Water supply and sanitary engineering lecture notes pdf

General water Academia.edu no longer supports the Internet Explorer.To browse the Academia.edu and the wider Internet faster and more securely, please take a few seconds to update the browser. Academia.edu uses cookies to personalize content, adapt ads, and improve user experience. Using our website, you agree to our collection of information using cookies. To find out more, check out our Privacy Policy. SANITARY AND ENVIRONMENTAL ENGINEERING (1) LECTURES NOTES Dr. Ahmed Sif Dr. Emad Hamdi WATER COUSCATION ENGINEERING 3RD GOD CIVIL ENG. ENVIRONMENTAL ENGINEERING DEP. 2. INTRODUCTIO N Environmental design is essential for the development of facilities for environmental protection and for the proper management of natural resources. The environmental engineer pays special attention to biological, chemical and physical reactions in the air, terrestrial and aquatic environment, as well as improved technology of integrated control systems, including reuse, recycling and restoration work. 3. SANITARY ENGINEERING This is a engineering industry responsible for providing communities with drinking water and getting rid of the resulting sewage. Sanitary engineering, including these four categories of water-ochemite systems, the water supply network of the wastewater treatment system of the wastewater treatment system 3rd year 4th year 4. Rain 1 2 3 4 Water sources in nature 5. SOURCE WATER 1- Rainwater The cleanest source of water Rich with dissolved oxygen (corrosion) and can cause acidic rains over industrial zones Small suspended content of solids (dust or sand) due to the washing of the earth Can be stored and used after filtration 6. CHARACTERISTICS WATER SOURCE CONT. 2- Ground water High content of dissolved solids Different properties depending on the limiting soil Due to the filtration of nature almost no content of suspended solids Can be used from a depth of more than 40 m 7. 3- Surface water Low content of dissolved solids with high suspended solids and bacterial content Highly contaminated due to misuse of Relatively large quantities can be used after processing (cleaning) CHARACTERISTICS OF WATER SOURCES cont. 8. 4. Seawater Very high content of dissolved solids over 35,000 (p.p.m) (part per million mg/litre-g/m3) Can be used after treatment (desalination) cost should be considered CHARACTERISTICS OF WATER SOURCES cont. 9. FLOW LINE TRACK OF SURFACE WATER TREATMENT Water source Plain sedimentation, chemical coagulation, settler tube plate (Lamella), Pulsator Collection works deposits filtering the storage of heat, chemicals, light / radiation disinfection Ground Tank Network, Elevated Reservoirs Slow and Fast Sand Filters, Double and Multimedia Filters 10. DATA REQUIRED TO SUPPLY A CITY BY WATER 1- Design period 2-Population Design (current and forecasting) forecasting) Stream 4- General Plan (water source, city development plans . . . etc.) 11. DESIGN PERIOD Factors influencing the design period of 1- Useful life of various components of the water supply system Concrete structures 40 - 50 years Tube 40 - 50 years Mechanical parts 20 - 25 years Electrical parts 15 - 20 years 12. Factors influencing the design period cont. 2- Population Growth Rate High Rates - Reducing the Design Period Low Period - Increasing the Design Period 3-Easy Expansion Easy Expansion - Reducing the Design Period Hard Extension - Increasing the Design Period 4- Percentage Breakdown 5- Primary Performance Of System Units 13. THE DESIGN OF THE POPULATION IS 14. POPULATION FORECASTING-There are different methods for assessing the future of the population: 1- Arithmetic Method: this method is a phase 2 chart of population growth population increase deemed permanent for each permanent duration of Pn and P0 ka . (t n - t 0) Where: Pn - future population at that time n P0 - the current population ka - rate of change in population P Δ Δ 15. POPULATION FORECASTING2- Geometric method: this method is a stage 1 population growth chart, population growth rates are considered constant for each constant duration of ln Pn and ln P0 and kg. (t n - t 0) Where: Pn - future population at the time n P0 - the current population kg - the rate of population change t P kg Δ Δ 16. POPULATION FORECASTING 3 - Reducing the rate of increase in saturation method : this method represents a phase 3 chart of population growth as the rate of population growth decreases, as the population