Registration Form

Arsenic CEU Training Course $150.00

48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL $50.00

Start and Finish Dates: _____

You will have 90 days from this date in order to complete this course

List number of hours worked on assignment must match State Requirement. _____

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I have read and understood the disclaimer notice on page 2. Digitally sign XXX

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Class/Grade_____

Please circle/check which certification you are applying the course CEU's.
Pretreatment ___ Collection___ Wastewater Treatment ___

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Professional Engineers; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

You can obtain a printed version of the course manual from TLC for an additional $69.95 plus shipping charges.

AFFIDAVIT OF EXAM COMPLETION

I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

Grading Information

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity.

Do not solely depend on TLC's Approval list for it may be outdated.

A second certificate of completion for a second State Agency $50 processing fee.

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Some States and many employers require the final exam to be proctored.

We will stop mailing the certificate of completion so we need either your fax number or e-mail address. We will e-mail the certificate to you, if no e-mail address; we will fax it to you.

Arsenic Answer Key

Name_____

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You are solely responsible in ensuring that this course is accepted for credit by your State. <u>No refunds</u>. Did you check with your State agency to ensure this course is accepted for credit?

Method of Course acceptance confirmation. Please fill this section

Website __ Telephone Call___ Email____ Spoke to_____

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You can use Adobe Acrobat DC Program to complete the assignment.

Please circle, underline, bold or X only one correct answer

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This course contains general EPA's SDWA and CWA federal rule requirements. Please be aware that each state implements wastewater/safety/environmental /building regulations that may be more stringent than EPA's regulations. Check with your state environmental/health agency for more information. These rules change frequently and are often difficult to interpret and follow. Be careful to not be in non-compliance and do not follow this course for proper compliance.

Please e-mail or fax this survey along with your final exam

ARSENIC CEU TRAINING COURSE

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Arsenic CEU Training Course Assignment

The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit www.ABCTLC.com and download the assignment and e- mail it back to TLC.

You will have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. We prefer if this exam is proctored. No intentional trick questions. If you should need any assistance, please email all concerns and the completed manual to info@tlch2o.com.

We would prefer that you utilize the enclosed answer sheet in the front, but if you are unable to do so, type out your own answer key. Please include your name and address on your answer sheet and make copy for yourself. You can e-mail or fax your Answer Key along with the Registration Form to TLC. **(S) Means answer may be plural or singular**

Arsenic Introduction
Metalloid

1. Arsenic is _____ with symbol As and the atomic number is 33.

A. A metalloid
B. The trioxide
C. A chemical element
D. An inorganic
E. Mixed with hydrogen
F. None of the Above

2. Arsenic occurs in many minerals, usually in conjunction with which missing term, and also as a pure elemental crystal?

A. Alloys of copper
B. Naturally occurring elements
C. Inorganics
D. Pure elemental crystals
E. Sulfur and metals
F. None of the Above

3. Arsenic is a metalloid. It can exist in which missing term, although only the gray form has important use in industry?

A. Various allotropes
B. The trioxide
C. Contamination
D. Inorganic forms
E. Aluminum arsenide
F. None of the Above

4. In 1974, Congress passed the Safe Drinking Water Act. This law requires EPA to determine the level of which missing term in drinking water at which no adverse health effects are likely to occur?

A. Zero
B. MCLs
C. MCLG
D. Safe Drinking Water Act
E. Contaminants
F. None of the Above

5. Which of the following terms is based solely on possible health risks and exposure over a lifetime with an adequate margin of safety, are called maximum contaminant level goals?

A. Zero
B. MCLs
C. MCLG
D. These non-enforceable health goals
E. 0.010 mg/L or 10 ppb
F. None of the Above

6. Which of the following terms are any physical, chemical, biological or radiological substances or matter in water?

A. Contaminants
B. MCLs
C. MCLG
D. Safe Drinking Water Act
E. 0.010 mg/L or 10 ppb
F. None of the Above

7. Which of the following terms is zero for arsenic?

A. Standard
B. MCLs
C. MCLG
D. Safe Drinking Water Act limit
E. 0.010 mg/L or 10 ppb
F. None of the Above

8. Based on the MCLG, EPA has set an enforceable regulation for arsenic, called a maximum contaminant level, at?

A. Zero
B. MCLs
C. 0.050 mg/L or 1.0 ppb
D. 00.10 mg/L or 1 ppb
E. 0.010 mg/L or 10 ppb
F. None of the Above

9. Which of the following terms are set as close to the health goals as possible, considering cost, benefits and the ability of public water systems to detect and remove contaminants?

A. Action levels
B. MCLs
C. MCLG
D. Safe Drinking Water Act limits
E. ppb
F. None of the Above

10. Which missing term is for strengthening alloys of copper and especially lead?

A. Alloys of copper
B. A naturally occurring element
C. Inorganic arsenic
D. A pure elemental crystal
E. Metallic arsenic
F. None of the Above

11. Arsenic is a common n-type dopant in semiconductor electronic devices, and the optoelectronic compound of which missing term is the most common semiconductor in use after doped silicon?

A. Gallium arsenide
B. Arsenates
C. Arsenic alloys
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

12. Arsenic and its compounds, especially of which missing term are used in the production of pesticides, herbicides, and insecticides?

A. Alloys of copper
B. Naturally occurring element
C. Inorganic arsenic
D. Pure elemental crystal
E. Trioxide
F. None of the Above

13. Which of the following terms of groundwater is a problem that affects millions of people across the world?

A. Metalloid contamination
B. The trioxide contamination
C. Arsenic contamination
D. Inorganic arsenic contamination
E. Hydrogen contamination
F. None of the Above

14. Arsenic, a naturally occurring element, is found throughout the environment; for most people, food is?

A. Alloys of copper
B. A naturally occurring element
C. Inorganic arsenic
D. A pure elemental crystal
E. The major source of exposure
F. None of the Above

15. Acute high-level inhalation exposure to arsenic dust or fumes has resulted in gastrointestinal effects; have occurred in workers acutely exposed to?

A. The Metalloid
B. The trioxide
C. The Arsenic contamination
D. Inorganic arsenic
E. Arsenic and hydrogen
F. None of the Above

16. Chronic inhalation exposure to which missing term in humans is associated with irritation of the skin and mucous membranes?

A. Alloys of copper
B. A naturally occurring element
C. Inorganic arsenic
D. The trioxide
E. Herbicides, and insecticides
F. None of the Above

17. Chronic oral exposure has resulted in which missing term, anemia, peripheral neuropathy, skin lesions, hyperpigmentation, and liver or kidney damage in humans?

A. Body weight basis
B. Risk factor for type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks for the fetus
E. Cancer risk is long-term exposure
F. None of the Above

18. EPA has classified inorganic arsenic as a?

A. Group A, human carcinogen
B. Risk factor for type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks for the fetus
E. Cancer risk is long-term exposure
F. None of the Above

19. EPA has not classified arsine for?

A. Body weight basis
B. Risk factor for type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks for the fetus
E. Cancer risk is long-term exposure
F. None of the Above

20. Which of the following terms require public water systems to monitor for arsenic at the entry point to the distribution system?

A. Drinking water regulations
B. MCLs
C. MCLG
D. Safe Drinking Water Act
E. 0.010 mg/L or 10 ppb
F. None of the Above

21. You may, however, want to test your distribution system water for arsenic to be sure that the water being delivered has arsenic levels below the?

A. Drinking water regulations
B. MCL
C. MCLG
D. Safe Drinking Water Act
E. Local limits
F. None of the Above

22. If your water system has installed some form of arsenic treatment, keep in mind that the treatment you installed may change the _____in other ways.

A. Problem
B. Water quality
C. Distribution system
D. Arsenic treatment technology
E. Arsenic and hydrogen
F. None of the Above

23. A change in the taste, odor or appearance of the water at _____may be the first indication of a problem.

A. The problem
B. Pipe scales
C. The distribution system
D. Arsenic treatment technology
E. Customers' taps
F. None of the Above

24. Which of the following terms to consider when monitoring, depending on your arsenic treatment technology, include iron, pH, manganese, alkalinity, and aluminum?

A. Synthetic arsenates in water is something
B. Arsenic acid in water is something
C. Readily soluble in water is something
D. Alloy-like intermetallic compounds
E. Some water quality parameters
F. None of the Above

25. The current drinking water standard or Maximum Contaminant Level set by the U.S. Environmental Protection Agency is 0.010 mg/L or parts per million, this is equivalent to?

A. 50 ppb to 10 ppb
B. MCLs
C. MCLG
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 0.010 mg/L or 100 ppb
F. None of the Above

26. In 2001, the U.S. Environmental Protection Agency (EPA) reduced the regulatory MCL from which term on the basis on bladder and lung cancer risks?

A. 50 ppb to 10 ppb
B. MCLs
C. MCLG
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 0.010 mg/L or 100 ppb
F. None of the Above

27. Long term exposure to drinking water containing arsenic at levels higher than this term increases the chances of getting cancer, while for lower arsenic water levels the chances are less.

A. 50 ppb to 10 ppb
B. 10 ppb
C. MCLG
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 00.10 mg/L or 100 ppb
F. None of the Above

28. If your water has arsenic levels above which term, you should obtain drinking water from another source or install a home treatment device?

A. 50 ppb to 10 ppb
B. 10 ppb
C. MCLG
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 00.10 mg/L or 100 ppb
F. None of the Above

29. Concentrations above this term will increase the risk of long-term or chronic health problems, the higher the level and length of exposure.

A. 50 ppb to 10 ppb
B. 10 ppb
C. MCLG
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 00.10 mg/L or 100 ppb
F. None of the Above

30. Children are at greater risk to any agent in water because of their greater water consumption on a per unit?

A. Body weight basis
B. Risk factor for type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks for the fetus
E. Cancer risk is long-term exposure
F. None of the Above

31. Pregnant women may wish to reduce which term because arsenic has been found at low levels in mother's milk and will cross the placenta, increasing exposures and risks for the fetus?

