are taken from National Fire Protection Association (NFPA) Code 30, “Flammable and Combustible Liquids Code,” 2018 edition.

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|---------------|----|---|
| IU, UR | 1. | What is the “flash point” of a liquid? (NFPA 30, Section 3.3.21) |
| UR | 2. | What is the definition of “flammable liquid”? (NFPA 30, Section 3.3.33.2) |
| UX, UR,
IU | 3. | What is the minimum distance required between an underground tank containing Class I liquids and any property line that can be built upon? (NFPA 30, Section 23.4.2) |
| UX, UR,
IU | 4. | What is the minimum distance required between an underground tank containing Class II or Class III liquids and the nearest wall of any basement, pit or property line that can be built upon? (NFPA 30, Section 23.4.3) |
| UX, IU | 5. | What are three options for the minimum acceptable depth of cover for underground tanks located in a traffic area? (NFPA 30, Section 23.5.2.2) |
| IU | 6. | What is the maximum static head that can be imposed at the bottom of an underground tank? (NFPA 30, Section 21.5.1.2) |
| UX, IU | 7. | How high above adjacent ground level must vent pipes for Class I liquids be located? (NFPA 30, Section 27.8.2.1) |

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| UX, IU | 8. What is the minimum inside nominal diameter for a vent pipe for an underground tank? (NFPA 30, Section 23.6.2) |
| UX, IU | 9. What are the three factors that determine venting capacity for an underground tank? (NFPA 30, Section 23.6) |
| UX, IU | 10. Openings for manual gauging on tanks shall be provided with _____. (NFPA 30, Section 21.8.7) |
| UX, UR, IU, | 11. What is the only acceptable type of joint when piping systems handling Class I liquids are located in concealed spaces within buildings? (NFPA 30, Section 27.5.1.4) |
| UR, IU | 12. What type of material should be used to fill an underground tank that is abandoned in place? (NFPA 30, Appendix C.4.11) |
| UR, IU | 13. After removal and cleaning, how should an underground tank be disposed? (NFPA 30, Appendix C.6.3, C.6.4) |

National Fire Protection Association

NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages

The following study guide questions are taken from National Fire Protection Association (NFPA) Code 30A, “Code for Motor Fuel Dispensing and Repair Garages,” 2018 edition.

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| IU | 1. | What is the definition of a combustible liquid? What is the definition of a Class IIIA combustible liquid? (NFPA 30A, Section 3.3.9.1 and 3.4.2.2) |
| UX, IU | 2. | What is the maximum length of hose allowed at an automotive service station for dispensing fuel into vehicles? (NFPA 30A, Section 6.5.1) |
| UX, IU | 3. | What type of device is required on all hoses dispensing Class I liquids to prevent spillage should a vehicle drive away with the dispensing nozzle still in the vehicle fuel tank? (NFPA 30A, Section 6.5.2) |
| UX, IU | 4. | What device must be installed at the base of each individual island-type dispenser connected to a remote pumping system? (NFPA 30A, Section 6.3.9)

- How must this device be anchored?

- Can a device incorporating a slip-joint feature be used?

- How often must the operation of this device be checked? (6.3.9.1) |

UX, IU

5. If a vapor return pipe is located inside a dispenser housing, what must the vapor return pipe be equipped with to ensure the operation of the emergency shutoff valve? (NFPA 30A, Section 5.7)

UX, IU

6. A power shut-off switch is required to cut power to all dispensing devices in the event of an emergency (section 6.7). Where should this switch be located at attended self-service stations? (NFPA 30A, Section 6.7.1)
 - Where should it be located at unattended self-service stations? (NFPA 30A, Section 6.7.2)

Environmental Protection Agency

Detecting Leaks - Successful Methods Step-by-Step

The following study questions were taken from the US Environmental Protection Agency's (EPA) Publication Number EPA/530/UST-89/012, "Detecting Leaks - Successful Methods Step-by-Step" (November 1989).

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| UX, IU | 1. What are seven methods of tank leak detection allowed by federal regulations? (EPA Detecting Leaks, p. 2) |
| UX | 2. Ground water monitoring cannot be used at sites where the ground water depth is more than _____ feet. (EPA Detecting Leaks, p. 8) |
| UX, IU, UT | 3. How can water be detected in underground storage tanks? (EPA Detecting Leaks, p. 17) |
| UT | 4. What two factors influence the effects of evaporation on a tank system? (EPA Detecting Leaks, p. 20) |
| IU | 5. What is the cumulative overage or shortage allowed by the rules for monthly inventory reconciliation? (EPA Detecting Leaks, p. 29) |
| IU | 6. For what range of tank sizes does manual tank gauging have the same leak detection sensitivity as inventory control? (EPA Detecting Leaks, p. 33) |
|
NOTE: <i>Manual tank gauging may not be used for leak detection for tanks more than 2,000 gallons capacity. For tanks between 1,001 and 2,000 gallons, manual tank gauging must be used with tightness testing. Refer to the EPA booklet entitled "Manual Tank Gauging for Small Underground Storage Tanks" (EPA 510-B-93-005) for more information on this method of leak detection.</i> | |
| IU, UT | 7. How do volumetric tightness test methods determine if there is a leak? (EPA Detecting Leaks, p. 48) |

