Water treatment

1. Introduction
2. Source water picking up contaminants
3. Source of contaminants
4. Goal of treating water
5. Basic treatment process
6. Intakes crib and structure, and wet wells
7. Submerged intake structures
8. Exposed intake structures
9. Wet intake structures
10. Dry intake structures
11. River intake structures
12. Reservoir intake structures
13. Lake intake structures
14. Canal intake structures
15. Other intake structures
16. Screening incoming water
17. Introduction
18. Screen types
19. Maintenance of screening equipment
20. Pre-sedimentation and other pretreatment processes
21. Introduction
22. Types of pre-sedimentation processes
23. Operations and maintenance of pre-sedimentation system
24. Low lift pump well (centrifugal pump)
25. Introduction
26. Types of heads
27. Components of the low lift pump and their functions
28. Operation of the low lift pump
29. Starting a low lift pump
30. Stopping a low lift pump
31. Common pump problems and their cases
32. Pump maintenance and safety
33. Valves
34. Introduction
35. Types of valves
36. Surge chamber
37. Motor and motor control
38. AC power generation
39. Power distribution
40. Importance, types, and operational concern with standby power
41. Motor
42. Motor control
43. Online instrumentation through the water treatment
44. Introduction
45. Turbidity
46. Introduction
47. Definition
48. Instrumentation/sensor(s) and theory of operation
49. Field calibration
50. Regulation(s)
51. Typical values
52. Particle counter
53. Introduction
54. Definition
55. Instrumentation/sensor(s) and theory of operation
56. Comparison between turbidity meter and particle counter
57. Field calibration
58. Regulation(s)
59. Typical values
60. Temperature
61. Introduction
62. Definition
63. Instrumentation/sensor(s) and theory of operation
64. Field calibration
65. Regulation(s)
66. Typical values
67. pH
68. Introduction
69. Definition
70. Instrumentation/sensor(s) and theory of operation
71. Field calibration
72. Regulation(s)
73. Typical values
74. Conductivity
75. Introduction
76. Definition
77. Instrumentation/sensor(s) and theory of operation
78. Field calibration
79. Regulation(s)
80. Typical values
81. Primary disinfection – pre-chlorination or ozone
82. Introduction
83. Pre-chlorination process
84. Forms of chlorine and methods of delivering
85. Chlorine gas and delivering equipment
	* 1. Chlorine safety precaution
		2. Proper safety procedures
		3. Emergency assistance for chlorine leaks
86. Calcium hypochlorite and delivering equipment
87. Sodium hypochlorite and delivering equipment
88. Source water possibly contain trihalomethanes (TTHMs) and haloacetics (HAA5s) acids
89. Methods of determining the presence of DBP
90. Activated carbon to remove TTHMs
91. Regulations regarding TTHMs and HAA5s
92. Chlorine (pre-chlorination)
93. Introduction
94. Definition
95. Instrumentation/sensor(s) and theory of operation
96. Field calibration
97. Regulations
98. Typical values
99. Ozone
100. Introduction
101. Principle behind the ozone generator
102. Properties of ozone
103. Ozone safety precaution
104. Sources of ozone leaks
105. Detecting leaks
106. Small/minor leaks
107. Major leaks
108. Presence of ozone in ambient air
109. Ozone contactor(s) and diffusers
110. Solubility of ozone in water
111. Introduction
112. Water temperature
113. Water pressure
114. Oxygen flow rate
115. Amount of contaminants
116. Ozone concentration
117. pH of the incoming raw water
118. Conclusion
119. Reactions between dissolved ozone and remaining constituents
120. Dissolved ozone measurement
121. Contact time calculation
122. Removal of residual ozone off-gas
123. Coagulation
124. Introduction
125. Types of equipment that are used in the coagulation process
126. Coagulation basin with rapid mix pump/flash mixer
127. Types of coagulants and coagulant aids used
128. Methods of delivering coagulants
129. Volumetric pump
130. Solution/metering pump
131. Factors affect the coagulation
132. Enhanced coagulation
133. Methods of measuring the effectiveness of coagulation addition
134. Reduction in turbidity (Jar testing)
135. Streaming current monitor
136. Reduction in pH
137. Calculation for dosing
138. Principles of coagulation
139. Factors affecting coagulation
140. Flocculation
141. Introduction
142. Principles of flocculation
143. Factors affecting flocculation
144. Settling (Sedimentation)
145. Introduction
146. Types of basins
147. Basin zones
148. Parts of a sedimentation basin
149. Operation of the sedimentation basin
150. Detention time
151. Calculation for detention time
152. Calculation for surface overflow rate (OR)
153. Monitoring the process
154. Operating problems
155. Maintenance of the sedimentation basin
156. Sludge removal
157. Sludge disposal
158. Summary
159. Filtration
160. Introduction
161. Filtration process
162. Types of filtration
163. Gravity
164. Pressure
165. Conventional treatment (open gravity filtration)
166. Direct filtration
167. Biologically active filters
168. Types of gravity filters
169. Shmutzdecke
170. Equipment associated with gravity filters
171. Filter tanks
172. Filter media
173. Media size
174. Underdrain system
175. Sand detectors
176. Wash-water troughs
177. Filter bed agitation
178. Filter control equipment
179. Operation of gravity filters
180. Filter operation methods
181. Filter bed ripening
182. Filter bed media in operation
183. Calculate the filtration rate
184. Monitoring filter operation
185. Filter bed maintenance
186. Bed depth
187. Bed expansion
188. Filter core and solids retention
189. Factors for replacing filter media
190. Filter operating problems
191. Backwashing
192. Introduction
193. Principle behind backwashing
194. Steps in backwashing a filter bed
195. Calculate the backwash flow rate and the percent of total water production used for backwashing
196. Factors that determine backwash frequency
197. Results of ineffective backwashing
198. Pressure filtration
199. Controls and gauges found on a typical console
200. Clear well
