Dear WTP ​community ​fellow members, ​

I am currently ​in the process ​of putting ​together a ​training manual ​for Water treatment entry ​level ​professionals. ​

Existing ​manuals cover a ​lot of ​information ​that can be ​overwhelming ​and may not ​pertain to ​specific plant ​layout, or are ​too technical ​that can be ​frustrating and ​confusing for ​entry level ​professionals. ​

My focus is to ​cover the ​basics of plant ​treatment ​operation, in a ​user-friendly ​way. This ​manual can also ​be used as a ​guide for ​studying for a ​certification ​exam or as a ​reference ​material. I ​would like to ​know from you ​all which ​topics I should ​be addressing ​in this manual. ​

Some of the ​topics I want ​to cover are: ​

* Operation of ​the water ​treatment ​
* The instrumentation ​and controls ​
* Chemistry that ​make the ​process work ​
* The regulations ​that utilities ​are required to ​follow ​
* Factors ​affecting the ​water quality ​
* Lab testing procedures

Please see below the expanded outline. If there is anything missing, questionable, or unclear, please let me know and I will explain the item in detail or add to my manual.

Your feedback ​will help me to ​create a ​training manual ​for Waste water ​treatment entry ​level ​professionals. ​

Thanks for your input!

Peter

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**Water Treatment Plant Operation**