- IU, UT 8. Into what two categories can volumetric tests be divided? (EPA Detecting Leaks, p. 50)
- UT 9. In tank tightness testing, the end of the analysis is a calculated _____. (EPA Detecting Leaks, p. 50)
- NOTE: “Partially filled” tests are also commonly known as “underfilled” tests.***
- UT 10. Why must sensing devices be considerably more sensitive for partially-filled tank tests than for overfilled tank tests in order to achieve the same accuracy? (EPA Detecting Leaks, p. 50)
- UT 11. Is the tank considered to be leaking if the temperature – compensated volume change exceeds the detection criterion? (EPA Detecting Leaks, p. 50)
- IU, UT 12. What should be done if a tank to be tightness tested contains a drop tube? (EPA Detecting Leaks, p. 53 & 57)
- UX, UT 13. What should be done when trying to tightness test a tank and abandoned piping is found? (EPA Detecting Leaks, p. 53)
- IU, UT 14. How can the correct coefficient of expansion for a product be determined? (EPA Detecting Leaks, p. 54 & 67)
- UT 15. What values and information should the tester determine during the waiting period(s) of the test? (EPA Detecting Leaks, p. 50)
- IU, UT 16. How can the height-to-volume conversion factor for a tightness test be determined? (EPA Detecting Leaks, p. 54 & 67)

- UX, UT 17. What are some common problems with UST systems that can occur over time? (EPA Detecting Leaks, p. 52)
- IU, UT 18. What should be done in order to test manifolded tanks appropriately? (EPA Detecting Leaks, p. 56)
- IU, UT 19. Can a volumetric tightness test be conducted in a tank with a remote fill pipe and no other accessible tank openings? (EPA Detecting Leaks, p. 57)
- IU, UT 20. What are two ways of overcoming tightness testing problems posed by abandoned piping? (EPA Detecting Leaks, p. 57)
- UT 21. What two factors that cause liquid level changes in a tank but are unrelated to a leak are produced when product is added to a tank? (EPA Detecting Leaks, p. 58)
- IU, UT 22. How can a volumetric tightness test distinguish between real volume changes and volume changes due to structural deformation? What is the solution to this problem (EPA Detecting Leaks, p. 60)
- IU, UT 23. An underground tank that has been empty is filled with product. For at least the first few hours after filling, what will happen to the tank walls? What will be the effect on the volume of the tank? What will happen to the product level? (EPA Detecting Leaks, p. 61)
- IU, UT 24. What is the most easily identifiable indication of a vapor pocket during an overfilled tightness test? (EPA Detecting Leaks, p. 62)

- UT 25. What are three possible causes of vapor pockets in an underground tank during an overfilled tightness test? (EPA Detecting Leaks, p. 63)
- IU, UT 26. If a vapor pocket is determined to be present in an underground tank during an overfilled tightness test, what must be done? (EPA Detecting Leaks, p. 64)
- IU, UT 27. What effect does the presence of ground water outside a tank have on a volumetric tightness test? (EPA Detecting Leaks, p. 64)
- IU, UT 28. For tightness tests where the liquid level and temperature data are gathered manually, how often should the measurements be taken? What should be the duration of the data gathering period? (EPA Detecting Leaks, p. 68)
- IU, UT 29. In a tightness test method that does not circulate the product, what is the minimum number of temperature sensors required to achieve adequate temperature compensation in a tank? How should these sensors be arranged? (EPA Detecting Leaks, p. 69)
- IU, UT 30. Do small product level changes that occur during test data collection influence test results? (EPA Detecting Leaks, p. 69)
- NOTE:*** *This section is referring to overfilled tightness tests.*
- IU, UT 31. For which type of tightness test is variable product level a problem? Is it possible to compensate for the effects of variable product level? (EPA Detecting Leaks, p. 70)
- IU, UT 32. To determine whether a tank has passed or failed a volumetric tank tightness test, what must the volumetric flow rate be compared to? (EPA Detecting Leaks, p. 72)

- IU, UT 33. What is the most commonly used threshold value in volumetric tightness testing? (EPA Detecting Leaks, p. 72)
- IU, UT 34. In volumetric tightness testing, if the threshold value for calling a leak is equal to the leak rate to be detected, the probability of detecting a leak of that size is _____ percent. (EPA Detecting Leaks, p. 72)
- IU, UT 35. According to the federal regulations, what size leak must a tightness test be able to detect? (EPA Detecting Leaks, p. 72)
- IU 36. What size leak is an automatic tank gauge in leak test mode able to detect? (EPA Detecting Leaks, p. 77)
- IU 37. Is vapor monitoring appropriate for non-volatile products? (EPA Detecting Leaks, p. 102)
- IU 38. How is the volatility of a substance measured? (EPA Detecting Leaks, p. 102)
- IU 39. In what type of soil materials does soil vapor monitoring work best? (EPA Detecting Leaks, p. 103)
- IU 40. What is the general rule of thumb concerning the rate of migration of petroleum vapors? (EPA Detecting Leaks, p. 111)
- IU 41. What is hydraulic conductivity? (EPA Detecting Leaks, p. 137)

- IU 42. For ground water monitoring to be most effective, what should be the hydraulic conductivity of the soils or backfill between the tank and the well? (EPA Detecting Leaks, p. 137)
- UX, IU 43. Do interstitial monitoring systems normally measure leak rates? (EPA Detecting Leaks, p. 162)
- UX, IU 44. Where do the majority of leaks in underground storage systems originate? (EPA Detecting Leaks, p. 183)
- UX, IU, UT 45. How do automatic flow restrictors work? (EPA Detecting Leaks, p. 187)
- IU 46. Can automatic shut off devices be used on non-pressurized lines? (EPA Detecting Leaks, p. 189)
- IU, UT 47. At what pressure are suction lines typically tested? (EPA Detecting Leaks, p. 190)
- IU, UT 48. What size leak must a piping tightness test be able to detect? (EPA Detecting Leaks, p. 190)
- IU, UT 49. What are two approaches to volumetric line tightness testing? (EPA Detecting Leaks, p. 190)
- IU, UT 50. How does a helium tightness test work? (EPA Detecting Leaks, p. 191)