A. Arsenic exposures
B. Risk factor
C. Prevalence
D. Exposures and risks for the fetus
E. Long-term exposure
F. None of the Above

32. If your water has arsenic levels above this term, you should immediately stop drinking the water until you can either obtain water from another source or install and maintain treatment.

A. 50 ppb to 10 ppb
B. 10 ppb
C. 200 ppb
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 00.10 mg/L or 100 ppb
F. None of the Above

Physical Characteristics

33. The three most common arsenic allotropes are metallic gray, yellow and this term, with gray being the most common.

A. Black arsenic
B. Arsenates
C. Arsenic alloys
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

34. Which of the following terms is brittle and has a relatively low Mohs hardness of 3.5?

A. Arsenic
B. Arsenates
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

35. Nearest and next-nearest neighbors form _____, with the three atoms in the same double-layer being slightly closer than the three atoms in the next.

A. Synthetic arsenates
B. Arsenic acid
C. Readily soluble in water
D. Alloy-like intermetallic compounds
E. A distorted octahedral complex
F. None of the Above

36. Solid yellow arsenic is produced by rapid cooling of arsenic vapor, As_4. It is rapidly transformed into this term by light.

A. Arsenic
B. Arsenates
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

37. Which of the following terms is similar in structure to red phosphorus?

A. Synthetic arsenates
B. Arsenic acid
C. Black arsenic
D. Alloy-like intermetallic compounds
E. Arsenic oxidizes to arsenic trioxide
F. None of the Above

Isotopes

38. Naturally occurring _____ is composed of one stable isotope.

A. Arsenic
B. Arsenate
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

Chemistry

39. When heated in air, arsenic oxidizes to arsenic trioxide; the fumes from this reaction have an odor resembling garlic odor and can be detected on striking arsenide minerals such as with _____ with a hammer.

A. Synthetic arsenates
B. Arsenic acid
C. Arsenopyrite
D. Alloy-like intermetallic compounds
E. Arsenic oxidizes to arsenic trioxide
F. None of the Above

40. Arsenic along with some arsenic compounds sublimes upon heating at atmospheric pressure, converting directly to a gaseous form without an intervening liquid state at 614 °C.

A. True B. False

41. Arsenic makes arsenic acid with concentrated nitric acid, arsenious acid with dilute nitric acid, and which missing term with concentrated sulfuric acid?

A. Synthetic arsenates
B. Arsenic acid
C. Arsenic trioxide
D. Alloy-like intermetallic compounds
E. Arsenic oxidizes to arsenic trioxide
F. None of the Above

Compounds

42. Arsenic compounds resemble in some respects those of which missing term, which occupies the same group (column) of the periodic table?

A. Phosphorus
B. Arsenates
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

43. The most common oxidation states for arsenic are: −3 in the arsenides, such as alloy-like intermetallic compounds; and +3 in the arsenites, arsenates (III), and?

A. Synthetic arsenates
B. Arsenic acid
C. Readily soluble in water
D. Alloy-like intermetallic compounds
E. Most organoarsenic compounds
F. None of the Above

44. Which of the following terms also bonds readily to itself as seen in the square As3−4 ions in the mineral skutterudite?

A. Arsenic
B. Arsenate
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

Inorganic

45. Arsenic forms colorless, odorless, crystalline oxides As_2O_3 ("_____") and As_2O_5, which are hygroscopic and readily soluble in water to form acidic solutions.

A. Synthetic arsenates
B. Arsenic acid
C. White arsenic
D. Alloy-like intermetallic compounds
E. Arsenic oxidizes to arsenic trioxide
F. None of the Above

46. Arsenic (V) acid is a weak acid, its salts are called?

A. White arsenic
B. Arsenates
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

47. Synthetic arsenates include which term, calcium arsenate, and lead hydrogen arsenate?
A. Paris Green
B. Arsenic acid
C. Phosphorus acid
D. Alloy-like intermetallic compounds
E. Arsenic oxidizes to arsenic trioxide
F. None of the Above

48. The protonation steps between the arsenate and arsenic acid are similar to those between?
A. Phosphate and phosphoric acid
B. Arsenates
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

49. Unlike phosphorus acid, this term is genuinely tribasic, with the formula $As(OH)_3$.
A. Arsenous acid
B. Arsenates
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

50. A broad variety of which term of arsenic are known?
A. Synthetic arsenates
B. Arsenic acid
C. Readily soluble in water
D. Alloy-like intermetallic compounds
E. Sulfur compounds
F. None of the Above

51. In which of the following terms, arsenic has a formal oxidation state of +2 in As_4S_4, which features As-As bonds so that the total covalency of As is still three?
A. As_4S_{10}
B. Arsenate
C. Solid yellow arsenic
D. Phosphorus acid
E. As_2S_{12}
F. None of the Above

Alloys

52. Arsenic is used as the group 5 element in the III-V semiconductors_____, indium arsenide, and aluminum arsenide.
A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Gallium arsenide
E. Aluminum arsenide
F. None of the Above

53. Other arsenic alloys include the II-IV semiconductor?
A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Cadmium arsenide
E. Aluminum arsenide
F. None of the Above

Health Hazard Information

54. While arsenic levels may fluctuate over time, what is most significant from the standpoint of this term is long-term exposure?
A. Pregnancy
B. Risk factor for type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks for the fetus
E. Cancer risk
F. None of the Above

55. For water systems in the 25 states that reported arsenic data to the EPA, we have calculated two estimates of average long-term levels: one is a very conservative estimate, the other our best estimate, based on what we believe to be the?
A. US drinking water standard
B. Most reasonable analytical techniques
C. MCL
D. Range of arsenic levels
E. Inorganic arsenic
F. None of the Above

Arsenic Diabetes

56. New research findings from the National Health and Nutrition Examination Survey suggest that exposure to levels of arsenic commonly found in drinking water may be a risk factor for?

A. Body weight
B. Type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks for the fetus
E. Cancer
F. None of the Above

57. The findings suggest that millions of Americans may be at increased which term based on the level of arsenic in their drinking water?

A. Body weight
B. Risk factor for type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks
E. Cancer risk is long-term exposure
F. None of the Above

58. Data on the nearly 800 participants in the study for which urinary arsenic concentrations were available, indicated that urine levels of arsenic were significantly associated with the?

A. Body weight basis
B. Risk factor for type 2 diabetes
C. Prevalence of type 2 diabetes
D. Exposures and risks for the fetus
E. Cancer risk is long-term exposure
F. None of the Above

59. Which of the following terms in drinking water at concentrations higher than 100 parts per million has been linked to type 2 diabetes in studies that took place in Taiwan, Mexico, and Bangladesh?

A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

60. The US drinking water standard is currently?

A. 50 ppb to 10 ppb
B. 10 ppb
C. 10 parts per million
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 00.10 mg/L or 100 ppb
F. None of the Above

61. The researchers estimate that about 13 million Americans live in areas where public water systems exceed the?

A. EPA standard
B. MCLs
C. MCLG
D. Safe Drinking Water Act
E. 0.010 mg/L or 10 ppb
F. None of the Above

62. The current findings reinforce the need to evaluate the role of arsenic in diabetes development in prospective epidemiologic studies conducted in populations exposed to a wide range of levels of?

A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

Acute Effects:
Inorganic Arsenic

63. Which of the following terms of workers to high levels of arsenic dusts or fumes has resulted in gastrointestinal effects?

A. Acute exposure
B. Acute animal tests
C. Acute inhalation exposure
D. Acute oral exposure
E. Acute arsine exposure
F. None of the Above

64. Which of the following terms to inorganic arsenic, at doses of approximately 600 micrograms per kilogram body weight per day or higher in humans, has resulted in death?

A. Acute exposure
B. Acute animal tests
C. Acute inhalation exposure
D. Acute oral exposure
E. Acute arsine exposure
F. None of the Above

65. Which of the following terms to lower levels of inorganic arsenic has resulted in effects on the gastrointestinal tract, central nervous system, cardiovascular system, liver, kidney, and blood.

A. Acute exposure
B. Oral exposure
C. Acute inhalation exposure
D. Acute oral exposure
E. Acute arsine exposure
F. None of the Above

66. Acute animal tests in rats and mice have shown inorganic arsenic to have?

A. Acute exposure
B. Acute animal tests
C. Acute inhalation exposure
D. Moderate to high acute toxicity
E. Acute arsine exposure
F. None of the Above

Arsine

67. Which of the following terms to arsine by humans has resulted in death; it has been reported that a half-hour exposure to 25 to 50 parts per million can be lethal?

A. Acute exposure
B. Acute animal tests
C. Acute inhalation exposure
D. Acute oral exposure
E. Acute arsine exposure
F. None of the Above

68. The major effects from this term in humans include headaches, vomiting, abdominal pains, hemolytic anemia, hemoglobinuria, and jaundice; these effects can lead to kidney failure.

A. Acute exposure
B. Acute animal tests
C. Acute inhalation exposure
D. Acute oral exposure
E. Acute arsine exposure
F. None of the Above

69. Arsine has been shown to have extreme acute toxicity from?

A. Acute exposure
B. Acute animal tests
C. Acute inhalation exposure
D. Acute animal tests
E. Acute arsine exposure
F. None of the Above

Chronic Effects (Non-cancer):

Inorganic arsenic

70. Which of the following terms to inorganic arsenic in humans is associated with irritation of the skin and mucous membranes?

A. Chronic oral exposure
B. Human studies
C. Oral animal studies
D. Ingested inorganic arsenic
E. Chronic inhalation exposure
F. None of the Above

71. Which of the following terms to inorganic arsenic in humans has resulted in gastrointestinal effects, anemia, peripheral neuropathy, skin lesions, hyperpigmentation, gangrene of the extremities, vascular lesions, and liver or kidney damage?