1. Introduction
2. Source of contaminants
   1. Source water picking up contaminants
3. Goal of treating water
4. Basic treatment process
5. Intakes crib and structure, and wet wells
   1. Submerged intake structures
   2. Exposed intake structures
   3. Wet intake structure
   4. Dry intake structures
   5. River intake structures
   6. Reservoir intake structures
   7. Lake intake structures
   8. Canal intake structures
   9. Other intake structures
6. Screening incoming water
   1. Introduction
   2. Screen type
   3. Maintenance of screening equipment
7. Pre-sedimentation and other pretreatment processes
   1. Types of pre-sedimentation processes
   2. Operations and maintenance of pre-sedimentation system
   3. Low lift pump well (centrifugal pump)
8. Types of heads
   1. Components of the low lift pump and their function
   2. Operation of the low lift pump
   3. Starting a low lift pump
   4. Stopping a low lift pump
   5. Common pump problems and their cases
   6. Pump maintenance and safety
9. Valves
   1. Introduction
   2. Types of valves
   3. Surge chamber
10. Motor and motor control
    1. Motors
    2. Motor Control
11. Power Generation and Distribution
    1. AC Power Generation
    2. Importance, types, and operational concern with standby power
12. Online instrumentation
    1. Introduction
13. Turbidity
    1. Introduction
    2. Definition
14. Instrumentation/sensor(s) and theory of operation
    1. Sensors
       1. Temperature
       2. Particle counters
       3. Turbidity
       4. PH
       5. Conductivity
    2. Field calibration
    3. Typical Valves
    4. Comparison of turbidity meters and particle counters
    5. Field calibration
15. Primary Disinfection- pre –Chlorination or Ozone
    1. Pre-chlorination or Ozone
    2. Forms of Chlorine and Methods of Delivery
    3. Chlorine (pre-Chlorination)
    4. Chlorine Gas and Delivering equipment
    5. Safety
       1. Proper safety procedures
       2. Chlorine Safety precaution
       3. Emergency assistance for Chlorine leaks
    6. Calcium hypochlorite and delivering equipment
    7. Sodium hypochlorite and delivering equipment
16. Ozone
    1. Principle behind the ozone generator
    2. Properties of ozone
    3. Ozone safety precaution
    4. Sources of ozone leaks
    5. Detecting leaks
    6. Small/minor leaks
    7. Major leaks
    8. Presence of ozone in ambient air
    9. Ozone contactor(s) and diffusers
    10. Solubility of ozone in water
    11. Reactions between dissolved ozone and remaining constituents
    12. Dissolved ozone measurement
    13. Contact time calculation
    14. Removal of residual ozone off-gas
17. Source water possibly contain trihalomethanes (TTHMs) and haloacetics (HAA5s) acids
    1. Methods of determining the presence of DBP
    2. Activated carbon to remove TTHMs
    3. Regulations regarding TTHMs and HAA5s
18. Coagulation
    1. Principles of coagulation
    2. Factors of coagulation
    3. Types of equipment that are used in the coagulation process
    4. Coagulation basin with rapid mix pump/flash mixer
    5. Types of coagulants and coagulant aids used
    6. Methods of delivering coagulants
    7. Volumetric pump
    8. Solution/metering pump
    9. Factors affecting the coagulation
    10. Enhanced coagulation
    11. Methods of measuring the effectiveness of coagulation addition
19. Reduction in turbidity (Jar testing)
20. Streaming current monitor
21. Reduction in pH
22. Flocculation
    1. Principles of flocculation
    2. Factors affecting flocculation
23. Settling (Sedimentation)
    1. Introduction
    2. Types of basins
    3. Basin zones
    4. Parts of a sedimentation basin
    5. Operation of the sedimentation basin
    6. Detention time
    7. Calculation for detention time
    8. Calculation for surface overflow rate (OR)
    9. Monitoring the process
    10. Operating problems
    11. Maintenance of the sedimentation basin
    12. Sludge removal
    13. Sludge disposal
    14. Summary
24. Filtration
    1. Introduction
    2. Filtration process
    3. Types of filtration
    4. Gravity
    5. Pressure
    6. Conventional treatment (open gravity filtration)
    7. Direct filtration
    8. Biologically active filters
    9. Types of gravity filters
    10. Shmutzdecke
    11. Equipment associated with gravity filters
        1. Filter tanks
        2. Filter media
        3. Media size
        4. Underdrain system
        5. Sand detectors
        6. Wash-water troughs
    12. Filter bed agitation
    13. Filter control equipment
    14. Operation of gravity filters
    15. Filter operation methods
    16. Filter bed ripening
    17. Filter bed media in operation
    18. Calculate the filtration rate
    19. Monitoring filter operation
    20. Filter bed maintenance
    21. Bed depth
    22. Bed expansion
    23. Filter core and solids retention
    24. Factors for replacing filter media
    25. Filter operating problems
    26. Backwashing
        1. Introduction
        2. Principle behind backwashing
        3. Steps in backwashing a filter bed
        4. Calculate the backwash flow rate and the percent of total water production used for backwashing
        5. Factors that determine backwash frequency
        6. Results of ineffective backwashing
    27. Pressure filtration
25. Controls and gauges found on a typical console
26. Clear well
    1. Introduction
    2. Baffles
    3. Isolation and draining clearwell for inspection or repairs
    4. Disinfection of clearwell
    5. Disinfecting tanks and pipes
27. Post-chlorination & ammonia Disinfection
    1. Introduction
    2. Disease-causing (pathogenic) organisms
    3. Post-chlorination
    4. Disinfection method
    5. Principle of UV in inactivating pathogens
    6. Limitation of UV disinfection
    7. Chemical treatment
    8. Chlorine chemistry