- UX, IU 51. When secondary containment is used for piping leak detection, what portion of the piping must be contained? (EPA Detecting Leaks, p. 191)
- UX, IU 52. Double-walled piping is a form of secondary containment. How does it work? (EPA Detecting Leaks, p. 192)
- NOTE:** This document was written before the advent of flexible piping.*
- UX, IU,
UT 53. How is a leak in a piping system detected when using ground water monitoring? (EPA Detecting Leaks, p. 193)
- UX, IU 54. What is the function of check valves in a piping system? (EPA Detecting Leaks, p. 197)
- UI, UT 55. How can the presence of vapor pockets in piping be determined? (EPA Detecting Leaks, p. 199)

Pennsylvania Department of Environmental Protection

25 PA Code Chapter 245: Administration of the Storage Tank and Spill Prevention Program

The following study guide questions are taken from the Pennsylvania Department of Environmental Protection storage tank regulations, originally published September 21, 1991. These rules are contained in Title 25 of the Pennsylvania Code, Chapter 245. This reference is often abbreviated “Chapter 245.”

The Pennsylvania rule is organized in an outline format using a system that works like this:

Subchapters: A,B,C,D,E,F,G,H	These are written in bold type and use the upper case alphabet. These are the major divisions of the rules.
Sections 245.1 to 245.708	These are written in bold type and are the important divisions of the rules.
(a), (b), (c), etc...	The major divisions of a section are indicated by lower case alphabet letters in parentheses.
(1), (2), (3), etc...	The next lower divisions of a section are indicated by arabic numerals in parentheses.
(i), (ii), (iii), (iv), etc...	The next lower divisions of a section are indicated by roman numerals in parentheses.
(A), (B), (C), (D), etc...	The next lower divisions of a section are indicated by upper case letters in parentheses.

The rule uses many lists to describe requirements, so it is often necessary to trace back the text to the next higher heading to understand what is being said. For example, section 245.2 (c) (1) states, “Will prevent releases due to corrosion or structural failure for the operational life of the system.”

This does not make much sense by itself. We must go back to 245.2(c) which says, “A person may not install a storage tank system regulated under the act unless the system does the following,” to determine that this is a requirement of tank installers.

Reading rules is difficult, but with some practice and diligence it can be done. It is highly recommended that you carefully read through a section of the rules before you attempt to answer the study guide questions for that section.

- | | |
|--------|--|
| UX, IU | 1. Is a hydraulic lift tank subject to these regulations? (245.1 – UST Definition (xv)) |
| UX, IU | 2. Is an underground used oil tank with a capacity of 100 gallons subject to these regulations? (245.1 – UST Definition (xii)) |
| UX, IU | 3. UST systems that store fuel solely for use by emergency power generators must meet release detection requirements by what date(s)? (245.403(b)) |
| UX | 4. How do the regulations define “Corrosion Expert”? (245.1) |

- UX 5. What is the regulatory definition of “Excavation Zone”? (245.1)
- IU, UX 6. What does the term “regulated substance” include? (245.1)
- UX, UR, IU 7. What percentage of an “underground storage tank” must be beneath the surface of the ground for it to be considered an underground storage tank? (245.1 – UST Definition)
- UX, IU 8. Do farm or residential tanks that have a capacity of 1,100 gallons or less and are used for storing motor fuel for noncommercial purposes have to meet the requirements of these regulations? (245.1 – UST Definition(i))
- NOTE:** In order to be subject to these regulations, a storage system must: 1) contain a regulated substance, 2) meet the definition of an underground tank, and 3) be used for a regulated purpose. Thus a 1,000 gallon underground gasoline tank used to fuel vehicles by a contractor is regulated, but the same tank used by a farmer is not regulated.*
- UX, IU 9. Is a tank used for storing heating oil for consumptive use on the premises where stored required to comply with these regulations? (245.1 – UST Definition(ii))
- UX, IU, UR 10. How do the regulations define a “change in service?” (245.1)
- UX, UR, IU 11. Are tanks located in an underground area but situated above the surface of the floor so that there is enough space for physical inspection of the exterior of the tank considered to be underground tanks? (245.1 – AST Definition)

- UT, IU 12. Does a failed tightness test, regardless of the test method, constitute a suspected release? (245.31(c))
- UX 13. What are three acceptable types of tank construction that meet the corrosion protection requirements of the regulations? (245.421(b)(1)(i, ii, iii))
- IU, UT, UX 14. What are two acceptable types of piping construction that meet the corrosion protection requirements of the regulations? (245.421(b)(2)(i, ii))
- UX, IU 15. What is the purpose of spill prevention equipment? What is an example of spill prevention equipment? (245.421(b)(3)(i)(A))
- NOTE:** Regulations do not specify any capacity requirements for this type of equipment.*
- UX, IU 16. What three types of overfill prevention devices are mentioned in the state and federal rules? (245.421(b)(3)(i)(B)(I, II, III))
- UX, IU 17. What type of overfill prevention is no longer permitted to be installed? (245.421(b)(3)(iii))
- UX, IU 18. What are two ways in which overfill protection can meet DEP regulations? (245.421)(3)(B))