approaches saturation level (S) P N S - (S - P 0) K d'(t n - t 0) Where: Pn - future population at the time n P0 - current population kd - rate of population change t PS kd Δ (Δ)) POPULATION FORECASTING4- Growth Rate Method : P n q P 0 (1 g) n Where: Pn - Future Population at the time n P0 - current population r - annual growth rate 5- Population density method : a- P - region - population density b- P - No. housing units - population density per unit 18. POPULATION FORECASTING Graphic Methods 6- Graphic Extension Method 7- Graphic Comparison Method 19. WATER FREE The amount of water consumed (litre/per capita/day) Types of water consumption according to the use of 1- Domestic (50%) 2- Industrial (15%) 3- Commercial (15%) 4- Public (20%) Losses and demand for fires (F.D.) F.D. (litre/sec) - 20 - population / 10,000 F.D. (m3/d) - 120 - population / 10,000 20. Factors influencing water consumption 1- City Size 2- Living Standards 3- Climate 4- Pressure and Water quality 5- Sewerage 6- Cost 21. CONSUMPTION 22. The types of water consumption according to the design of Ave W C ave Population comparison between cities maximum » »1.2-1.6» . . distribution lines : max hour - 2.5 - Ave Design of minor distribution lines 23. WATER CONSUMPTION FORECASTING1- Rate of increase method : W.C n . W.C 0 (1 - r) n Where: W.Cn - future W.C. while n W.C0 - real population r' - the rate of growth in water consumption ≈ 10% population growth rate 2% increase method a) % increase WC (p n / P 0) 0.125 - 1 (b) % increase WC ((P n/ P 0) 0.11 - 1 (W.C n and W.C 0 (1 % - increase 24. Suggests a study of water quality: 1.Determine the degree of pollution. 2.Determine the design stages of the water purification process, (drinking water - industrial water - swimming ponds). Evaluation of medical units. 4.Check WTP runoff with environmental. WATER QUALITY 25. WATER CHARACTERISTICS 1. Physical characteristics. 1.1 Temperature. 1.2 Color : Colorless. 1.3 Odor: No smell. 1.4 Turbitability : Measurements of turbidity are made by muddy-meters in terms (NTU), (FTU), and (JTU). There is no direct link between NTU or FTC readings and JTU readings. NTU is a standard measure requiring the use of a non-flemelber that measures the amount of light scattered, usually 90o from the direction of light, suspended by particles in a water test sample. 26. TURBITIM METERS 27. WATER CHARACTERISTICS 1. Physical characteristics. 1.5 Suspended solids : Those solids that are stored by the fiberglass filter and dried to a permanent weight at 103-105o C. Method: a well-mixed sample is filtered through the standard GF/F fiberglass filter, and the residues stored on the filter are dried to a permanent weight at 103-105o C. WATER CHARACTERISTICS 1. Physical characteristics. 1.6 Dissolved solids : Method: A well-mixed sample is filtered through a standard glass fiber filter. The filter evaporates to dry in the weighing and is dried to a permanent weight at 180 degrees Celsius. Weight gain dishes are a common dissolved solid body. Note: Suspended and dissolved solids can be measured using suspended and dissolved solids-meters. 29. SOLID METERS 30. WATER CHARACTERISTICS 2. Chemical characteristics. A.Organic tests of ammonia, nitrite and nitrate B. Inorganic tests B.1 pH : measured by pH meters. pH is a measurement of the concentration of hydrogen ions, H. All humans and animals rely on internal mechanisms to maintain their blood pH levels. Blood flowing through our veins should have a pH between 7.35 and 7.45. 31. CHARACTERISTICS OF WATER B.2 Electrical conductivity: it is the measurement of dissolved material in an aquisque solution, which refers to the ability of the material to conduct an electric current through it. 32. FREE WALEB.3 Alkalinity, acidity and salinity. B.4. Solidity. B.5. Chlorides. B.6. Minerals. (Fe, Mn, Mg, Ca,......... Etc.) B.7. Gaza (O2, CO2, H2S, ... ets) 33. 3. Biological characteristics. Source bacteria, viruses, protozoa... Etc.) - Pathogens (harmful bacteria) - An indicator used to indicate a real pathogen. Ideal indicator properties: 1. Applicable for all types of water. 2. Always present when pathogens are present. 3. Nonpatogen for the laboratory. Personal. 