A. Chronic oral exposure
B. Human studies
C. Oral animal studies
D. Ingested inorganic arsenic
E. Chronic inhalation exposure
F. None of the Above

72. No _____ studies have been performed in animals for any inorganic arsenic compound.

A. Chronic oral exposure
B. Human studies
C. Oral animal studies
D. Ingested inorganic arsenic
E. Chronic inhalation exposure
F. None of the Above

73. Some studies have suggested that _____ is an essential dietary nutrient in goats, chicks, and rats.

A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

Reproductive/Developmental Effects:

Inorganic arsenic

74. Several studies have suggested that women who work in, or live near, metal smelters may have higher than normal spontaneous abortion rates, and their children may exhibit lower than normal birth weights, these studies are limited because they were designed to evaluate the effects of smelter pollutants in general, and are not specific for?

A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

75. Ingested _____ can cross the placenta in humans, exposing the fetus to the chemical.

A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

76. Oral animal studies have reported _____ at very high doses to be fetotoxic and to cause birth defects.

A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

Arsine

77. Human studies have indicated higher than expected spontaneous abortion rates in women in the microelectronics industry who were exposed to arsine. However, these studies have several limitations, including small sample size and exposure to which missing term in addition to arsine?

A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

Cancer Risk: Inorganic arsenic

78. Which of the following terms studies have reported inorganic arsenic exposure to be strongly associated with lung cancer?

A. Chronic oral exposure
B. Human
C. Oral animal
D. Human, inhalation
E. Chronic inhalation exposure
F. None of the Above

79. Which of the following terms in humans has been associated with an increased risk of nonmelanoma skin cancer and to an increased risk of bladder, liver, and lung cancer?
A. Chronic oral exposure
B. Acute exposure
C. Oral animal studies
D. Ingested inorganic arsenic
E. Chronic inhalation exposure
F. None of the Above

80. Which of the following terms have not associated inorganic arsenic exposure via the oral route with cancer, and no cancer inhalation studies have been performed in animals for inorganic arsenic?
A. Acute exposure studies
B. Acute animal tests
C. Acute inhalation exposure
D. Acute oral exposure studies
E. Animal studies
F. None of the Above

81. EPA has classified _____ as a Group A, human carcinogen.
A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Inorganic arsenic
E. Aluminum arsenide
F. None of the Above

Arsenic Applications
Agricultural
82. The toxicity of arsenic to insects, bacteria and fungi led to its use as a wood preservative. In the 1950s, a process of treating wood with _____ was invented, and for decades this treatment was the most extensive industrial use of arsenic.
A. Chromated copper arsenate
B. Arsenates
C. Arsenic alloys
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

83. Which of the following terms was a common insecticide on fruit trees, but contact with the compound sometimes resulted in brain damage among those working the sprayers?
A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Lead hydrogen arsenate
E. Aluminum arsenide
F. None of the Above

84. Which of the following terms and disodium methyl arsenate (DSMA) – less toxic organic forms of arsenic – have replaced lead arsenate in agriculture.
A. Roxarsone
B. Arsphenamine
C. Monosodium methyl arsenate (MSMA)
D. Less toxic organic forms of arsenic
E. Fowler's solution
F. None of the Above

85. Which of the following terms is still added to animal food, in particular in the US as a method of disease prevention and growth stimulation?
A. Roxarsone
B. Arsphenamine
C. Arsenic
D. Less toxic organic forms of arsenic
E. Fowler's solution
F. None of the Above

86. The Poison-Free Poultry Act of 2009 proposes to ban the use of _____ in industrial swine and poultry production.
A. Roxarsone
B. Arsphenamine
C. Arsenic
D. Less toxic organic forms of arsenic
E. Fowler's solution
F. None of the Above

87. Alpharma, a subsidiary of Pfizer Inc., which produces this term and has voluntarily suspended sales of the drug in response to studies showing elevated levels of arsenic in treated chickens.

A. Roxarsone
B. Arsphenamine
C. Arsenic
D. Less toxic organic forms of arsenic
E. Fowler's solution
F. None of the Above

Medical use

88. During the 18th, 19th, and 20th centuries, a number of arsenic compounds have been used as medicines, including?

A. Roxarsone
B. Arsphenamine
C. Arsenic
D. Less toxic organic forms of arsenic
E. Fowler's solution
F. None of the Above

89. Arsphenamine as well as this term was indicated for syphilis and trypanosomiasis, but has been superseded by modern antibiotics.

A. Roxarsone
B. Arsphenamine
C. Neosalvarsan
D. Less toxic organic forms of arsenic
E. Fowler's solution
F. None of the Above

90. Which of the following terms has been used in a variety of ways over the past 500 years, but most commonly in the treatment of cancer?

A. Arsenic trioxide
B. Arsenates
C. Arsenic alloy
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

91. Which of the following terms was used as in treatment of psoriasis?

A. Roxarsone
B. Arsphenamine
C. Arsenic
D. Soluble arsenic compounds
E. Fowler's solution
F. None of the Above

92. Which of the following terms act as stimulants, and were once popular in small doses as medicine by people in the mid-18th century?

A. Roxarsone
B. Arsphenamine
C. Arsenic
D. Soluble arsenic compounds
E. Fowler's solution
F. None of the Above

Alloys

93. Which of the following terms is for alloying with lead?

A. Metallic arsenic
B. Arsenates
C. Arsenic alloys
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

94. Which of the following terms is an important semiconductor material, used in integrated circuits?

A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Gallium arsenide
E. Aluminum arsenide
F. None of the Above

95. Circuits made from this term are much faster than those made in silicon.
A. Arsenic D. Phosphorus acid
B. Arsenates E. Aluminum arsenide
C. Arsenic alloys F. None of the Above

Bacteria
96. Under oxidative environmental conditions some bacteria use arsenite, which is oxidized to this term as fuel for their metabolism?
A. Roxarsone D. Less toxic organic forms of arsenic
B. Arsphenamine E. Fowler's solution
C. Arsenate F. None of the Above

97. The enzymes involved are known as?
A. Iron media D. Arsenate reductases (Arr)
B. Water chemistry E. Arsenic-rich particles
C. Arsenic levels F. None of the Above

Arsenic Control Measures Can Affect Finished Water Quality
98. Some systems may need to adjust their finished water quality to address new concerns about?
A. Iron media D. Corrosion
B. Water chemistry E. Arsenic-rich particles
C. Arsenic levels F. None of the Above

99. Which of the following terms due to using new sources, blending different source waters, or installing arsenic treatment are some of the factors that can affect distribution system water quality?
A. Iron media D. Arsenate reductases (Arr)
B. Water chemistry E. Arsenic-rich particles
C. Arsenic levels F. None of the Above

100. In some cases, this may cause an increase in which term in the distribution system or create simultaneous compliance issues with other drinking water regulations?
A. Iron media D. Arsenate reductases (Arr)
B. Water chemistry E. Arsenic-rich particles
C. Arsenic levels F. None of the Above

101. Water systems may also find deposits of _____ in their storage tanks or at locations in their distribution system with low flows.
B. Water chemistry E. Arsenic-rich particles
C. Arsenic levels F. None of the Above

102. This situation occurs primarily when which term used in treatment are released into the distribution system?
A. Iron media D. Arsenate reductases (Arr)
B. Water chemistry E. Arsenic-rich particles
C. Arsenic levels F. None of the Above

Is Arsenic in your Storage Tank?
Is Your Ground Water System Installing Disinfection for Pathogen Control?

103. Water systems that disinfect their water should be aware of the possibility of an increase in arsenic concentrations in their distribution system, particularly if the water contains high concentrations of dissolved?

A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

104. When chlorinated, the dissolved iron forms particles on which arsenic can accumulate. As a result, high arsenic concentrations may occur in distribution system water even if arsenic concentrations in the raw water are below the?

A. Zero limit
B. MCL
C. MCLG
D. Safe Drinking Water Act standard
E. 0.010 mg/L or 10 ppb
F. None of the Above

105. This happened to a small community water system in the Midwest that began chlorinating water from a series of wells that had raw water arsenic levels between 0.003 and 0.008 mg/L and iron concentrations up to?

A. 50 ppb to 10 ppb
B. 10 ppb
C. 0.4 mg/L
D. 10 ug/L (micrograms per liter) or 10 ppb
E. 00.10 mg/L or 100 ppb
F. None of the Above

106. Soon after chlorination begins, the system received intermittent this term complaint from its customers with increasing frequency across the distribution system.

A. Groundwater
B. Arsenic exposure
C. Colored-water
D. Toxic waste
E. Organic compound arsenobetaine
F. None of the Above

107. Which of the following terms collected from several representative locations throughout the service area had a reddish-brown color and contained particles?

A. Arsenic poisoning
B. Samples
C. Arsenic
D. Source water
E. Arsenic-rich particles
F. None of the Above

108. A metals analysis showed high levels of copper and iron oxides in the finished water, along with arsenic concentrations approaching?

A. 50 ppb to 10 ppb
B. 10 ppb
C. 0.4 mg/L
D. 5 mg/L
E. 00.10 mg/L or 100 ppb
F. None of the Above

109. Doctors and health care professionals were notified of the situation and instructed to watch for signs of?

A. Chronic oral exposure
B. Arsenic poisoning
C. Oral animal
D. Human, inhalation
E. Chronic inhalation exposure
F. None of the Above

110. Researchers found that chlorinating the water caused the formation of?

A. Ferri-hydroxide solids
B. Arsenic exposure
C. Arsenic levels
D. Toxic waste disposal problem
E. Organic compound arsenobetaine
F. None of the Above

Biomethylation

111. Inorganic arsenic and its compounds, upon entering the food chain, are progressively metabolized through?

A. Arsenic poisoning
B. Samples
C. A process of methylation
D. Blending different source waters
E. Progressively metabolized
F. None of the Above

112. There is little danger in eating fish because this term is nearly non-toxic.

A. Arsenic compound
B. Arsenic exposure
C. Arsenic levels
D. Toxic waste disposal problem
E. Organic compound arsenobetaine
F. None of the Above

Arsenic Environmental Issues

Arsenic Control Measures Can Affect Finished Water Quality

113. Public water systems may need to adjust their finished water quality to address new concerns about?

A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Corrosion
E. Aluminum arsenide
F. None of the Above

114. Changes in _____ chemistry due to using new sources, blending different source waters, or installing arsenic treatment are some of the factors that can affect distribution system water quality.