UX, IU

19. What was the deadline for upgrading existing UST systems? (245.422(a))

NOTE: *The above deadline applies to the techniques and procedures referred to in the next three questions*

UX, IU

20. What are three techniques that could be used to upgrade an existing underground storage tank? (245.422(b)(1,2,3))

UX, IU

21. What is the only technique available to upgrade existing underground piping? (245.422(c)(2))

UX, IU

22. What must be done to existing UST systems with regard to spill and overfill prevention? (245.422(d))

UX, IU

23. When must cathodic protection systems first be tested to see whether they are working properly? How often must they be tested after the first test? (245.432(a)(2)(i))

IU

24. What is the purpose for maintaining records of the operation of cathodic protection systems? (245.432(a)(4))

- UX, IU 25. Except for certain circumstances, what must be done to repaired tanks and piping prior to placing the underground storage tank system back into service? (245.434(4))
- IU 26. What must be done to cathodically protected UST systems within six months of completing a repair to the system? (245.434(5))
- IU 27. For how long must owners and operators of a repaired UST system keep a record of repairs done to the system in response to a release? (245.434(6))
- UX, IU 28. What portion of a tank system must have release detection? (245.441(a)(1))
- IU 29. How must release detection equipment be “installed, calibrated, operated and maintained?” (245.441(a)(2))
- IU 30. How often must tanks be monitored for releases when methods such as automatic tank gauges, ground water or soil vapor monitoring, or interstitial monitoring are used for release detection? (245.442)

- UX, UT, IU 31. What two different types of leak detection must be used on pressurized piping? (245.442(a), 245.442(b)(2)(i)(A,B))
- UT, IU 32. If line tightness testing is used for leak detection on suction piping, how often must the line tightness test be conducted? (245.442(b)(2)(ii))
- NOTE:** There are three basic options for leak detection on suction piping: 1) periodic tightness testing, 2) monthly monitoring, or 3) construction according to certain requirements (see next question). Monthly monitoring methods would include vapor monitoring, ground water monitoring, secondary containment and statistical inventory reconciliation (SIR).*
- UX, IU 33. No leak detection is required on suction piping systems when certain design requirements are met. Among these requirements are:
- How many check valves can be in each suction line? (245.442(b)(2)(ii)(c))
 - Where in the suction line must the check valve be located? (245.442(b)(2)(ii)(D))
- IU 34. What are some requirements that new underground hazardous substance UST systems must meet? (245.443)
- UX, IU, UR 35. What is the only form of release detection routinely allowed for new UST systems that are to contain non-petroleum liquids that are hazardous substances?? (245.443(1))
- UX, IU 36. An external liner or vault used to provide secondary containment for a tank containing a hazardous substance must contain what percentage of the volume of the largest tank that it contains? (245.443(3)(ii)(A))

- UX, IU 37. Piping for new hazardous substance storage systems must be equipped with what two forms of leak detection? (245.443(4))
- UT, IU 38. What size leak must a tank tightness test be able to detect? What five factors must a tightness test be able to take into account in order to meet the requirements of the regulations? (245.444(2))
- IU, UR 39. What size leak must an automatic tank gauge (ATG) be able to detect? (245.444(3)(i))
- UX, UR,
IU 40. When using soil vapor monitoring as a leak detection method, what must be done to ensure compliance with the regulatory requirements and establish the number and positioning of monitoring wells? (245.444(4)(vi))
- UX, IU 41. When monitoring for liquids on the water table as a leak detection method, what is the maximum depth of the water table from the ground surface? (245.444(5)(ii))
- UX, UR,
IU 42. When using ground water monitoring as a leak detection method, what must be done to ensure compliance with the regulatory requirements and establish the number and positioning of monitoring wells? (245.444(5)(vii))
- UX, IU 43. What must be done to monitoring wells to avoid unauthorized access and tampering? (245.444(5)(viii))

UX, UT,
IU 44. In what ways can an automatic line leak detector alert the operator of a facility to the presence of a leak? (245.445(1))

UX, UT,
IU 45. What size leak must an automatic line leak detector be able to detect? At what pressure must this leak be detected? Within what time period must this leak be detected? (245.445(1))

NOTE: *A properly operating "Red Jacket" line leak detector should be able to meet these requirements. Similar equipment is produced by other manufacturers, including Vaporless and FE Petro. Electronic devices that are usually tied in to automatic tank gauges can also meet this requirement. It may also be possible to meet this requirement by using secondary containment with continuous monitoring of the interstitial space.*

UX, IU 46. How often must an automatic line leak detector be tested to be sure it is operating properly? (245.445(1))

UX, IU 47. What is the exception to the pump shut-off requirement for storage tank systems installed after November 10, 2007? (245.445(1)(ii))

UX, IU,
UT 48. What size leak must a line tightness test be able to detect? At what pressure must this leak be detected? (245.445(2))

UX, IU,
UT 49. A line leak detector is not required on pressurized piping when using which type of piping release detection? (245.446(2))

- IU 50. For how long must an UST operator keep the results of any sampling testing or monitoring of release detection devices? (245.446(2))
- IU 51. How long must an UST operator keep written records of calibration, maintenance or repair of release detection equipment? (245.446(3))
- UR, IU 52. Within what time frame must releases be reported to the implementing agency? (245.305(a))
- NOTE:** In Pennsylvania the implementing agency is the Pennsylvania Department of Environmental Protection (DEP). Release reporting by certified individuals or companies is outlined in 245.132(a)(4)*
- UR, IU 53. What are three conditions that are considered to be evidence of a suspected release? (245.304(a)(1-7))
- UR, IU 54. What must an UST owner or operator continue to do if an UST system is temporarily closed and the tank is not empty? (245.451(b))
- UR, IU 55. Under what conditions is a temporarily closed UST system considered to be empty? (245.451(c))