4. Have a longer survival time outside OF CHARACTERISTICS OF WATER 34. Impurities in water, their causes and effects impurity Causes the effects of suspended solids Some causes of Silt disease and clay Turbidity algae and the simplest Odor, color and turbidity 35. GROUNDWATER FLOW LINE DIAGRAMS (HIGH D.S.) GW Source Sand - Ceramic - Cartridge Filters Collection Wells Filtering Nano Filters /RO Storage Disinfection Distribution Network Ground Reservoir, Elevated Tanks 36. WATER TREATMENT (IRON AND MANGANESE) GW Source Cascade or Scattered Air Collection Wells Aeration sedimentation and filtration storage disinfection network ground reservoir, elevated reservoirs 37. WATER TREATMENT (HARDNESS REMOVAL) GW heat source - lime - soda - Ion Exchange Collection Wells Soft Precipitation and filtration storage disinfection network ground reservoir, elevated reservoirs 38. COMPONENT COLLECTION 1. The entry structure. 2. Entrance channels. 3. Raw water is the lift pump and sump. 4. Power lines (Force-may). COLLECTION WORKS Works that are performed at a water source in order to transfer enough raw water to treatment plants 39. INPUT TYPES 1. Pipe entrance 2. Coast consumption 3. Underwater (tower) entrance 4. Temporary consumption The main function of water intakes is to - To supply the largest amount of water from sources - to protect pipelines and pumps from damage or clogging as a result of floating and submerged debris. 40. FACTOR INFLUENCES ON CHOICE OF INTAKE STRUCTURE TYPE 1. The width of the water source. 2.Fluctuations of water level 3.Water depth and the nature of the bottom source. Navigation requirements. 5.Influence of currents, floods and storms on the structure. 6.State of pollution of the shore. 41. FACTORS INFLUENCING THE CHOICE OF PLACE 1 OF THE ENTRY STRUCTURE. Upstream served the city to prevent direct pollution. 2. On the direct part of the water source to prevent settlement and scored. 3. A limited area taken around the water intake structure (150 m upstream and 50 m downstream). CONSUMPTION TYPES 1. Water intake pipes (Wide W cannells and 50 m) 2. Coast water intake (Narrow cannells W 50 m, uncontaminated shore) 3. Underwater (Tower) water intake (Narrow cannells W - 50 m, polluted shore) 4. Temporary water intake 43. Pipe Water Intake Channel Main headline Raw P.S. 44. SLUICE VALVES GATE VALVE - 300 MM BUTTERFLY VALVE - 300 MM 45. THE NON-RETURNED LEG VALVE VALVES CHECK VALVE 46. PIPE 1) (Ductile iron) 2) (Чугун) 3) (SS) 4) (GRP) 5) (PVC-u PVC) 6) PE (HDPE и LDPE) 7) (PP) 8)) 9)) . 47. НАСОС S НАСОСЫ ХАРАКТЕРНЫЕ КРИВЫЕ 48. CURVE SYSTEM CURVE PUMPS DUTY POINT T.D.H. - H st. h l and H m - H v 49. Shore consumption 50. Underwater entrance 51. DESIGN OF INTAKE CONDUITS - Number (n) - 2 - Diameter (Фmm) - 200- 250 - 300 - ... - 500 - 600 - ... - 1000 mm. (up to 3200) 10 x 1.5 - yaz (or) 1.10 th P.F. zav - Normal speed 0.6 - 1.5 m/s. Maximum speed on one pipe is broken - 2.5 m/s DESIGN FOR PRESENT AND FUTURE 1. Number (n) No 2 in the future. 2. The allowable speed in the future is from 1.4 to 1.5 m/s, 3. Get the current V.future speed if it is unsafe to close some pipes now 52. Head loss calculation calculated for maximum speed (present or future) v act 0.355 th C and D 0.63 s 0.54 Thus, that V operates Maximum speed (present or future) (m/s) C Fraction Ratio (80-150) takes 120 D - Water intake diameter (m) S - Hydraulic gradient line tilt (m/m) receives (m) H L and L s L - Water intake channel length (m) 53. The total width of each screen (L) - the input channel Φ 0.40 m., the width of the bar (b) 1.0 - 2.0 cm θ. The minimum screen depth (d) (LWL - BL) - 0.5 m 2 - v1 2) / (2 g) - 10 cm. No1 - 1 screen / (L q d) q2 - 1 screen / (n s) DESIGN OF SHORE INTAKE SCREEN 54. Main header design (pipe consumption) - 1.1 mm Future - R.T. - 1 min pumps) - Get Φ Sump Design - R.T. - 2 mins with maximum flow (1.50 - qav.f) - R.T. - 5 mins with minimum flow (0.80 - qav.f) - Volume of RD R.T. - Length (depending on No. pumps) - BL - BL - ∑ HL m - W 1.50 m (for maintenance purposes) 55. 1. Improve the physical characteristics of water by removing the turbidity, color and taste. 2. Destroy any contained bacteria, special pathogenic bacteria. 3. Removal of hard, iron and manganese salts and excessive amounts of gases and salts soluble in water. WATER PURIFICATION TARGETS 56. 1. Slow installation of the sand filter - which consists of a simple deposition followed by slow filtration of sand and disinfection. 2. A fast sand filter plant that consists of chemical coagulation followed by rapid sand filtration and disinfection. Most surface water systems use two water treatment systems: 57. 1. Settlement of discrete (not flocculent) particles. Deposition theory ( ) 2 18 d g v l s - Stoke Law 58. 