A. Groundwater
B. Arsenic exposure
C. Arsenic levels
D. Toxic waste
E. Water
F. None of the Above

Occurrence in drinking water

115. In the United States, arsenic is most commonly found in the ground waters of the southwest. Parts of New England, Michigan, Wisconsin, Minnesota and the Dakotas are also known to have significant concentrations of?

A. Iron media
B. Arsenic in ground water
C. Arsenic levels
D. Arsenate reductases (Arr)
E. Arsenic-rich particles
F. None of the Above

116. Increased levels of skin cancer have been associated with arsenic exposure in Wisconsin, even at levels below this term drinking water standard, although this link has not been proven.

A. 50 ppb to 10 ppb
B. 10 ppb
C. 0.4 mg/L
D. 100 ug/L (micrograms per liter) or 100 ppb
E. 10 part per billion
F. None of the Above

117. According to a recent film funded by the US Superfund, millions of private wells have _____ levels.

A. Arsenic poisoning
B. Unknown arsenic
C. Arsenic
D. Blending different source waters
E. Progressively metabolized
F. None of the Above

118. Low-level exposure to arsenic at concentrations found commonly in US drinking water compromises the initial immune response to this missing term according to NIEHS-supported scientists.

A. Acute exposure
B. Acute animal tests
C. Acute inhalation exposure
D. Acute oral exposure
E. H1N1 or swine flu infection
F. None of the Above

Water Purification Solutions
Small-scale water treatment

119. Which of the following terms to remove arsenic from groundwater in Pakistan summarizes the most technically viable inexpensive methods?

A. Traditional anion exchange
B. Long-term column performance
C. Concrete stabilization
D. Coagulation/filtration
E. Domestic treatment
F. None of the Above

120. A simpler and less expensive form of arsenic removal is known as which missing term using three pitchers containing cast iron turnings and sand in the first pitcher and wood activated carbon and sand in the second?

A. Arsenic de-poisoner
B. Sono arsenic filter
C. Arsenic feed
D. Blending different source waters
E. Progressively forward filter
F. None of the Above

121. These systems are in use and can last for years while avoiding _____ disposal problem inherent to conventional arsenic removal plants.

A. Groundwater
B. Arsenic exposure
C. Arsenic levels
D. Toxic waste
E. Arsenobetaine
F. None of the Above

122. In the United States small "under the sink" units have been used to remove arsenic from drinking water. This option is called?

A. Ion Exchange
B. Activated alumina
C. Concrete stabilization
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

123. Which of the following terms and activated alumina have been considered but not commonly used?

A. Traditional anion exchange
B. Ion exchange
C. Concrete stabilization
D. Coagulation/filtration
E. Domestic treatment
F. None of the Above

Arsenic Large-scale water treatment

124. The effectiveness of any method depends on the _____makeup of a particular water supply.

A. Arsenic
B. Arsenates
C. Chemical
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

125. The aqueous chemistry of which missing term is complex, and may affect the removal rate that can be achieved by a particular process?

A. Arsenic
B. Arsenate
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

126. Some large utilities with this missing term could shut down those wells with high arsenic concentrations, and produce only from wells or surface water sources that meet the arsenic standard.

A. Traditional anion exchange
B. Long-term column performance
C. Concrete stabilization
D. Coagulation/filtration
E. Domestic treatment
F. None of the Above

127. Other utilities, however, especially small utilities with only a few wells, may have no _____ that meets the arsenic standard.

A. Traditional anion exchange
B. Long-term column performance
C. Concrete stabilization
D. Available water supply
E. Domestic treatment
F. None of the Above

128. Coagulation/filtration also known as _____ removes arsenic by coprecipitation and adsorption using iron coagulants.

A. Traditional anion exchange
B. Long-term column performance
C. Concrete stabilization
D. Flocculation
E. Domestic treatment
F. None of the Above

129. Which of the following terms using alum is already used by some utilities to remove suspended solids and may be adjusted to remove arsenic?

A. Traditional anion exchange
B. Long-term column performance
C. Concrete stabilization
D. Coagulation/filtration
E. Domestic treatment
F. None of the Above

130. The toxic arsenic sludge are disposed of by?

A. Ion Exchange
B. Activated alumina
C. Concrete stabilization
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

131. Which of the following terms filters the water through a granular medium containing ferric oxide?

A. Ion Exchange
B. Activated alumina
C. Iron oxide adsorption
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

132. Which of the following terms eventually becomes saturated, and must be replaced?

A. Ion Exchange
B. Activated alumina
C. Iron oxide medium
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

133. Which of the following terms columns connected to shallow tube wells in India and Bangladesh have successfully removed both As(III) and As(V) from groundwater for decades?
A. Ion Exchange
B. Activated alumina
C. Concrete stabilization
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

134. Which of the following terms performance has been possible through the efforts of community-elected water committees that collect a local water tax for funding operations?
A. Ion Exchange
B. Activated alumina
C. Long-term column
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

135. Which of the following terms has long been used as a water-softening process?
A. Ion Exchange
B. Activated alumina
C. Concrete stabilization
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

136. Which of the following terms is effective in removing As(V), but not As (III), or arsenic trioxide?
A. Traditional anion exchange
B. Treatment trains
C. Influent and effluent concentrations
D. One of these methods to reduce total dissolved solids
E. Precipitation/ coprecipitation and filtration
F. None of the Above

137. Which of the following terms removal of arsenic requires a trained operator to maintain the column?
A. Traditional anion exchange
B. Treatment trains
C. Influent and effluent concentrations
D. Ion exchange
E. Precipitation/ coprecipitation and filtration
F. None of the Above

138. Both reverse osmosis and this term can remove arsenic with a net ionic charge.
A. Ion Exchange
B. Activated alumina
C. Electrodialysis
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

139. Some utilities presently use _____ to reduce total dissolved solids and therefore improve taste.
A. Traditional anion exchange
B. Treatment trains
C. Influent and effluent concentrations
D. One of these methods
E. Precipitation/ coprecipitation and filtration
F. None of the Above

Subterranean Arsenic Removal (SAR) Technology

140. The oxidation zone created by aerated water boosts the activity of _____ which can oxidize arsenic from +3 to +5 state SAR Technology.
A. Arsenic
B. Oxidizing microorganisms
C. Arsenic alloys
D. Arsenic-oxidizing microorganisms
E. Aluminum arsenide-oxidizing microorganisms
F. None of the Above

141. No chemicals are used and almost _____ is produced during operational stage since iron and arsenic compounds are rendered inactive in the aquifer itself.

A. Arsenic
B. Arsenates
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

The Hungarian Solution

142. Hungarian engineer László Schremmer has recently discovered that by the use of this term it is possible to reduce the arsenic content of water to 3 microgram/liter.

A. Traditional anion exchange
B. Treatment trains
C. Influent and effluent concentrations
D. Chaff-based filters
E. Precipitation/ coprecipitation and filtration
F. None of the Above

Arsenic Can Build Up on and Release in Pipes and Storage Tanks

143. Which of the following terms may also find deposits of arsenic-rich particles in their storage tanks or at locations in their distribution system with low flows?

A. Regulatory cleanup levels
B. Iron removal treatment
C. Vitrification
D. Other arsenic treatment technologies
E. Relatively high arsenic concentrations
F. None of the Above

144. This situation occurs primarily when iron media used in this missing term are released into the distribution system, or when iron particles are not properly filtered out.

A. Regulatory cleanup levels
B. Iron removal treatment
C. Vitrification
D. Other arsenic treatment technologies
E. Treatment
F. None of the Above

145. Public water systems with arsenic in their raw water may find that scales on pipes and other components in their _____contain relatively high arsenic concentrations.

A. Regulatory cleanup levels
B. Iron removal treatment facilities
C. Vitrification
D. Distribution systems
E. Meters
F. None of the Above

146. Because iron is so effective at binding with arsenic, corrosion deposits can have high concentrations of?

A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Arsenic solids
E. Aluminum arsenide
F. None of the Above

Who Needs to Know about Arsenic Treatment Technologies?

147. Arsenic is a common inorganic element found widely in the environment. It is in many industrial products, wastes, and wastewaters, and is a contaminant of concern at?

A. Regulatory cleanup levels
B. Iron removal treatment
C. Many remediation sites
D. Other arsenic treatment technologies
E. Relatively high arsenic concentrations
F. None of the Above

148. Arsenic contaminated soil, waste, and water must be treated by removing _____ or immobilizing it.

A. Arsenic
B. Arsenates
C. Arsenic alloys
D. Arsenic solids
E. Aluminum arsenide
F. None of the Above

149. Because arsenic readily changes valence states and reacts to form species with varying toxicity and mobility, effective, long-term treatment of which missing term can be difficult?
A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

150. In some disposal environments, which missing term has leached from arsenic-bearing wastes at high concentrations.
A. Arsenic
B. Arsenate
C. Arsenic alloys
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

151. Drinking water suppliers may need to add new treatment processes or retrofit existing treatment systems to meet the revised?
A. US drinking water standard
B. EPA
C. MCL
D. A wide range of arsenic levels
E. Inorganic arsenic
F. None of the Above

Where Does Arsenic Come From?