- UR, IU 56. What must be done to an UST system that is temporarily closed for three months or more? (245.451(f))
- UX, IU,
UR 57. A tank must be permanently closed or must be granted a variance from DEP if it has not been protected from corrosion and has remained out-of-service for more than _____. (245.451(g))
- UX, UR 58. Under normal circumstances, how long before beginning a change-in-service or permanent closure of an underground tank must the DEP be notified? (245.452(a))
- UX, IU,
UR 59. To permanently close a tank, owners and operators must _____. (245.452(b))
- IU, UR 60. What must owners and operators measure for prior to the completion of permanent closure? (245.453(a))
- UR, IU 61. How long must the results of an excavation zone assessment be maintained? (245.455)
- UR, IU 62. Where should records of an excavation zone assessment be kept if they cannot be kept at the closed facility? (245.455(1, 2, 3))

National Fire Protection Association

NFPA 326: Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair

The following study guide questions are taken from National Fire Protection Association (NFPA) Code 326, “Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair,” 2015 Edition.

- | | | |
|----|----|---|
| UR | 1. | When working with the tank, what must be done to all energy sources supplying power to the pumps? (NFPA 326, Section 5.1.1) |
| UR | 2. | What type of pumps must be used to remove flammable liquids or vapors from a tank? (NFPA 326, Section 5.2.4) |
| UR | 3. | What type of saw must be used to cut a manway into a tank once it is safe for entry? (NFPA 326, Section 9.2.5) |

National Fire Protection Association

NFPA 329: Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases

The following study guide questions are taken from National Fire Protection Association (NFPA) Code 329, “Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases” (2015 edition).

- | | | |
|--------|----|--|
| IU | 1. | The areas around fill pipes where liquid is transferred should be checked for what? (NFPA 329, Section 6.2.7) |
| UT | 2. | What are three indications that a leaking check valve or a leaking pipe may be present in a suction piping system? (NFPA 329, Section 7.2.3.2) |
| IU, UT | 3. | A non-volumetric test is acceptable for leak detection, but what does it not quantify? (NFPA 329, Section 7.4.9) |
| IU, UT | 4. | Pressure testing of tanks that contained flammable or combustible liquids can be done with what type of gas? (NFPA 329, Section 7.4.11.2) |
| IU, UT | 5. | How is a leak indicated when a hydrostatic test of buried piping is conducted? (NFPA 329, Section 7.5.1.4) |
| IU, UT | 6. | A hydrostatic test for pressurized piping should be conducted at what percent of the maximum anticipated pressure on the system? (NFPA 329, Section 7.5.1.2) |
| UT | 7. | What are four conditions that can cause a loss of liquid pressure when conducting a hydrostatic test of piping? (NFPA 329, Section 7.5.1.5) |

- | | | |
|--------|-----|--|
| UT | 8. | What should be the test pressure when conducting a hydrostatic test of pressurized piping? (NFPA 329, Section 7.5.1.2) |
| IU, UT | 9. | What should be the test pressure when conducting a hydrostatic test of suction piping? (NFPA 329, Section 7.5.2.2) |
| UT | 10. | What are a few reasons that perforation of a tank shell might not be detected? (NFPA 329, Section A.7.1.3) |

American Petroleum Institute

API 1604: Closure of Underground Petroleum Storage Tanks

The following questions were taken from the American Petroleum Institute Recommended Practice 1604, “Closure of Underground Petroleum Storage Tanks” Third Edition, March 1996, Reaffirmed 2010).

- | | | |
|--------|----|--|
| UR, IU | 1. | What are the symptoms of inhaling high concentrations of petroleum hydrocarbon vapors? (API 1604, Section 1.3.1) |
| IU | 2. | What is the first step in treating the minor effects of exposure to petroleum hydrocarbon vapors? (API 1604, Section 1.3.1) |
| UR, IU | 3. | List six safe work practices closure personnel should follow to reduce health risks at a closure site. (API 1604, Section 1.3.1)

a)

b)

c)

d)

e)

f) |
| UR | 4. | What component of leaded gasoline can cause diseases of the nervous system, the kidney and the blood? (API 1604, Section 1.3.1.2) |

- UR 5. What is a major route of entry of tetraethyl lead into the body? (API 1604, Section 1.3.1.2)
- UR, IU 6. What are three types of precautions that must be taken to prevent the accidental ignition of explosive vapors at a tank removal site? (API 1604, Section 1.3.2.1)
- a)
- b)
- c)
- UR, IU 7. Under what circumstances is an UST considered to be temporarily out of service? (API 1604, Section 2.1)
- UR, IU 8. How long can a UST that meets regulatory standards for a new or upgraded system remain temporarily out of service? How long can a UST that does not meet regulatory standards stay out of service? What is required for an out of service UST that does not meet regulatory standards to obtain an extension of the out of service period? (API 1604, Section 2.1)
- UR, IU 9. What are six steps that should be taken to properly secure a tank that is to be temporarily out of service? (API 1604, Section 2.2)
- a)
- b)
- c)
- d)
- e)
- f)

UR, IU

10. How much product should be left in a tank in order to maintain a saturated vapor space when a tank is being placed temporarily out of service? (API 1604, Section 2.2)

NOTE: For gasoline, “saturated vapor space” is another way of saying that the concentration of flammable vapors is above the upper flammable limit, and so the vapors cannot burn or explode.