2. Settlement of flocculent particles. Deposition theory 3. Settlement zone. 4.Compression settlement. Factors affect the effectiveness of deposition: 1. retention time. 2.Horizontal speed. 3.State of the flow. 4.Form, size and specific severity of solids. between the size of the tanks. 6.Surface loading speed. 7. Hydraulic load on out let weir. 8. The entrance and location of the outlet. 9. Suspended concentration of solids in water for treatment. 10.The temperature of the water that needs to be treated. (Specific gravity, viscosity) 60. 1. Flow of laminar flow. 2. The impurity particles are evenly distributed throughout the tank area 3.Case of entry and exit does not affect the efficiency of deposition 4.Settled particles are not reused by assumptions of ideal sedimentary reservoirs of the range of a typical sedimentary reservoir 61. 1 - The walls of the tank should be completely smooth and vertical. 2 - Tank bodies be impervious to water. 3 - At the entrance and exit are installed fans for the distribution of water in a horizontal plane. The requirements of a typical sedimentary tank are 62. 4 - Buffs and barriers to the distribution of water in a vertical plane. The requirements of a typical sedimentary tank are 63. 5 - Ensure a tilt at the bottom of the sludge assembly tank. 6 - The sediment should be removed periodically. The requirements of a typical sedimentary tank are 64. According to the operating technique: 1.Fill and draw (Batch System) In this type of raw water remains a period of deposition inside the sedimentary basin. 2. The flow of flow between the sedimentary basin from the location of the entrances continues, and at the same time the exit of the agreement, the time of retention in the pool is a necessary time of sedimentary rocks. TIPS OTARDION TANKI By Form: 1.Rectangular. 2. Circular 65. The design of the simple sediment of tanks d 1.1 mm 1.10 th P.F ms (m3/d), Get d (m3/hr) g)/working period (hour/d) retention time 2- 5 hours,SLR 25 - 40 m3 /m2 /d-ed / S.A. SVR 15 - 30 m W L R (V-notch Weir) 300 (m3/m/g) W L R (V-notch Weir) 300 (m3/m/g) For rectangular tanks only Vh 0.3 m/min Speed in the entrance and socket of the pipe 0.60 - 1.50 (m/s) 66. Rectangular Sed. Circular Sed tanks. Tanks (explaining circumstances) d 3 - 5m d 3 - 5m b - 2 - 4 y 35m l 🔍/4) No2 DD Tom y nLBd S.A. n 🔍/4 s.A. nLB Lw - n🔍 'Cross.A. nBd Lw - nB 67. V.S. (S.S.R.R.) / (∂ - 106) (1-WC) - N.N. Removal Factor - 90 - 95% ∂ - sludge density - 1.02 (t/m3) WC - water sludge content - 95% n. The minimum diameter of the sludge pipe is 200 mm Sludge removal 68. COAGULATION PROCESS The purpose of removing more solids present in raw water by chemical action. Coagulation theory. The particles are small in size and have a negative electrical charge, means repulsion between it and the stability of these impurities on the ground, which prevents deposition. This theory is based on the disturbance of the state of stability that exist between particles (destabilization), and compilation of the work of these molecules (Aggregation) there are two theories that are used to explain this theory 69. Types of coagulants 1. Alum or Aluminum Sulfate (AL2 (SO4)3 and 18H2O). 2. Ferric and Ferros sulfate. 3. Ferric chloride (spice for colored water) Chemical theory Adding a chemical (coagulant) to raw water that reacts with water alkalinity and produces gelatinous formation (floky.). Physical flox theory. carries a positive charge on its surface, on the other hand, hanging solids carry a negative charge on their surface. The force of attraction appears between them, the suspended solids attached to the surface of the flox, which leads to an increase in the weight of the flox. Faster, it appears, the effectiveness of deposition will increase. 70. Factors affect the effectiveness of clotting 1.Coagulant doses. 2.pH of raw water. 3.Mixing eff. 4.turbidity . Coagulant Optimal pH alum 4 - 7 Fe. 8.5 71 euros. Alum feeding methods 1.Dry feeding Use alum as a powder in the case of insoluble materials. 2. Wet feeding Use of alum in liquid form (solution), better than dry feeding, you need a concentrated alum solution tank to prepare the alum solution. 72. The Jar Test Jar test is used to determine the daily dose of coagulant. Test steps 1. 5 vessels each 1 liter put in them different doses of coagulant. 2. Flash mixing for 30 seconds. (100 - 300 rpm) 3. Gently mixing for 10 minutes (10 - 30 rpm) 4. Precipitation for 30 minutes. 