152. Industrial products containing arsenic include wood preservatives, paints, environment include mining and smelting operations; agricultural applications; burning of fossil fuels and wastes; pulp and paper production; cement manufacturing; and former agricultural uses of?
A. Arsenic
B. Arsenate
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

How Does Arsenic Chemistry Affect Treatment?

153. Arsenic is a metalloid or inorganic semiconductor that can form?
A. Valence state and chemical form
B. BATs
C. Toxicity and mobility of arsenic
D. Inorganic and organic compounds
E. Valence states of -3 and 0
F. None of the Above

154. _____ of -3 and 0 occur only rarely in nature.
A. Valence state
B. BATs
C. Toxicity and mobility of arsenic
D. Inorganic and organic compounds
E. Valence states of -3 and 0
F. None of the Above

155. The toxicity and mobility of arsenic varies with its?
A. Valence state and chemical form
B. BATs
C. Toxicity and mobility of arsenic
D. Inorganic and organic compounds
E. Valence states of -3 and 0
F. None of the Above

156. Which of the following terms are the dominant species in surface water and seawater, and organic arsenic species can be found in natural gas and shale oil?
A. Arsenic
B. Arsenate
C. Solid yellow arsenic
D. Phosphorus acid
E. Gray arsenic
F. None of the Above

157. Which of the following terms exhibit varying degrees of toxicity and solubility?
A. Groundwater D. Chemical compounds containing arsenic
B. Arsenic exposure E. Organic compound arsenobetaine
C. Arsenic levels F. None of the Above

158. Arsenic readily changes _____ in the environment.
A. Valence state and chemical form D. Inorganic and organic compounds
B. BATs E. Valence states of -3 and 0
C. Toxicity and mobility of arsenic F. None of the Above

159. Which of the following terms can also affect the mobility of arsenic in the environment?
A. Traditional anion exchange D. Coagulation/filtration
B. Long-term column performance E. Domestic treatment
C. Adsorption-desorption reactions F. None of the Above

160. Which of the following terms express treatment and long-term disposal of arsenic requires an understanding of arsenic chemistry and the disposal environment?
A. Ion Exchange D. Reverse osmosis and electrodialysis
B. Activated alumina E. Point of use
C. The successful F. None of the Above

How Often Does Arsenic Occur in Drinking Water?
161. Which of the following terms is a common environmental contaminant?
A. Arsenic D. Phosphorus acid
B. Arsenates E. Aluminum arsenide
C. Arsenic alloys F. None of the Above

162. The levels of arsenic are typically higher in?
A. Groundwater D. Toxic waste
B. Arsenic exposure E. Groundwater sources
C. Arsenic levels F. None of the Above

How Often Does Arsenic Occur at Hazardous Waste Sites?
163. Hazardous waste sites fall under several clean-up programs, such as this term along with corrective actions, and state cleanup programs.
A. US drinking water standard D. A wide range of arsenic clean-up laws
B. EPA E. Inorganic arsenic super sites
C. MCL F. None of the Above

Different Arsenic Treatment Technologies
Number of Applications of Arsenic Treatment Technologies at Superfund Sites
164. Information on the application of groundwater pumps and treatment technologies, including precipitation/coprecipitation, this term, adsorption, and ion exchange, is based on available data and is not comprehensive.
A. Ion Exchange D. Reverse osmosis and electrodialysis
B. Activated alumina E. Point of use
C. Membrane filtration F. None of the Above

Treatment Trains

165. Treatment trains consist of two or more technologies used together, either integrated into a single process or operated as?

A. Traditional anion exchange
B. Treatment trains
C. Influent and effluent concentrations
D. A series of treatments in sequence
E. Precipitation/ coprecipitation and filtration
F. None of the Above

166. A common treatment train used for arsenic in water includes an oxidation step to change arsenic from As(III) to its less soluble As(V) state, followed by _____ and filtration to remove the precipitate.

A. Traditional anion exchange
B. Treatment trains
C. Influent and effluent concentrations
D. One of these methods to reduce total dissolved solids
E. Precipitation/ coprecipitation
F. None of the Above

167. Which of the following terms are employed when one technology alone is not capable of treating all of the contaminants?

A. Traditional anion exchange
B. Trains
C. Influent and effluent concentrations
D. One of these methods to reduce total dissolved solids
E. Precipitation/ coprecipitation and filtration
F. None of the Above

168. Which of the following terms, where available, often were provided for the entire train, and not the individual components?

A. Traditional anion exchange
B. Trains
C. Influent and effluent concentrations
D. One of these methods to reduce total dissolved solids
E. Precipitation/ coprecipitation and filtration
F. None of the Above

169. Which of the following terms is most commonly used to treat organic contaminants?

A. Ion Exchange
B. Activated alumina
C. Activated carbon adsorption
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

What Technologies Are Used Most Often to Treat Arsenic?

170. The most frequently used technology for soil and waste containing arsenic is?

A. Solidification/stabilization
B. Iron removal treatment
C. Vitrification
D. The Rust treatment technologies
E. The Brake Fern
F. None of the Above

171. The available data show that this technology can effectively meet regulatory cleanup levels, is commercially available to treat both soil and waste, is usually less expensive, and generates a residual that typically does not require?

A. Regulatory cleanup levels
B. Iron removal treatment
C. Vitrification
D. Other arsenic treatment technologies
E. Further treatment prior to disposal
F. None of the Above

172. Other arsenic treatment technologies for soil and waste are typically used for?

A. Regulatory cleanup levels
B. Iron removal treatment
C. Vitrification
D. Specific applications
E. Relatively high arsenic concentrations
F. None of the Above

173. Vitrification may be used when a combination of contaminants are present that cannot be effectively treated using?
A. Regulatory cleanup levels D. Other arsenic treatment technologies
B. Iron removal treatment E. Relatively high arsenic concentrations
C. Solidification/stabilization F. None of the Above

174. Which of the following terms typically requires large amounts of energy, can be more expensive than S/S, and may generate off-gasses containing arsenic?
A. Regulatory cleanup levels D. Arsenic treatment
B. Iron removal treatment E. Relatively high arsenic concentrations
C. Vitrification F. None of the Above

175. Which of the following terms is used primarily to treat soil. However, it is not applicable to all types of soil or to waste?
A. Soil washing/acid extraction D. Toxic waste extraction
B. Arsenic exposure E. Organic extraction
C. Arsenic extraction F. None of the Above

176. Which of the following terms has been used primarily to recycle arsenic from industrial wastes containing high concentrations of arsenic from metals refining and smelting operations?
A. Regulatory cleanup levels D. Other arsenic treatment technologies
B. Iron removal treatment E. Pyrometallurgical treatment
C. Vitrification F. None of the Above

177. No performance data were identified for the limited number of full-scale applications of _____ to arsenic.
A. Precipitation/ coprecipitation D. Best available technologies (BATs)
B. A general variance E. Lime softening
C. Clarification and filtration F. None of the Above

178. Which of the following terms is frequently used to treat arsenic contaminated water, and is capable of treating a wide range of influent concentrations to the revised MCL for arsenic?
A. Precipitation/ coprecipitation D. Best available technologies (BATs)
B. A general variance E. Lime softening
C. Clarification and filtration F. None of the Above

179. The effectiveness of this term is less likely to be reduced by characteristics and contaminants other than arsenic, compared to other water treatment technologies.
A. Precipitation/ coprecipitation D. Best available technologies (BATs)
B. This technology E. Lime softening
C. Clarification and filtration F. None of the Above

180. Which of the following terms is more cost effective at a large scale where labor costs can be spread over a larger amount of treated water produced?
A. Precipitation/ coprecipitation D. Best available technologies (BATs)
B. A general variance E. Lime softening
C. Clarification and filtration F. None of the Above

181. The effectiveness of _____ for arsenic treatment is more likely than precipitation/coprecipitation to be affected by characteristics and contaminants other than arsenic.

A. Precipitation/ coprecipitation
B. Adsorption and ion exchange
C. Clarification and filtration
D. Best available technologies (BATs)
E. Lime softening
F. None of the Above

EPA Water Treatment Processes Section

182. Treating your water to reduce arsenic will be necessary if more cost-effective alternatives are not available. EPA has identified this term and small system compliance technologies for removing arsenic from drinking water.

A. Precipitation/ coprecipitation
B. Adsorption and ion exchange
C. Clarification and filtration
D. Best available technologies (BATs)
E. Lime softening
F. None of the Above

183. BATs are technologies that have proven effective for large systems, and this term are technologies that are effective and affordable for small systems.

A. Precipitation/ coprecipitation
B. SSCTs
C. Clarification and filtration
D. Best available technologies (BATs)
E. Lime softening
F. None of the Above

184. Systems are not required to use?

A. Precipitation/ coprecipitation
B. SSCTs
C. Clarification and filtration
D. Any specific technology
E. Lime softening
F. None of the Above

185. Which of the following terms if approved by the State, would allow the system to supply water with an arsenic level above the MCL for a certain period of time?

A. Precipitation/ coprecipitation
B. A general variance
C. Clarification and filtration
D. Best available technologies (BATs)
E. Lime softening
F. None of the Above

186. EPA anticipates that most small systems will use this term, reverse osmosis POU devices, or modified lime softening.

A. US drinking water standard
B. Clarification and filtration
C. Activated alumina
D. A wide range of arsenic levels
E. Inorganic arsenic
F. None of the Above

Activated Alumina

187. When AA is exhausted it is simply disposed of and replaced with fresh?

A. Ion Exchange
B. Activated alumina(AA)
C. Concrete stabilization
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

Reverse Osmosis

188. Which of the following terms can treat water containing up to 0.160 mg/L of arsenic?

A. Ion Exchange
B. Activated alumina
C. Reverse osmosis
D. Reverse osmosis and electrodialysis
E. Point of use
F. None of the Above

Modified Lime Softening

189. The addition of lime to water causes calcium and magnesium to form solid particles, which can then be removed by?

A. Precipitation/ coprecipitation
B. A general variance
C. Clarification and filtration
D. Best available technologies (BATs)
E. Lime softening
F. None of the Above

190. Which of the following terms is very expensive and water systems are unlikely to install this technology only for arsenic removal?