According to federal and Pennsylvania regulations, leak detection procedures must be maintained while a tank is out of service if more than one inch of product is left in the tank.

UR

11. What are four elements of a pre-closure evaluation that should be conducted prior to permanent closure or change-in-service? (API 1604, Section 3.3.1)

a)

b)

c)

d)

NOTE: In addition to the steps above, the Pennsylvania underground utility line protection act (Act 187 of 1996) requires notification by excavators, designers or any person preparing to disturb the earth's surface anywhere in Pennsylvania. Contractors must call the One Call System (1-800-242-1776) not less than three nor more than 10 working days in advance of beginning excavation or demolition work.

UR

12. During the closure operation, what should be done with the contents of the product piping? (API 1604, Section 4.2.2)

UX, UR,
IU

13. If pumps are used to remove liquids and residues from an underground tank, what precaution must be taken to prevent electrostatic ignition hazards? (API 1604, Section 4.2.3)

- UR, IU 14. If a vacuum truck is used for removal of liquids or residues from an underground tank:
(API 1604, Section 4.2.3)
- The area of operation of the vacuum truck must be _____ .
 - The truck should be located _____ from the tank.
 - Vacuum pump exhaust gases should be discharged through a hose of adequate size and length _____ of the truck and tank area.
- NOTE:*** *In May 1986, a tank worker in Portland, Maine was killed and several others were burned by an explosion and fire resulting from the accidental ignition of vacuum pump exhaust from a vacuum truck.*
- UR, IU 15. When closing tanks, after all the liquid product has been removed, what is the next step?
(API 1604, Section 4.2.4)
- UR, IU 16. After removing product and exposing the top of the tank, what is the next step in closing a tank? (API 1604, Section 4.2.5)
- UR, IU 17. Once the top of the tank has been excavated and tank fixtures removed, all tank openings should be plugged except one. Which pipeline should remain connected to the tank? (API 1604, Section 4.2.5)
- UR, IU 18. What is the definition of purging? (API 1604, Section 4.3.1)
- UR, IU 19. What is the definition of inerting? (API 1604, Section 4.3.1)

- UR, IU 20. During purging and inerting flammable vapors are displaced from the tank. At what height above grade should flammable vapors be vented? At what height above adjacent roof lines? (API 1604, Section 4.3.2)
- UR, IU 21. Under what circumstance should inerting NOT be used? (API 1604, Section 4.3.3)
- UR, IU 22. Why should inert gases should be introduced into tanks at low pressure? (API 1604, Section 4.3.3)
- UR, IU 23. What is the maximum pressure allowed in the tank when using carbon dioxide or nitrogen to inert the tank? (API 1604, Section 4.3.3)
- UR, IU 24. Why must the device that discharges an inert gas into an underground tank be grounded? (API 1604, Section 4.3.3)
- UR 25. Why should carbon dioxide fire extinguishers not be used to inert underground tanks? (API 1604, Section 4.3.3)

- UR, IU 26. What is the minimum amount of solid carbon dioxide (dry ice) that should be used to inert a tank? (API 1604, Section 4.3.4)
- UR, IU 27. When inerting a tank with dry ice, what should be done to promote rapid evaporation of the dry ice? (API 1604, Section 4.3.4)
- UR, IU 28. What are three general techniques for freeing a tank of flammable vapors? (API 1604, Section 4.3.5, 4.3.6 and 4.3.7)
- UR, IU 29. Which method of tank purging requires that a drop tube be in place during the procedure? What does the drop tube ensure? (API 1604, Section 4.3.5)
- NOTE:** There appears to be a typographical error in the document. The sentence “When using this method, the fill (drop) tubes that are not removable should be purged” should be “When using this method, the fill (drop) tube should remain in place to ensure ventilation at the bottom of the tank. Tanks equipped with fill (drop) tubes that are not removable should be purged by this method.”*
- UR 30. When using an eductor type air mover to purge a tank, what will be the direction of air flow through the tank's vent line? (API 1604, Figure 1, page 6)

- UR 31. When purging a tank using a diffused air blower, what must be done to prevent the discharge of a spark? (API 1604, Section 4.3.5)
- UR 32. What is the maximum allowable pressure in an underground tank when using a diffused air blower? (API 1604, Section 4.3.5)
- UR, IU 33. Until what point in the tank removal process should combustible vapor concentrations be measured in the tank and the excavation area? (API 1604, Section 4.4.1)
- UR, IU 34. At what level in a tank should combustible vapor concentrations be measured? (API 1604, Section 4.4.2)
- UR, IU 35. What lower explosive limit (LEL) readings must be obtained before a tank is considered safe for removal from the ground? (API 1604, Section 4.4.2)

- UR, IU 36. Under what circumstances should closure in place be considered? (API 1604, Section 4.5.1)
- a)
- b)
- c)
- UR, IU 37. What type of material should be used to fill a tank that is being closed in place? (API 1604, Section 4.5.4)
- UR, IU 38. After a tank that is being closed in place is filled with inert material, what is the next step? (API 1604, Section 4.5.5)
- UR, IU 39. When closing a tank in place, what is the last tank connection to be disconnected? (API 1604, Section 4.5.6)
- UR, IU 40. What should be done after a tank has been freed of vapors and before it is removed from the excavation? (API 1604, Section 4.6.1)
- UR, IU 41. After a tank has been freed of vapors, it should be sealed except for a 1/8 inch vent hole. Where should this vent hole be located during subsequent storage and transport? (API 1604, Section 4.6.1)

