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Continuing Education Course #386
Introduction to Planning of Desalination Projects

1. Which of the following is not a main consideration in the initial planning of desalination projects:
 - a. the area the desalination plant must serve
 - b. the type of water use
 - c. the useful life of desalination membrane elements
 - d. the water demand and quality requirements
2. What does project definition entail?
 - a. identifying the contractors to build the desalination plant
 - b. selecting the supplier of membrane elements
 - c. defining the type of cartridge filters for seawater pretreatment
 - d. identifying site location, intake and discharge type and configurations
3. Which entity typically determines the area to be served by a new desalination plant?
 - a. the local environmental permitting agency
 - b. the local water authority
 - c. the local fire department
 - d. the vendors supplying equipment to the desalination project
4. Which of the following areas are not suitable for locating drinking water desalination plants.
 - a. Areas near main highways
 - b. Areas in close proximity to the source of saline water
 - c. Environmental protection zones
 - d. Areas close to existing drinking water reservoirs
5. Typical land requirement, for the site of plant with fresh water production capacity of 100,000 m³/day is:
 - a. 10,000 - 14,200 m²
 - b. 18,200 - 24,300 m²
 - c. 26,300 - 34,400 m²
 - d. 36,400 - 48,600 m²
6. Which of the following developments located in the vicinity of the intake wellfield of desalination plant will not be a source of contamination of the saline source water?
 - a. Hazardous waste landfill
 - b. Cemetery
 - c. Airport
 - d. Military site
7. Vertical beach wells are the most common type of intake for SWRO plants with production capacity of:
 - a. less than 10,000 m³/day
 - b. between 20,000 - 50,000 m³/day

- c. between 50,000 - 200,000 m³/day
- d. over 200,000 m³/day
8. Well intakes may cause heavy fouling of the downstream reverse osmosis membranes if the water they collect has high concentration of:
- a. iron
- b. sodium
- c. chloride
- d. bromide
9. Impingement and the associated negative environmental impact of open intake screen operations is reduced by:
- a. using reverse osmosis membranes with lower salt rejection
- b. using two sets of screens in series
- c. installing membrane pretreatment system for seawater filtration
- d. reducing the water velocity through the intake screens
10. Why should source water quality data be gathered over an extended period of time rather than a once-off collection?
- a. To decrease the project planning budget
- b. To satisfy the environmental lobby groups
- c. Because water quality can vary significantly over time
- d. Because the pretreatment membranes are made of plastic material
11. Which of the following statements is false?
- a. RO facilities typically contribute more than 60% of construction and O&M costs
- b. brackish groundwater is preferred as source water as its lower salinity results in significantly lower desalination costs
- c. saline source water quality has impact on plant operations
- d. algal blooms have no impact on saline source water quality
12. Single pass SWRO systems typically generate permeate within regulatory requirements for drinking water, with concentrations of:
- a. TDS <2,000 mg/L, chlorides of 500 to 15,000 mg/L and sodium of 200 to 1000 mg/L
- b. TDS of 300 to 500 mg/L, chlorides of 150 to 240 mg/L and sodium of 90 to 180 mg/L
- c. TDS < 5 mg/L, chlorides <0.5 mg/L and sodium < 1 mg/L
- d. TDS > 10,000 mg/L, chlorides < 2,000 mg/L and sodium > 5,000 mg/L
13. The mineral content of desalination plant permeate in terms of sodium and chloride is not impacted by the:
- a. pre-treatment system
- b. content of sodium and chloride in the saline source water
- c. RO membrane salt rejection
- d. source water temperature
14. No taste and odor changes are likely to occur when desalinated water is blended with surface water sources, when the concentration of bromide in desalinated water is:
- a. < 0.4 mg/L
- b. the same as in the source water
- c. > 0.4 mg/L
- d. > 1 mg/L
15. While desalinated seawater produced by SWRO systems usually contains an order of magnitude lower level of organics than most traditional fresh water sources, the following organics can cause concern due to their molecular weight being comparable with SWRO membrane rejection size:

- a. yessotoxin
 - b. okadaic acid
 - c. domoic acid and saxitoxin
 - d. brevetoxin, microcystin and nodularin
16. In terms of pathogen removal by the SWRO membranes, which one of the following statements is true:
- a. SWRO membrane systems are an absolute barrier for microbial contaminants
 - b. Instruments for inline measurement of pathogen content in RO permeate are widely used in practice
 - c. the expected pathogen removal of SWRO membranes is 4 to 6-logs
 - d. SWRO membranes typically achieve less than 1 log (99%) of pathogen removal
17. As compared to desalinated water produced by SWRO systems, the product water of BWRO facilities typically has:
- a. relatively higher levels of sodium and chloride
 - b. relatively lower levels of sodium and chloride
 - c. relatively lower content of ions other than sodium and chloride
 - d. relatively higher content of algae
18. Which of the following statements is incorrect:
- a. Desalinated water usually has significantly lower levels of calcium and magnesium as compared with fresh surface water sources.
 - b. Blending desalinated seawater with surface water always results in the improvement of the water quality of the blended water.
 - c. Blending of desalinated water with drinking water may have either positive or negative impact on the blended water quality.
 - d. Blending of low-DBP desalinated seawater with surface water of high DBP content can increase the overall DBP concentration of the drinking water.
19. Elevated content of boron above 1 mg/L in the desalinated water may have impact on its suitability for agricultural and horticultural irrigation - true or false?
- a. True
 - b. False
20. Which of the following water uses may require producing desalinated water of quality better than that meeting drinking water regulations:
- a. industrial water use of ultrapure water
 - b. toilet flushing
 - c. car washing
 - d. street cleaning
21. What is the most common method for disposal of concentrate from seawater desalination plants:
- a. Discharge to sanitary sewer
 - b. Surface discharge via ocean outfall
 - c. Evaporation in ponds
 - d. Zero Liquid Discharge systems
22. Which one of the following waste streams generated in a typical desalination plant is the largest:
- a. spent filter backwash water from the plant pretreatment facilities
 - b. debris collected by the intake screens
 - c. spent chemicals from periodic RO membrane cleaning
 - d. concentrate (brine) generated by the desalination process

23. Which of the following concentrate water quality parameters is difficult to predict based on chemical characterization?

- a. whole effluent toxicity
- b. concentration of various minerals contained in the brine
- c. total dissolved solids (TDS) concentration of the brine
- d. conductivity of the brine

24. Comparing granular and membrane filter pretreatment systems, which statement is true:

- a. both systems produce the same amount of backwash water
- b. membrane systems require more coagulant than granular systems
- c. membrane systems typically produce more backwash water than granular systems
- d. granular media filtration systems occupy more space than membrane pretreatment systems

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