A. Precipitation/ coprecipitation
B. A general variance
C. Clarification and filtration
D. Best available technologies (BATs)
E. Lime softening
F. None of the Above

191. Which of the following terms can treat water containing up to 0.080 mg/L of arsenic?

A. Precipitation/ coprecipitation
B. Modified lime softening
C. Clarification and filtration
D. Best available technologies (BATs)
E. Lime softening
F. None of the Above

Point-of-Use Units

192. Under the Arsenic Rule, systems have this approach involves system-installed and maintained _____on a single tap in each customer's household.

A. Ion Exchange
B. Activated alumina
C. Concrete stabilization
D. Reverse osmosis and electrodialysis
E. POU devices
F. None of the Above

193. Which of the following terms the EPA is developing guidance on how to implement a POU compliance strategy?

A. Ion Exchange
B. Activated alumina
C. Concrete stabilization
D. Reverse osmosis and electrodialysis
E. Point-of-use reverse osmosis treatment unit
F. None of the Above

Model of a Precipitation/Coprecipitation System

194. Which of the following terms has been the most frequently used method to treat arsenic contaminated water, including groundwater, surface water, leachate, mine drainage, drinking water, and wastewater?

A. Traditional anion exchange
B. Long-term column performance
C. Precipitation/coprecipitation
D. Coagulation/filtration
E. Domestic treatment
F. None of the Above

195. Which of the following terms uses chemicals to transform dissolved contaminants into an insoluble solid?

A. Traditional anion exchange
B. Long-term column performance
C. Precipitation
D. Coagulation/filtration
E. Domestic treatment
F. None of the Above

196. Colloidal or suspended contaminants become enmeshed with other precipitated species, or are removed through processes such as?

A. Traditional anion exchange
B. Long-term column performance
C. Concrete stabilization
D. Coagulation and flocculation
E. Domestic treatment
F. None of the Above

197. The precipitated/coprecipitated solid is then removed from the liquid phase by?
A. Traditional anion exchange D. Clarification or filtration
B. Long-term column performance E. Domestic treatment
C. Concrete stabilization F. None of the Above

198. Which of the following terms usually involves pH adjustment and addition of a chemical precipitant or coagulant; it can also include addition of a chemical oxidant?
A. Traditional anion exchange D. Coagulation/filtration
B. Long-term column performance E. Domestic treatment
C. Precipitation/coprecipitation F. None of the Above

199. Oxidation of arsenic to its less soluble As(V) state can increase the effectiveness of _____, and can be done as a separate pretreatment step or as part of the precipitation process.
A. Pretreatment D. Precipitation/coprecipitation
B. Oxidation of arsenic E. An active ex situ treatment technology
C. Clarification or filtration F. None of the Above

200. Which of the following terms that oxidize As(III) to As(V) include ozonation, photo oxidation?
A. Pretreatment processes D. Precipitation/coprecipitation processes
B. Oxidation of arsenic E. An active ex situ treatment technology
C. Clarification or filtration F. None of the Above

201. Which of the following terms is commonly used to remove the solid precipitate. Precipitation/coprecipitation is frequently used to treat water contaminated with metals?
A. Pretreatment process D. Precipitation/coprecipitation process
B. Oxidation of arsenic E. An active ex situ treatment technology
C. Clarification or filtration F. None of the Above

202. The references identified for this report contained information on this term to industrial wastewater, groundwater, surface water, leachate, and mine drainage.
A. Pretreatment processes D. Precipitation/coprecipitation processes
B. Oxidation of arsenic E. An active ex situ treatment technology
C. Clarification or filtration F. None of the Above

Precipitation/Coprecipitation Chemistry
Precipitation Reactions
203. Which of the following terms occur all around us?
A. Traditional anion exchange D. Coagulation/filtration
B. Long-term column performance E. Domestic treatment
C. Precipitation reactions F. None of the Above

204. Another example is a kidney stone, it is nothing more than a precipitate - often of calcium ions and?
A. Chronic oral exposure D. Ingested inorganic arsenic
B. Human ingestion E. Chronic inhalation exposure
C. Oral abuse F. None of the Above

Complex

205. The chemistry of this term is often complex, and depends upon a variety of factors, including the speciation of arsenic, the chemical precipitants used and their concentrations.

A. Traditional anion exchange
B. Long-term column performance
C. Precipitation/coprecipitation
D. Coagulation/filtration
E. Domestic treatment
F. None of the Above

Factors Affecting Precipitation/Coprecipitation Performance

206. Valence state of arsenic - The presence of which missing term of arsenic may reduce the removal efficiency?

A. Valence state and chemical form
B. Soluble trivalent state
C. Toxicity and mobility of arsenic
D. Inorganic and organic compounds
E. Than states of -3 and 0
F. None of the Above

207. Which of the following terms depends upon its valence state, pH, the specific arsenic compound, and the presence of other chemicals with which arsenic might react?

A. Valence state and chemical form
B. Solubility of arsenic
C. Toxicity and mobility of arsenic
D. Inorganic and organic compounds
E. Than states of -3 and 0
F. None of the Above

208. The optimal pH range for this term depends upon the waste treated and the specific treatment process.

A. Pretreatment processes
B. Oxidation of arsenic
C. Clarification or filtration
D. Precipitation/coprecipitation
E. An active ex situ treatment technology
F. None of the Above

209. Which of the following terms could decrease arsenic removal in processes using ferric chloride as a coagulant, while the presence of calcium or iron may increase the removal of arsenic in these processes?

A. Arsenic
B. Arsenate
C. Arsenic alloy
D. Phosphorus acid
E. Aluminum arsenide
F. None of the Above

Applicability, Advantages, and Potential Limitations

210. Which of the following terms is an active ex situ treatment technology designed to function with routine chemical addition and sludge removal?

A. Pretreatment processes
B. Oxidation of arsenic
C. Clarification or filtration
D. Precipitation/coprecipitation
E. An active ex situ treatment technology
F. None of the Above

211. Some sludge from the precipitation/coprecipitation of arsenic can be a hazardous waste and require additional treatment such as this term prior to disposal.

A. Pretreatment processes
B. Solidification/stabilization
C. Clarification or filtration
D. Precipitation/coprecipitation processes
E. An active ex situ treatment technology
F. None of the Above

212. In the presence of other metals or contaminants, arsenic _____ may also cause other compounds to precipitate, which can render the resulting sludge hazardous.

A. Pretreatment processes
B. Oxidation of arsenic
C. Clarification or filtration
D. Precipitation/coprecipitation processes
E. An active ex situ treatment technology
F. None of the Above

Factors Affecting Precipitation/Coprecipitation Costs

213. Type of chemical addition - The chemical added will affect costs. For example, calcium hypochlorite, is a less expensive oxidant than?

A. Pretreatment processes
B. Oxidation of arsenic
C. Clarification or filtration
D. Potassium permanganate
E. An active ex situ treatment technology
F. None of the Above

214. Chemical dosage - The cost generally increases with increased?

A. Sludge
B. Chemical addition
C. Additional treatment or disposal
D. Increased potassium permanganate addition
E. Effluent and disposal standards
F. None of the Above

215. Larger amounts of chemicals added usually results in a larger amount of?

A. Sludge
B. Dissolved arsenic species
C. Additional treatment or disposal
D. Increased chemical addition
E. Effluent and disposal standards
F. None of the Above

216. Treatment goal - Application could require additional treatment to meet stringent cleanup goals and/or effluent and?

A. Sludge
B. Remove dissolved arsenic species
C. Additional treatment or disposal
D. Increased chemical addition
E. Disposal standards
F. None of the Above

217. Which of the following terms could be considered a hazardous waste and require additional treatment before disposal, or disposal as hazardous waste?

A. Precipitation/coprecipitation process
B. Remove dissolved arsenic species
C. Additional treatment or disposal
D. Increased chemical addition
E. Effluent and disposal standards
F. None of the Above

Membrane Filtration for Arsenic

218. Which of the following terms can remove a wide range of contaminants from water?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Membrane filtration
E. Precipitation/coprecipitation
F. None of the Above

219. Its effectiveness is sensitive to a variety of untreated water contaminants and characteristics. It also produces a larger volume of residuals and tends to be more expensive than?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Other arsenic treatment technologies
E. Precipitation/coprecipitation
F. None of the Above

220. Therefore, it is used less frequently than precipitation/coprecipitation?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Arsenic removal
E. Adsorption, and ion exchange
F. None of the Above

221. Which of the following terms separates contaminants from water by passing it through a semi-permeable barrier or membrane?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Membrane filtration
E. Precipitation/coprecipitation
F. None of the Above

Technology Description and Principles

222. There are four types of membrane processes: this missing term, ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO).

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Microfiltration (MF)
E. Precipitation/coprecipitation
F. None of the Above

223. All four of these processes are _____ and are categorized by the size of the particles that can pass through the membranes or by the molecular weight cut-off of the membrane.

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Arsenic removers
E. Precipitation/coprecipitation
F. None of the Above

224. The force required to drive fluid across the membrane depends on the pore size; NF and RO require a relatively high pressure, while which missing term requires lower pressure?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Arsenic concentrations
E. MF and UF
F. None of the Above

225. Which of the following terms primarily remove contaminants through physical sieving, and the high pressure processes through chemical diffusion across the permeable membrane?