- UR 42. What should be used to prevent movement of a tank after it has been removed from the ground and prior to moving it off site? (API 1604, Section 4.6.2)
- UR, IU 43. What should be used to plug any corrosion holes in a tank that has been removed from the ground? (API 1604, Section 4.6.2)
- UR, IU 44. At what point during the removal process should a tank label listing precautions regarding used petroleum storage tanks be affixed to the tank? What is the minimum recommended size of letters on this label? (API 1604, Section 4.6.4)
- UR, IU 45. What four items of information should be included in the tank label? (API 1604, Section 4.6.4)
- UR 46. “Lead vapors may be released if heat is applied to the tank shell.” These words should be part of the label applied to what tanks? (API 1604, Section 4.6.5)

- UR, IU 47. For safety sake, what measurement should be made before a tank is removed from a site? (API 1604, Section 4.6.6.1)
- UR, IU 48. What size vent hole is required for tanks that are in storage? What should be done to all other tank openings? (API 1604, Section 5.2.1)
- UR, IU 49. Where should used tanks be stored? (API 1604, Section 5.2.2)
- UR, IU 50. Before being sold for scrap or otherwise disposed of, what should be done to an underground tank? (API 1604, Section 7.1.1)
- UX, UR,
IU 51. Prior to re-use, tanks must be recertified by _____. (API 1604, Section 7.1.2)

American Petroleum Institute

API 2015: Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks

The following questions were taken from the American Petroleum Institute's Publication 2015, "Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks" (Eighth Edition, January, 2018).

Please note: Although these standards were developed for aboveground storage tank systems, many of the health and safety concepts also apply to the removal and cleaning of underground storage tank systems.

- | | | |
|----|----|--|
| UR | 1. | What is a confined space entry permit? (API 2015, Section 3.37.1) |
| | | |
| UR | 2. | What are the hazards a person may encounter during tank entry and cleaning? (API 2015, Sections 7.1 and A.1) |
| | | |
| UR | 3. | What three types of atmospheric tests (measurements) must be conducted before a tank is entered? In what order should these tests be performed? (API 2015, Section 6.3) |
| | | |
| UR | 4. | Storage of leaded gasoline creates a potential toxic hazard. Is there a test method that can determine whether a tank was used to store leaded gasoline prior to cleaning and drying the tank? How should entry supervisors classify tanks that may have been used for storage of leaded gasoline? (API 2015, Section 7.4.3) |

- UR 5. What is an example of a petroleum compound that has the potential to cause cancer? (API 2015, Section 7.4.5)
- UR 6. When vapor freeing (purging) a tank, where should measurements (tests) of vapor levels be conducted? (API 2015, Section 6.3.4 and 6.3.5)
- UR 7. How long should the ventilation system be shut down before testing the interior of a tank? (API 2015, Section 6.3.5)
- UR 8. The tank must be emptied of all recoverable product through _____. (API 2015, Section 5.2.2)

- UR 9. What are three factors that may result in a fire or explosion when there is a source of ignition inside or near a tank? (API 2015, Section 7.3.3)
- UR 10. What is the definition of “hot work”? (API 2015, Section 11)
- UR 11. In a tank where hot work is being done, what should the flammable vapor-in-air atmosphere not be in excess of? (API 2015, Section 11.2.3.1)
- UR 12. What are the three elements necessary for fire or explosion to occur? (API 2015, Section A.1.3.2)
- a)
- b)
- c)
- UR 13. Why is the elimination of ignition sources difficult? (API 2015, Section A.1.3.2.3)
- UR 14. What is a highly toxic, colorless, flammable gas that has a rotten egg smell and is dangerous in low concentrations?

- UR 15. What is the reading on an oxygen analyzer that indicates the oxygen content is below the breathing range and respiratory equipment must be worn? (API 2015, Section A.1.2.4)
- UR 16. Death or brain damage can occur within minutes breathing in an oxygen deficient atmosphere. Do workers in an oxygen deficient atmosphere without respiratory equipment usually notice that they are not getting enough oxygen? (API 2015, Section A.1.2.4)
- UR 17. What are four ways that toxic substances can enter the body? (API 2015, Section A.1.6.2)
- a)
- b)
- c)
- d)
- UR 18. What is the definition of an irritant? (API 2015, Section A.1.6.2.1)
- UR 19. After the tank has been emptied of gasoline, what is the primary source of organic lead hazard in tanks? (API 2015, Section A.1.8)
- UR 20. By what routes can toxic lead alkyls enter the body? (API 2015, Section A.1.8.3)

- UR 21. What personal protective equipment is required for entry into tanks that contained organic lead? (API 2015, Section A.1.8.3)
- UR 22. What two ways are vapors freed from a tank? (API 2015, Section B.1.1)

New England Interstate Water Pollution Control Commission

Tank Closure Without Tears

The following questions are taken from the New England Interstate Water Pollution Control Commission publication, "Tank Closure Without Tears: An Inspector's Safety Guide" (May 1988, Reprinted May 1991).