73. Various mixing techniques 1- Mechanical Mixing (Impellers) 2- Hydraulic Mixing 3- Inline Mixing Chemical Components of the Coagulation Process 1- Alum Solution Tanks 2-Flash Mixing Tank (s) 3-Clari-Fluculator/rectangular floculation and sedimentary tanks 74. The design of the Alum Solution Tanks V (I S) / (∂ y 106) Such that V - Alum solution with a volume of 30 - 80 P.P.M ∂ C . Tanks (2 x 3) d 1 x 3 m A, W2 and V1/d Wes Aluma Days) / 106 is designed for 30 days 75. The design of Flash Mixing Tank (🔍 s) R T No. 5 - 60 sec. Design of impellers G (P / q V) - 300 - 700 sec -1 P - Theoretical power - dynamic water viscosity 500 sec-1 Get P P - K s n3 - D5 K - impeller coefficient - 1 S - water density - 1000 (kg/m3 (n - no rotation per sec (1 x 2 p.p. Diameter D and impeller (m) n получить D Таким образом, что D (0,33 и 0,50) диаметр камеры 77. Клари-флокулятор 78. д-й й 1,1 максимальный месяц Предположим, SLR No 25 - 40 (m3 / m2 / d) SA й d / SLR (рабочее время имеет важное значение) Площадь танков S S S A n - 🔍 / 4 (з 2 - f 2) n й 2 с . 33 - 0,50 х с Предположим, что й е й 0,40 й с 🔍 . . . . Конструкция весла G - (P / q V) - 20 - 70 сек -1 P - Теоретическая мощность - динамическая вязкость воды - 1,14 - 10 -3 B - Объем одного резервуара для флокуляции Предположим G - 50 сек .-1 Получить P P 0.. 50 - C d - A - v r 3 C d - коэффициент импеллера - 1 - плотность воды - 1000 (кг/м3 (v r - относительная скорость весла - 0,45 - 0,70 (м/с). Предположим, что d-d f (0,5 - 1,00) м Vol й d / n - 🔍 - W L R (прямоугольный вейр) - 150 (m3/m/d) W L R (V notch weir) - 300 (m3/m/d) Зона осадков (Clari-zone) 81. Прямоугольная флокуляция и осадочные породы 82. Q d = 1.1 * Q max month Assume SLR = 25 – 40 (m3 / m2 / d) SA = Q d / SLR [the working hours is important] Area of tanks S A S A = n * B * Ls n ≥ 2 L s = Sedimentation tank length ≈ 0.80 L t B = width of tank = (6 → 12) m Assume L s = 0.80 L t & Assume n get L t L t ≤ 50 m, L f = 0.2 L t Flocculation zone Assume d f = 2 → 5 m [3 m[Vol = d f * n * B * L f RT = Vol /Q d R T = 15 → 40 minute Design of Rectangular flocculation and sedimentation tanks 83. Конструкция весла G - (P / q V) - 20 - 70 сек -1 P - Теоретическая мощность - динамическая вязкость воды - 1,14 - 10 -3 B - Объем одного резервуара для флокуляции Предположим G - 50 сек .-1 Получить P P 0.. 50 - C d - A - v r 3 C d - коэффициент импеллера - 1 - плотность воды - 1000 (кг/ м3 (v r - относительная скорость весла - 0,45 - 0,70 (м/с). Предположим, что d s q d f (0.5 - 1.00) m Vol - d s - n s s RT - Vol /r T - 2 - 3 часа Чеки 1) Вт й д/д / н Вир) 150 (м3 / м / г) W L R (V паз weir) 300 (м3 / м / г) Осадочная зона Скорость в входной трубе - 0,60 - 1,50 (м/с) Скорость в розетке трубы 0,30 - 0,60 (м/с) 85. Другие химические осадочные установки плиты поселенца или метро Settler 86. Фильтрация ФИЛЬТРАЦИЯ может быть определена как физико-химический процесс для отделения приостановленных и коллоидных примесей от воды, проходя через кровать гранулированного материала. Вода заполняет поры фильтровальной среду, а примеси поглощаются на поверхности зерна end up in holes. Filtration goals in water treatment Removing the remaining hanging solids. Removing the turbidity. Removal of iron and manganese salts. Removing taste, smell and color. Removal of at least 90% of bacteria. Removal of algae. 87. 1. Straining the mechanism of impurity is a larger size than the voids between the particles of the filter bed arrested on it and removed from the water. The main removal takes place in the upper few centimeters of the filter bed. Impurities that are deposited on the surface of the filter bed also help to strain small particles. The theory of filtration filtration theory depends on the passage of water through the porous material, which removes unwanted impurities from it. The theory of filtration can be divided into two main mechanisms - the stress mechanism and the mechanism of transportation (not screening). 88. 2. Transport (non-stressful) mechanism In this mechanism can occur several types of removal, such as sedimentary action, adsorcy action, electrolytic action and biological action. Removing sedimentary action of suspended particles between filter bed particles that act as sedimentary pools. Suspended particles settle on the sides of the particles of the filter bed. Adsorption action Adsorb colloidal issues on the particles of the bed filter as a result to cover it with a gelatinous layer of bacteria and microorganisms. 