       1. Chlorine chemicals and their relative chlorine content
       2. Various forms of chlorine used for water disinfection
       3. Minimum chlorination residual
       4. Factors that affect the success of chlorination
       5. Define T10 and how it is determined
       6. Define CT value and list the variables needed to determine a required CT value
       7. Explain how to calculate chlorine feed rate
       8. Control tests
       9. Chlorine residual test
       10. Online chlorine analyzers to monitor chlorine
    9. The frequency of testing disinfectant residual in a water distribution system
       1. Addition of ammonia to chlorinated water
       2. Introduction
       3. Water softening
       4. Testing for ammonia
28. Regulations
    1. The total inactivation/removal for Giardia Lamia cysts and viruses required by the EPA Surface Water Treatment Rule
    2. Maximum residual disinfectant level (MRDL) and list the MRDL for chlorine, chloramines and ozone
    3. Removal credit given for a well-operated conventional plant and resultant disinfection levels required
    4. Bacteriological test
       1. Introduction
       2. Bacteriological monitoring requirements for surface water suppliers
       3. Maximum contaminant level (MCL) for bacteria in surface water
       4. Preparation of a bacteriological sampling bottle for testing for chlorination
       5. Perform a bacteria analysis
       6. An ‘unsafe” bacteriological sample
       7. When public notification is required
    5. Fluoride
       1. Introduction
       2. Supporting evidence of the fluoride benefits
       3. Fluoridation is practiced
       4. Acceptable range, and optimum levels for fluoridation
       5. Common fluoride compounds in surface water treatment
       6. Operation of the fluoridation process
       7. Fluoridation operating problems
29. Chemical feeders
    1. Introduction
    2. Dry feeders
    3. Solution feeders
    4. Other feeders systems
    5. Auxiliary equipment
    6. Calculating fluoride feed rate
       1. Control tests
       2. Online fluoride analyzer to monitor fluoride
       3. Frequency of testing fluoride in a water distribution system
    7. Corrosion and scaling control of iron and lead
       1. Introduction
       2. Corrosion control chemistry of iron
       3. Scale formation of iron
       4. Factors affecting scale formation of iron
       5. How did lead get into the water supply?
          1. Prior to the distribution system and the customers plumbing
          2. At the distribution system and the customers plumbing
          3. How does lead leach or mobilize into the water supply? (corrosion chemistry of lead)
          4. Health concerns of lead in the water supply
          5. Factors affecting corrosion of iron and lead
       6. Corrosion and scaling control chemicals
          1. Corrosion control chemicals and chemical feed equipment
          2. Corrosion and scaling control methods
          3. Choice of proper corrosion control treatment methods or chemicals
30. Operational control
    1. Common operating problems
    2. Calculating orthophosphate feed rate
    3. Testing methods used to establish corrosive and deposition potential of finished water
    4. Online phosphate analyzer to monitor orthophosphate
    5. Frequency of testing phosphate in the a water distribution system
    6. Calculation for calcium carbonate saturation
    7. Monitoring requirement (Lead and copper rule)
31. Safety
    1. Introduction
    2. Definition
    3. Sources of potential hazardous areas or situations that exist at a surface water facility
    4. Sources of potential hazardous areas or situations that exist in the water laboratory
    5. Cause of accidents
    6. Corrective actions or proper safety procedures/equipment
    7. Protective measures used to store and handle water treatment chemicals
    8. List of the corrective actions when working with chemicals
    9. Safety policy
       1. Definition
       2. What is included in the safety policy?
       3. Who writes the safety policy and implements them?
       4. Responsible parties
       5. Example of a safety policy
       6. Safety equipment
          1. Introduction
          2. Fire extinguishers
          3. Personal protective equipment
          4. Self-contained breathing apparatus
          5. Confined space
             1. Introduction
             2. Fall safety equipment
             3. Confined space hoist system/tripod
             4. Fall safety harness
          6. Monitoring equipment
             1. Summary
             2. Lockout-tagout devices

Introduction

Definition of lockout

Definition of tagout

Definition of energy-isolating device

Definition of hazardous energy

Is lockout and hazardous energy control the same thing?

Examples of lockout-tagout equipment

OSHA standard for lockout/tagout

Examples of lockout procedures

Chemical receiving

Receiving laboratory chemicals

Receiving bulk chemicals from tankers

Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS

1. SDS Heading (includes a description of all 16 sections)
   1. Globally Harmonized System of Classification and Labeling of Chemical(GHS)
   2. Introduction
   3. Definition
   4. Purpose
   5. Label requirements
   6. Label Elements
   7. Pictogram and DOT
2. Chemical storage
   1. Introduction
   2. Random storage
   3. Alphabetical storage
   4. Storage Method
   5. Introduction
   6. Flinn storage method
   7. Storage of chemicals
   8. Consideration for storing chemicals
   9. Labeling
   10. Storage Criteria
   11. Refrigeration storage
   12. Visual inspection
   13. Miscellaneous
   14. Disposal
3. Five Most Common (Deadly and EPA-Fineable) Errors in Waste Handling
   1. Disposal concepts
   2. Satellite containers
   3. Checklist for proper requirements of waste containers