201. Introduction
202. Baffles
203. Isolation and draining clearwell for inspection or repairs
204. Disinfection of clearwell
205. Disinfecting tanks and pipes
206. Post-chlorination & ammonia Disinfection)
207. Introduction
208. Disease-causing (pathogenic) organisms
209. Post-chlorination
210. Disinfection method
211. Principle of UV in inactivating pathogens
212. Limitation of UV disinfection
213. Chemical treatment
214. Chlorine chemistry
215. Chlorine chemicals and their relative chlorine content
216. Various forms of chlorine used for water disinfection
217. Chlorine chemistry
218. Minimum chlorination residual
219. Factors that affect the success of chlorination
220. Define T10 and how it is determined
221. Define CT value and list the variables needed to determine a required CT value
222. Explain how to calculate chlorine feed rate
223. Control tests
224. Chlorine residual test
225. Online chlorine analyzers to monitor chlorine
226. The frequency of testing disinfectant residual in a water distribution system
227. Addition of ammonia to chlorinated water
228. Introduction
229. Water softening
230. Testing for ammonia
231. Regulations
232. The total inactivation/removal for Giardia Lamia cysts and viruses required by the EPA Surface Water Treatment Rule
233. Maximum residual disinfectant level (MRDL) and list the MRDL for chlorine, chloramines and ozone
234. Removal credit given for a well-operated conventional plant and resultant disinfection levels required
235. Bacteriological test
236. Introduction
237. Bacteriological monitoring requirements for surface water suppliers
238. Maximum contaminant level (MCL) for bacteria in surface water
239. Preparation of a bacteriological sampling bottle for testing for chlorination
240. Perform a bacteria analysis
241. An ‘unsafe” bacteriological sample
242. When public notification is required
243. Fluoride
244. Introduction
245. Supporting evidence of the fluoride benefits
246. Fluoridation is practiced
247. Acceptable range, and optimum levels for fluoridation
248. Common fluoride compounds in surface water treatment
249. Safety
250. Chemical feeders
251. Introduction
252. Dry feeders
253. Solution feeders
254. Other feeders systems
255. Auxiliary equipment
256. Operation of the fluoridation process
257. Fluoridation operating problems
258. Calculating fluoride feed rate
259. Control tests
260. Online fluoride analyzer to monitor fluoride
261. Frequency of testing fluoride in a water distribution system
262. Corrosion and scaling control of iron and lead
263. Introduction
264. Corrosion control chemistry of iron
265. Scale formation of iron
266. Factors affecting scale formation of iron
267. How did lead get into the water supply?
268. Prior to the distribution system and the customers plumbing
269. At the distribution system and the customers plumbing
270. How does lead leach or mobilize into the water supply? (corrosion chemistry of lead)
271. Health concerns of lead in the water supply
272. Factors affecting corrosion of iron and lead
273. Corrosion and scaling control chemicals
274. Corrosion control chemicals and chemical feed equipment
275. Corrosion and scaling control methods
276. Choice of proper corrosion control treatment methods or chemicals
277. Operational control
278. Common operating problems
279. Calculating orthophosphate feed rate
280. Testing methods used to establish corrosive and deposition potential of finished water
281. Online phosphate analyzer to monitor orthophosphate
282. Frequency of testing phosphate in the a water distribution system
283. Calculation for calcium carbonate saturation
284. Monitoring requirement (Lead and copper rule)
285. Safety
286. Introduction
287. Definition
288. Sources of potential hazardous areas or situations that exist at a surface water facility
289. Sources of potential hazardous areas or situations that exist in the water laboratory
290. Cause of accidents
291. Corrective actions or proper safety procedures/equipment
292. Protective measures used to store and handle water treatment chemicals
293. List of the corrective actions when working with chemicals
294. Safety policy
295. Definition
296. What is included in the safety policy?
297. Who writes the safety policy and implements them?
298. Responsible parties
299. Example of a safety policy
300. Safety equipment
301. introduction
302. Fire extinguishers
303. Personal protective equipment
304. Self-contained breathing apparatus
305. Confined space
306. Introduction
	* 1. Fall safety equipment
		2. Confined space hoist system/tripod
		3. Fall safety harness
		4. Monitoring equipment
307. Summary
308. Lockout-tagout devices
309. Introduction
310. Definition of lockout
311. Definition of tagout
312. Definition of energy-isolating device
313. Definition of hazardous energy
314. Is lockout and hazardous energy control the same thing?
315. Examples of lockout-tagout equipment
316. OSHA standard for lockout/tagout
317. Examples of lockout procedures
318. Chemical receiving
319. Receiving laboratory chemicals
320. Receiving bulk chemicals from tankers
321. Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS
322. Introduction
323. SDS Heading (includes a description of all 16 sections)
324. Globally Harmonized System of Classification and Labeling of Chemical(GHS)
325. Introduction
326. Definition
327. Purpose
328. Label requirements
329. Label Elements
330. Pictogram and DOT
331. Chemical storage
332. Introduction
333. Random storage
334. Alphabetical storage
335. Storage Method
336. Introduction
337. Flinn storage method
338. Storage of chemicals
339. Introduction
340. Consideration for storing chemicals
341. Labeling
342. Storage Criteria
343. Refrigeration storage
344. Visual inspection
345. Miscellaneous
346. Disposal
347. Introduction
348. 5 Most Common (Deadly and EPA-Fineable) Errors in Waste Handling
349. Disposal concepts
350. Satellite containers
351. Checklist for proper requirements of waste containers
352. Water monitoring & quality within the plant
353. Regulations