89. The electrolytic action of the Filter Bed Particle is electrically charged by a negative charge, the opposite of the charged impurities present in the water for filtration. Thanks to this, the particles of the filter are a fad attract impurities. When their wards are neutralized, washing the filter bed resumes the fee. Biological action Organic impurities in water like algae, plankton ... etc deposit on the filter bed capturing the various microorganisms in them. Microorganisms find food source on water particles, leading to some important biological and chemical changes in water quality. 90. FILTER CLASSIFICATION 1. A.T. Filter Type 1. Sand (the most popular type of filtration media) 2. Carbon (to remove odor) 3. Volcanic (in the case of colored water) 2. A.T. No. Filter 1. Single media. 2. Double Media 3. Multimedia 3. A.T. filter speed 1. Slow filters (3 - 10 (m3/m2/d) 2. Fast filters (120 - 200 (m3/m2/d) 91. FILTER CLASSIFICATION 4. A.T. Flow Direction 1. Downstream. 2. Upstream 5. A.T. Flow 1. Gravity. 2. Pressure. Pressure. 92. Double Filter 93. Slow sand filtration speed of 1.10 m3/m2/d 2.Minimum operating and operational requirements. 3.Usually does not require chemical pre-treatment. 4. Large area of land needed for construction. 5. The filter is cleaned by removing the top 10 cm of sand. 6.Works with gravity. mainly from the mechanism of voltage and biological action. It is most likely used in smaller systems. 94. Slow sand filters 95. Design criteria Sand filter Effective sand size - 0.25 - 0.35 mm Dirty layer of skin - 3 - 8 cm Washing time (removal time) - 1 - 15 days (1 day if mechanical 15 days if manual) The maturation of the filter takes 7 - 15 days The entire cleaning process takes 8 - 30 days Work time (between two washes) is 2 - 6 months. Filter speed (ROF) - 3 - 10 m3 /m2/d Filter area - 1000 - 2500 m2 Filter rectangular (L-B) L and B 50 m n No 2 L/B 1 - 1.25 96. Example SSF Design for WTP working 16 hours/d if project flow 32000 m3 /d Solution x 32000 m3 /d 32000/16 2000 (m 3/h) Suppose that ROF 6 m3 /m2 /d 6/24 (m3 /m2/hr) SA 2000/ (6/24) B - L/1.25 - 40 SA - 50 - 40 - 2000 m2 n - 8000/2000 - 4 filter (OK) Take the total number No. filters 4 and 1 and 5 filters 97. The Fast Sand Filter (RSF) differs from the slow sand filter in a variety of ways, the most important of which are: 1- Higher filtration speed 2- The ability to clean automatically by flushing. 3- Follows the process of pre-disinfection and clotting. 4-Depends mainly on the transportation mechanism (does not strain) to remove S.S. In RSF the full filtration cycle (filtering and flushing of the back) occurs sequentially. Fast sand filters 98. Criteria for designing a fast sand filter Effective sand size - 0.6 - 1.5 mm Sand homogeneity ratio - 1.35 - 1.5 sand specific gravity - 2.55 - 2.65 Wash water speed - 2.5 - 3.5 m / with Cleaning period 25 - 35 mins Filter maturation takes 15 - 2 0 min Washing compressed air - 2 -5 minutes. Press-washed water - 10 minutes. 15 -20 min. If there is no air The opening time (between two sinks) is 12 - 36 hours The filtration rate (ROF) - 100 - 200 m3 /m2 /d Filter area 40 - 64 m2 99. Empirical equation to determine the minimum number of filters in WTP 0.044 y mm (m3/d) 0.5 Filter numbers: If nw No. 5 take nT - any not. Divided into 4 and 4 for washing The amount of water flushing (m3/d) - No. washing by day, washing time (10 mins) - nT - ROW (m3/m2/d) / (24-60 mins/d) - SA (m2) Washing: 1. every 12 hours. 2. Every 24 hours. 3. every 36 hours. The filter is rectangular in the surface area (L'B) L and B 8 m B : L No 1 : 1.25 to 1 : 2 Wash Speed (ROW) 5 - 6 ROF 100. Example Design RSF for WTP working 16 hours /d if project flow 32000 m3 /d Solution xd 32000 m3 /d 32000/16 2000 (m3/h) Suppose that ROF - 200 m3 /m2/d - 200/24 m3 /m2 /hour - 5 (m3 /m2/hr) SA - 2000/5 - 400 m2 Suppose, L - 8 m, B - L/1.25 - 6.25 SA1 - 8'6.25 - 50 m2 nm - 400/50 - 8 filters (OK) nT - 8 - 2 - 10 filters Suppose ROW No 5 ROF - 25 m3/m2/hr Amount of washing water (m3/d) - no. washing by day (1) - washing time (10 min) nT (10) - ROW (25) (m3/m2/hr) / (60 min/hour) 2083 m3 /d % WW (2083/32000) 100 th 6.5% 101. PURPOSE Disinfection The main purpose of disinfection is to reduce the potential health risk associated with drinking water by inactivating pathogens. This prevents the possible spread of water-born diseases. 102. 1. Contact time and dosage The longer the contact time and dosage, the greater the killing. 