A. Reverse osmosis (RO)
B. NF and RO
C. The high pressure processes
D. The low pressure
E. Precipitation/coprecipitation
F. None of the Above

226. Because arsenic species dissolved in water tend to have relatively low molecular weights, only which missing membrane processes are likely to effectively treat dissolved arsenic?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. MF and UF
E. Precipitation/coprecipitation
F. None of the Above

227. Which of the following terms has been used with precipitation/coprecipitation to remove solids containing arsenic?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. MF
E. Precipitation/coprecipitation
F. None of the Above

Membrane filtration processes

228. Which of the following terms process is a separating process, in which a feed flow is divided into two flows, either gaseous or liquid?

A. Oxidation
B. NF membranes
C. RO
D. A membrane
E. High pressure processes
F. None of the Above

229. If the two phases are fluid, then we speak of?
A. MF is a low-pressure process
B. Membrane filtration
C. NF
D. Membrane fouling
E. MF
F. None of the Above

230. The membrane itself forms a semi-permeable barrier through which some particles are transported faster than others, so that?
A. Oxidation
B. NF membranes
C. A separation occurs
D. Precipitation/ coprecipitation
E. High pressure processes
F. None of the Above

231. The pressure driven membrane filtration processes are: microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and?
A. Reverse osmosis (RO)
B. Adsorption of arsenic
C. NF
D. Membrane fouling
E. MF
F. None of the Above

232. The smaller the pore size of the membranes, the higher the pressure needed to achieve separation. In the case of microfiltration and ultrafiltration, we speak of low-pressure processes, while _____ are high pressure processes.
A. Oxidation
B. NF membranes
C. RO
D. Nanofiltration and reverse osmosis
E. High pressure processes
F. None of the Above

233. Which of the following terms generates two treatment residuals from the influent waste stream: a treated effluent and a rejected waste stream of concentrated contaminants?
A. MF is a low-pressure process
B. Adsorption of arsenic
C. NF
D. Membrane fouling
E. MF
F. None of the Above

234. The molecular weight cut off for which missing term ranges from 1 to 20,000, which is a significantly lower cut off than for NF membranes?
A. Oxidation
B. NF membranes
C. RO membranes
D. Precipitation/ coprecipitation
E. High pressure processes
F. None of the Above

235. The molecular weight cut off for _____ membranes ranges from approximately 150 to 20,000.
A. Low-pressure process
B. Adsorption
C. NF
D. Membrane fouling
E. MF
F. None of the Above

236. NF is slightly less efficient than _____ in removing dissolved arsenic from water.
A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Arsenic concentrations
E. Precipitation/coprecipitation
F. None of the Above

Factors Affecting Membrane Filtration Performance

237. Suspended solids, high molecular weight, dissolved solids, organic compounds, and colloids - The presence of these constituents in which missing term may cause membrane fouling?

A. MF is a low-pressure process
B. Adsorption of arsenic
C. NF
D. Membrane fouling
E. MF
F. None of the Above

238. Which of the following terms of the influent stream to convert As(III) to As(V) will increase arsenic removal?

A. Post oxidation
B. NF membranes
C. Prior oxidation
D. Precipitation/ coprecipitation
E. High pressure processes
F. None of the Above

239. pH may affect the adsorption of arsenic on the membrane by creating?

A. MF is a low-pressure process
B. Adsorption of arsenic
C. NF
D. Membrane fouling
E. An electrostatic charge
F. None of the Above

240. Temperature - Low influent stream temperatures decreases membrane flux. Increasing system pressure or increasing the membrane surface area may compensate for?

A. Oxidation
B. NF membranes
C. Low influent stream temperature
D. Precipitation/ coprecipitation
E. High pressure processes
F. None of the Above

241. Which of the following terms is a low-pressure process that primarily removes particles with a molecular weight above 50,000 or a particle size greater than 0.050 micrometers?

A. MF
B. Adsorption
C. NF
D. Membrane fouling
E. MC Hammer
F. None of the Above

242. The pore size of MF membranes is too large to effectively remove dissolved arsenic species, but MF can remove particulates containing arsenic and solids produced by?

A. Oxidation
B. Magic
C. Low pressure processes
D. Precipitation/ coprecipitation
E. High pressure processes
F. None of the Above

Media and Contaminants Treated

243. Which of the following terms can treat dissolved salts and other dissolved materials?

A. Membrane filtration
B. Remove dissolved arsenic
C. Additional treatment
D. Increased chemical addition
E. Effluent and disposal
F. None of the Above

Adsorption Treatment for Arsenic

244. Which of the following terms has been used to treat groundwater and drinking water containing arsenic?

A. Bulk liquid phase
B. Adsorption
C. Greensand
D. Contaminants are adsorbed
E. Precipitation/coprecipitation
F. None of the Above

245. Based on the information collected for this course, this technology typically can reduce arsenic concentrations to less than _____ and in some cases has reduced arsenic concentrations to below 0.010 mg/L.
A. 50 ppb to 10 ppb D. 10 ug/L (micrograms per liter) or 10 ppb
B. 10 ppb E. 00.10 mg/L or 100 ppb
C. 0.050 mg/L F. None of the Above

246. It is used less frequently than which missing term, and is most commonly used to treat groundwater and drinking water, or as a polishing step for other water treatment processes?
A. Bulk liquid phase D. Contaminants are adsorbed
B. Adsorption E. Precipitation/coprecipitation
C. Greensand F. None of the Above

247. In which of the following terms, solutes concentrate at the surface of a sorbent, thereby reducing their concentration in the bulk liquid phase?
A. Bulk liquid phase D. Membrane filtration
B. Adsorption E. Precipitation/coprecipitation
C. Greensand F. None of the Above

248. The adsorption media is usually packed into?
A. Bulk liquid phase D. A column
B. Adsorption filter E. Precipitation/coprecipitation
C. Greensand F. None of the Above

249. When adsorption sites become filled, the column must be regenerated or disposed of and replaced with?
A. Bulk liquid phase D. New media
B. Adsorption sand E. Precipitation/coprecipitation
C. Greensand F. None of the Above

Technology Description and Principles
250. The primary removal mechanism in each process is adsorption. For example, greensand is made from?
A. Bulk liquid phase D. Contaminants are adsorbed
B. Glauconite E. Precipitation/coprecipitation
C. Greensand F. None of the Above

251. Which of the following terms containing sand is treated with potassium permanganate, forming a layer of manganese oxides on the sand?
A. Bulk liquid phase D. Greensand media
B. Adsorption E. Glauconite
C. Greensand F. None of the Above

252. As water passes through a greensand filtration bed, the KMnO4 oxidizes As(III) to As(V), and As(V) adsorbs onto the greensand surface. In addition, arsenic is removed by this term, displacing species from the manganese oxide (presumably hydroxide ion and water.
A. Ion exchange D. The regeneration process
B. Greensand media E. Iron-based adsorption media
C. Activated carbon (AC) F. None of the Above

253. When which of the following terms is exhausted, the greensand media must be regenerated or replaced?
A. Ion exchange D. KMnO4
B. Greensand media E. Iron-based adsorption media
C. Activated carbon (AC) F. None of the Above

254. Greensand media is regenerated with a solution of excess KMnO4.Greensand filtration is also known as?
A. Ion exchange D. Oxidation/filtration
B. Greensand media E. Iron-based adsorption media
C. Activated carbon (AC) F. None of the Above

255. Which of the following terms is the sorbent most commonly used to remove arsenic from drinking water, and has been used for groundwater?
A. KMnO4 D. Solution of surfactant
B. AC regeneration E. Greensand
C. Activated alumina (AA) F. None of the Above

256. The regeneration process desorbs the arsenic, the regeneration fluid most commonly used for AA treatment systems is?
A. Ion exchange D. A solution of sodium hydroxide
B. Greensand media E. Iron-based adsorption media
C. Activated carbon (AC) F. None of the Above

257. The most commonly used neutralization fluid is a solution of sulfuric acid. The regeneration and neutralization steps for _____ might produce a sludge because the alumina can be dissolved by the strong acids and bases used in these processes.
A. AA adsorption systems D. The regeneration process
B. Greensand media E. Iron-based adsorption media
C. Activated carbon (AC) F. None of the Above

258. Which of the following terms is an organic sorbent that is commonly used to remove organic and metal contaminants from drinking water, groundwater, and wastewater?
A. Ion exchange D. The regeneration process
B. Greensand media E. Iron-based adsorption media
C. Activated carbon (AC) F. None of the Above

259. The arsenic might not volatilize at the temperatures typically used in?
A. Ion exchange D. AC regeneration
B. Greensand media E. Iron-based adsorption media
C. Activated carbon (AC) F. None of the Above

260. Iron-based adsorption media include this term, ferric hydroxide-coated newspaper pulp, ferric oxide, iron oxide-coated sand, sulfur-modified iron, and iron filings mixed with sand.
A. Ion exchange D. The regeneration process
B. Greensand media E. Granular ferric hydroxide
C. Activated carbon (AC) F. None of the Above

261. Processes that use these media typically remove arsenic using adsorption in combination with oxidation, precipitation/coprecipitation?

A. Reverse osmosis (RO)
B. NF and RO
C. The low pressure processes
D. Arsenic concentrations
E. Ion exchange, or filtration
F. None of the Above

262. Which of the following terms uses adsorption and ion exchange with surface hydroxides to selectively remove arsenic from water?

A. Ion exchange
B. Greensand media
C. Activated carbon (AC)
D. The regeneration process
E. Iron oxide-coated sand
F. None of the Above

263. The media requires periodic regeneration or disposal and replacement with new media. The regeneration process is similar to that used for this term, and consists of rinsing the media with a regenerating solution containing excess sodium hydroxide, flushing with water, and neutralizing with a strong acid, such as sulfuric acid.

A. AA
B. Greensand media
C. Activated carbon (AC)
D. The regeneration process
E. Iron-based adsorption media
F. None of the Above

264. Which of the following terms is prepared by treating zeolite with a solution of surfactant, such as hexadecyltrimethyl-ammonium bromide?