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|----|----|--|
| UR | 1. | What are the three points of the basic fire triangle? (NEIWPCC, p. 2) |
| | | a) |
| | | b) |
| | | c) |
| UR | 2. | How many points of the fire triangle are necessary to support combustion? (NEIWPCC, p. 2) |
| UR | 3. | Movement of which of the following causes static electricity: liquids, air or solids? (NEIWPCC, p. 3) |
| UR | 4. | What must be eliminated prior to the use of heavy equipment for handling the tank? (NEIWPCC, p.3) |
| UR | 5. | If static-producing movement can not be eliminated, how can the contractor provide a "safe" discharge of static electricity? (NEIWPCC, p. 3) |
| UR | 6. | How can electrostatic ignition hazards be reduced when removing product or residue from the tank? (NEIWPCC, p. 3-4) |

- UR 7. Why should plastic (PVC) pick-up tubes be avoided on the stripping lines of vacuum trucks? (NEIWPCC, p. 4)
- UR 8. Where should the vacuum truck be in relation to the tank when removing liquid or residues from a tank? Where should exhaust hoses be situated relative to the tank? (NEIWPCC, p. 5)
- UR 9. How does purging work? Which point of the fire triangle is dealt with in purging the potentially explosive atmosphere in a tank? (NEIWPCC, p. 5)
- UR 10. What is the flammable range of vapor given off by most petroleum products? (NEIWPCC pp. 5-6)
- UR 11. Below the lower explosive level (LEL) the mixture of fuel and vapor in a tank is too lean to support combustion. What is the LEL for petroleum products? (NEIWPCC, p. 6)
- NOTE:** It is very important to individuals health and safety that they understand the relationship between flammable range of vapor and lower explosive level. Refer to the charts and text on page 8 for more information.*
- UR 12. What is the goal of purging? (NEIWPCC, p. 6)
- UR 13. How does inerting work? Which point of the fire triangle is dealt with in “inerting” the atmosphere of a tank? (NEIWPCC, p. 6)

- UR 14. What is the goal of inerting a tank? (NEIWPCC, p. 6)
- UR 15. Why is it especially important to control sources of ignition when purging an underground tank with air? (NEIWPCC, p. 6)
- UR 16. Which method of purging with air pumps fresh air into the tank and which one draws vapors out of the tank? (NEIWPCC, pp. 6-7)
- UR 17. When purging a tank, one should NOT use _____.
(NEIWPCC, p. 7)
- UR 18. Once a tank has been purged, is there any need to continue monitoring it for flammable vapors? (NEIWPCC, p. 7)
- UR 19. When testing with a Combustible Gas Indicator (CGI), a reading of 100 percent LEL would indicate that what percent of gasoline vapors were present? (NEIWPCC, p. 8)
- UR 20. What substances can foul or “poison” a CGI probe? (NEIWPCC, pp. 8-9)

- UR 21. When inerting, how can carbon dioxide be generated? (NEIWPCC, p. 9)
- UR 22. When inerting a tank with dry ice, how many pounds of dry ice should be used for every 1,000 gallons of tank capacity? (NEIWPCC, p. 9)
- UR 23. What are two ways to reduce the concentration of oxygen in a tank to a level that is insufficient to support combustion? (NEIWPCC, p. 9)
- UR 24. What readings on an oxygen meter indicate a non-combustible atmosphere in tanks that have contained most petroleum products? What readings should you target for a more conservative safety rule of thumb? (NEIWPCC, p. 11)
- UR 25. What percent oxygen by volume indicates a safe range for breathing? (NEIWPCC, p. 11)
- UR 26. Should a single point of the fire triangle be the focus of efforts to avoid fire and explosion during tank closure? (NEIWPCC, p. 12)
- UR 27. Can a combustible gas indicator be used to monitor a tank which is being inerted? Why or why not? (NEIWPCC, p. 13)
- UR 28. What is the definition of “flashpoint”? (NEIWPCC, p. 13)

- UR 29. Why is it necessary to check the atmosphere in the tank before cleaning it when the tank has already been purged or inerted? (NEIWPCC, p. 14)
- UR 30. Why should tanks be cleaned regardless of whether they are to be removed or closed in place? (NEIWPCC, p. 14)
- UR 31. What are the primary safety factors to consider when deciding whether to clean a tank on-site or off-site? (NEIWPCC, p. 14)
- UR 32. When closing an UST in-place, what is used to fill the tank? (NEIWPCC, p. 15)
- UR 33. Where is the most dangerous position in relation to a tank if it should explode? (NEIWPCC, p. 16)
- UR 34. What is the procedure for sealing corrosion holes in a tank prior to transport? (NEIWPCC, p. 16)
- UR 35. When transporting an UST removed from a site, how large should the vent hole be on the top of the tank? (NEIWPCC, p. 16)
- UR 36. What are the elements of a safe removal checklist? (NEIWPCC, p. 17)

Petroleum Equipment Institute

PEI RP-1200: Recommended Practices for the Testing and Verification of Spill, Overfill, Leak Detection and Secondary Containment Equipment at UST Facilities

The following study guide questions are taken from the Petroleum Equipment Institute's "Recommended Practices for the Testing and Verification of Spill, Overfill, Leak Detection and Secondary Containment Equipment at UST Facilities" (PEI RP-1200-2012).

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| UX, IU,
UT | 1. | What can visually indicate a test failure during integrity testing of a spill bucket? (PEI, Section 6.3.4) |
| UX, IU,
UT | 2. | How high should the test fluid level be when doing a hydrostatic test of a containment sump? (PEI, Section 6.5.6 and Figure 6-7) |
| UX | 3. | Flow restriction and overfill alarms are required to engage when the tank gets _____ full. (PEI, Section 7) |
| UX | 4. | When does an automatic shutoff device pass an inspection? (PEI, Section 7.1.7) |
| UX, IU,
UT | 5. | How does an ATG probe pass a functionality test? (PEI, Section 8.2.1.7) |



For more information, visit www.dep.pa.gov, Search: Storage Tanks.