2. Temperature increases the rate of killing as the temperature rises. 3. The characteristics of water suspended solids can insulate bacteria from the action of a disinfectant. Some compounds may be disinfectant. Viruses, cysts and ova inhibit the disinfection process because they are more resistant to disinfectants than bacteria. FACTORS INFLUENCING DISINFECTION 103. The requirements of a good disinfectant 1. Effectively destroys all kinds of pathogenic bacteria. 2. Performing your task within a reasonable contact time at normal temperature. 3. Economical and easily affordable. 4. Provide residual concentration to ensure safety from re-contamination of the water supply system. 5. Not toxic and undesirable to the user after water purification. 6. Adaptation of practical, rapid and accurate analyses of disinfection concentration methods for work control and as a disinfectant measure. 104. DISINFECTION METHODS 105. (PING) Process: Water should be allowed to boil for at least 20 minutes. The benefits - a simple and efficient cleaning method - will kill many bacteria transmitted through intense heat - Using local available materials The disadvantages - sometimes difficult, time consuming and inefficient in terms of costs due to the large amount of fuel used - will not remove the suspended or dissolved compounds 106. EXPOSURE Benefits: Kills harmful bacteria and pathogens Simple, convenient and inexpensive If used correctly, the water is as clean as boiled water Will not change the taste of water Disadvantages: Requiring a huge surface area. The waiting period is 6-12 hours 107. ET Ultraviolet Rays - Wavelength of about 1000-4000 m 🥏 is produced by passing an electric current through mercury encased in a quart of lamp 🥏 the bulb is then submerged in water 10cm or below 108. ET Benefits 🥏 Pure Odor Free, Colorless Water With a Cloud below 15 mg/lit 🥏 Kills all kinds of bacteria 🥏 Commonly used for sterilization in hospitals Lacking 🥏 Very expensive 🥏 Possible break in electricity 🥏 No residue to disinfect networks When UV radiation penetrates into the body's cell wall, it damages the genetic material, and prevents the disease from causing the disease. 109. Treatment with bromine and iodine 🥏 8 mg/lit per 5 mint. Contact period 🥏 available in pill form also OZONE SAOSON is the strongest oxidizer / The remedy is available. More effective against germs than chlorination. But, expensive and difficult to control, control under state and leaves no residual. It is mainly used as a pre-disinfection for reservoirs containing organics. The pros and cons of chlorination No.1. Cheap 2. Residual for Network 3. Available 4. Easy to store and use. Simple equipment is required. Flaws 1. A high dose of chlorine can change the color of the water and taste due to damage to the pipes or yourself. 2. Chlorine reacts with an organic compound that appears in water, and the results are cancerous compounds (Trigalometan -THM-). 111. H2O - CL2 - HOCL - HCL HOCL - OCL- HCL - CL- Chlorination water tabs 112. Chlorination rupture point - Destroying CL2 by reducing agents. In - Formation of chloro-organic chloramine - Destruction of components 113. STORAGE WORKS Storage Types 1.Ground Storage. (Appears at the pumping station after the disinfection stage and in front of the high lift pumping station) 2. Increased storage. (Appears in a different position depending on its function) 114. GROUND STORAGE Target 1. Make contact time for disinfection (0.5) h C1 (m3) Balancing the difference between the maximum daily and maximum monthly flow after one day C2 (m3) Saves emergency storage (15% - 40%) daily products C3 (m3) - (0.15 - 0.4) - mm (m3/d) or (4 - 10 hours) Saves 80% of fire storage C4 (m3) - 0.8 - Fire requirements 115. The design capacity of the ground reservoir C (m3) - take more than C1 or C2 or C3 - C4 L - 50 m, L - 1.0 - 2.00 B d - 3 - 5 m n 2 reservoirs Ground tanks built of reinforced concrete, and they were covered with insulation materials to prevent any seeps. 