A. Ion exchange
B. Greensand media
C. Activated carbon (AC)
D. SMZ
E. Iron-based adsorption media
F. None of the Above

Zeolite

265. The name zeolite is a general term for a stonelike material that consist of this term with a large internal surface area of up to 1000 m^2/g.

A. The optimal pH
B. Adsorption
C. Zeolite
D. Crystalline metal-alumo-silicates
E. Laundry detergent zeolite
F. None of the Above

266. The word zeolite is of Greek origin and means – directly translated – ?

A. The optimal pH
B. Adsorption
C. Boiling rock
D. Molecular sieve
E. Laundry detergent
F. None of the Above

267. More than 40 natural and 100 synthetic _____ are known.

A. The optimal pH
B. Adsorption
C. Zeolites
D. Molecular sieve
E. Laundry detergent zeolite
F. None of the Above

268. Even after several thousand adsorption/desorption cycles, the structural changes of this term are insignificant if the process parameters pressure and temperature do not exceed certain limits.

A. The optimal pH
B. Adsorption
C. Crystal lattice
D. Molecular sieve
E. Laundry detergent zeolite
F. None of the Above

269. The application diversity of zeolites is tremendous: they are applied as molecular sieves, as adsorbents, as catalysts in cracking of hydrocarbons in the pretro-chemical industry, as filler components in paper production and as?

A. The optimal pH
B. Adsorption sponges
C. Zeolites
D. Zeolites concentrations
E. Ion exchange material in detergents
F. None of the Above

270. The price, e.g. for this missing term is between 1.00 and 8.00 DM/kg, depending on the type and consistency of material delivered.

A. Optimal zeolites
B. Adsorption
C. Zeolites
D. Iron-based adsorption media
E. Laundry detergent zeolite
F. None of the Above

Media and Contaminants Treated

271. Which of the following terms is frequently used to remove organic contaminants and metals from industrial wastewater?

A. Greensand media
B. Adsorption
C. Activated carbon (AC)
D. Iron-based adsorption media
E. Ion exchange
F. None of the Above

Summary of Performance Data

272. Which of the following terms treatment effectiveness can be evaluated by comparing influent and effluent contaminant concentrations?

A. Greensand media
B. Adsorption
C. Activated carbon (AC)
D. Iron-based adsorption media
E. Ion exchange
F. None of the Above

Factors Affecting Adsorption Performance

273. Fouling - The presence of suspended solids, organics, solids, silica, or mica, can cause fouling of this term's media.

A. Greensand media
B. Adsorption
C. Activated carbon (AC)
D. Iron-based adsorption media
E. Ion exchange
F. None of the Above

274. Arsenic oxidation state – this term is more effective in removing As(V) than As(III).

A. Greensand media
B. Adsorption
C. Activated carbon (AC)
D. Iron-based adsorption media
E. Ion exchange
F. None of the Above

275. Flow rate - Increasing the rate of flow through this term can decrease the adsorption of contaminants.

A. The exchange medium
B. Water treatment process
C. Pretreatment and post-treatment
D. Adsorption unit
E. Influent arsenic concentration
F. None of the Above

276. Wastewater pH - The optimal pH to maximize adsorption of arsenic by this term is acidic.

A. Greensand media
B. Adsorption
C. Activated carbon (AC)
D. Iron-based adsorption media
E. Activated alumina
F. None of the Above

277. In two groundwater and surface water projects, the influent arsenic concentration was between which missing, and the effluent concentration was less than 0.010 mg/L.
A. 50 ppb to 10 ppb
B. 10 ppb
C. 0.010 mg/L
D. 0.050 or 0.010 mg/L
E. 0.010 mg/L and 0.050 mg/L
F. None of the Above

278. Of the ten drinking water projects (eight full and two pilot scale) having both influent and effluent arsenic concentration data, eight had influent concentrations greater than?
A. 50 ppb to 10 ppb
B. 10 ppb
C. 0.010 mg/L
D. 0.050 or 0.010 mg/L
E. 0.050 mg/L
F. None of the Above

279. Effluent concentrations of less than 0.050 mg/L were achieved in seven of these projects. For two drinking water projects, the influent arsenic concentration was between this term, and the effluent concentration was less than 0.010 mg/L.
A. 50 ppb to 10 ppb
B. 0.010 mg/L and 0.050 mg/L
C. 0.010 mg/L
D. 0.050 or 0.010 mg/L
E. 0.050 mg/L
F. None of the Above

280. Projects that did not reduce arsenic concentrations to below this term do not necessarily indicate that adsorption cannot achieve these levels.
A. 50 ppb to 10 ppb
B. 10 ppb
C. 0.010 mg/L
D. 0.050 or 0.010 mg/L
E. 0.050 mg/L
F. None of the Above

Ion Exchange Treatment for Arsenic

281. Which of the following terms has been used to treat groundwater and drinking water containing arsenic?
A. The exchange medium
B. Water treatment processes
C. Pretreatment and post-treatment
D. Ion exchange
E. Influent arsenic concentration
F. None of the Above

282. Based on the information collected to prepare this course, this technology typically can reduce arsenic concentrations to less than this term and in some cases has reduced arsenic concentrations to below 0.010 mg/L.
A. 50 ppb to 10 ppb
B. 10 ppb
C. 0.010 mg/L
D. 0.050 or 0.010 mg/L
E. 0.050 mg/L
F. None of the Above

283. Its effectiveness is sensitive to a variety of untreated water contaminants and characteristics. It is used less frequently than this term, and is most commonly used to treat groundwater and drinking water, or as a polishing step for other water treatment processes.
A. The exchange medium
B. Water treatment processes
C. Pretreatment and post-treatment
D. Precipitation/coprecipitation
E. Influent arsenic concentration
F. None of the Above

284. Ion exchange is a physical/chemical process in which ions held electrostatically on the surface of a solid are exchanged for ions of similar charge in?
A. A solution
B. The regenerating solution
C. A column
D. More frequent bed regeneration
E. Replenish the exchanged ions
F. None of the Above

285. It removes ions from the aqueous phase by the exchange of cations or anions between the contaminants and?

A. The exchange medium
B. Water treatment processes
C. Pretreatment and post-treatment
D. Groundwater and drinking water
E. Influent arsenic concentration
F. None of the Above

Technology Description and Principles

286. The medium used for this term is typically a resin made from synthetic organic materials, inorganic materials, or natural polymeric materials that contain ionic functional groups.

A. Ion exchange
B. The regenerating solution
C. A column
D. More frequent bed regeneration
E. Replenish the exchanged ions
F. None of the Above

287. Dissolved arsenic is usually in an anionic form, and weak base resins tend to be effective over _____, and strong base resins are typically used for arsenic treatment.

A. An anionic form
B. A chloride ion
C. Arsenic removal
D. The regeneration process
E. A smaller pH range
F. None of the Above

288. Which of the following terms may also be categorized by the ion that is exchanged with the one in solution?

A. Ion exchange
B. The regenerating solution
C. A column
D. More frequent bed regeneration
E. Resins
F. None of the Above

289. Resins that exchange a chloride ion are referred to as?

A. An anionic form
B. A chloride ion
C. Arsenic removal
D. The regeneration process
E. Chloride-form resins
F. None of the Above

290. Resins that preferentially exchange sulfate ions are referred to as?

A. Sulfate-selective
B. The regenerating solution
C. A column
D. More frequent bed regeneration
E. Replenish the exchanged ions
F. None of the Above

291. Both sulfate-selective and nitrate-selective resins have been used for?

A. An anionic form
B. A chloride ion
C. Arsenic removal
D. The regeneration process
E. Ion exchange
F. None of the Above

292. The resin is usually packed into which missing term, and as contaminated water is passed through the column, contaminant ions are exchanged for other ions such as chloride or hydroxide in the resin?

A. Ion exchange
B. The regenerating solution
C. A column
D. Bed regeneration
E. Exchanged ions
F. None of the Above

293. Ion exchange is often preceded by treatments such as _____ to remove organics, suspended solids, and other contaminants that can foul the resins and reduce their effectiveness.
A. An anionic form D. The regeneration process
B. A chloride ion E. Filtration and oil-water separation
C. Arsenic removal F. None of the Above

294. Which of the following terms resins must be periodically regenerated to remove the adsorbed contaminants and replenish the exchanged ions?
A. Ion exchange D. More frequent bed regeneration
B. The regenerating solution E. Replenish the exchanged ions
C. A column F. None of the Above

295. The volume of spent regeneration solution ranges from 1.5 to 10 percent of the treated water volume depending on the feed water quality and type of unit?
A. An anionic form D. The regeneration process
B. A chloride ion E. Ion exchange
C. Arsenic removal F. None of the Above

296. The number of which missing term that can be treated before regeneration is needed can range from 300 to 60,000?
A. Ion exchange bed volumes D. More frequent bed regeneration
B. The regenerating solution E. Replenish the exchanged ions
C. A column F. None of the Above

Factors Affecting Ion Exchange Performance
297. Valence state - As(III) is generally not removed by?
A. An anionic form D. The regeneration process
B. A chloride ion E. Ion exchange
C. Arsenic removal F. None of the Above

298. Which of the following terms can reduce the effectiveness of ion exchange if ions in the resin are replaced by ions other than arsenic, resulting in a need for more frequent bed regeneration?
A. Ion exchange D. Frequent bed regeneration
B. The regenerating solution E. Replenishing the exchanged ions
C. Exchange ion F. None of the Above

299. Fouling - The presence of organics, suspended solids, calcium, or iron, can cause this _____ of ion exchange resins.
A. An anionic form D. The regeneration process
B. A chloride ion E. Fouling
C. Arsenic removal F. None of the Above

300. Presence of trivalent iron - The presence of Fe (III) could cause arsenic to form complexes with the iron that are not removed by?
A. Ion exchange D. More frequent bed regeneration
B. The regenerating solution E. Replenish the exchanged ions
C. A column F. None of the Above