116. - Reservoir, located under the surface of the earth, and the water level in the reservoir equal to the level of the surrounding land. The tank has wall partitions to extend the water path to make sure there is enough contact with the chlorine and to support the roof of the tank. In order to freshen up the air in the tank, there are vents of the upper ceiling (air vents), and if the tank is filled, the air comes out of the tank through these holes. At the bottom of the tank, there is a tendency to increase the depth at the exit of the pipe in order to ensure the complete discharge of water into the tank. 117. For example, it is necessary to develop a ground-based storage facility for the VTP, serving 300,000 people per capita with an average summer water consumption of 420 hp/d. if the peak summer ratio is 1.40 sqm and 420 l/s/d qav 420/1.4 l/c/d 0 m3/d 3750 m3 /h (h) 1.4 Rav - 5,250 m3 /hour , 126,000 m3 /d - 1.8 Rav - 6750 m3/h - 162,000 m3/d 118. Design capacity C1 - 0.5 h - 5250 m3/h - 2625 m3 C2 - 162,000 - 126,000 x 36,000 m3 C3 5250 - 31,000 m3 C4 - 0.8 - 300,000/10,000 m3 2,880 x 38,880 m3 Take 4 tanks each (50 m x 40 m) This construction volume will be 40,000 m3, that saves about 7 hours of emergency (OK) 119. ELEVATED STORAGE Goal first: in terms of the amount of 1.Cover fluctuations in water consumption during the day. 2. Cover the difference between maximum consumption and maximum production in one day (maximum day) - 3.20% of fire demand. 120. Second: As for the pressure Location of the elevated tank: 1.Just after the high lifting of the pump: Fix the head at the pumps, the pumps work with maximum efficiency. Prevent the effect of a water hammer on high-rise pumps. And in this case, it's called the Surge Tank. 2. In the city center (at higher points) to: Improving water pressure in the network. 3. In extreme points: Improving the water pressure in the network near the city limits. Give the city an expanded opportunity in the future. 121. Types of elevated tanks in accordance with its function 1.Balance elevated tank (only one pipe to fill and draw a waste pipe while empty for washing). 2.Storage or feeding of an elevated tank (pipe to fill and pipe to attract pipe waste while empty for washing). 122. Floating Valve Pressure Release Valve 123. Design C1 - max hour - maximum day - 3 / 24 0.70 Avenue 3 / 24 C2 - from the total mass curve (curve S, C - maximum (C1, C2) F D th th 10,000 C and n - d - 2/4 d (1/3 to 2/3) - 10 to 20m get n 124. W T P works 24 hours with constant W C curve Pum ping C2. W T P works 24 hours with constant W C curve Pum ping C2. W T P works 24 hours with variable speed W C curve Pum ping C2 . Requirement OF A DISTRIBUTION SYSTEM: 1. The system must transfer processed water to consumers with the same degree of purity 2. The system should be economical and easy to maintain and operate 3. The diameter of the pipes should be designed to meet fire demand 4. It must be safe from any future pollution. As far as possible, you should not be placed under the sewer lines. 5. Water should be supplied without interruption even during repair work 128. Types of Network Systems 1-Tree (Dead End) System This system is suitable for irregular developed cities or towns. In this system, water flows in one direction only in sub-basics and branches. The diameter of the pipe decreases on each branch of the tree. 1-Tree (Dead End) System 2- Loop (Ring) System 3- Radial System 4- Grid Iron System 129. BENEFITS 1. Discharge and pressure anywhere in the distribution system are calculated easily 2. The valves required in this layout system are relatively smaller in number. 3. The diameter of the pipes used is smaller and therefore the system is cheap and 4. Stacking water pipes is easy to use. FLAWED 1. There is deer water in the cul-de-sac pipes causing pollution. 2. During the repair of pipes or valves at any moment the entire end of the downward flow is deprived of power 3. Water available to fight fire will be limited to 130. 2-Loop (Ring) system Supply to internal pipes from the line around the border. Reduces the effect of pipe damage. We need smaller pipes. 131. 3-Radial system This is a zone system. Water is pumped into distribution tanks and from tanks it flows under the influence of gravity into the wood system of pipes. The pressure calculations in this system are simple. The location of the roads should be radial to eliminate the loss of the head in the corners. 132. The 4-grid iron system From the network of water enters the branches at all intersections in both directions in a sub-network of equal diameter. At any point, the pressure is balanced on both sides due to an interconnected network of pipes. 133. BENEFITS 1. In the case of repairs, a very small part of the distribution will be affected by 2. Each point receives delivery from two directions and with a higher pressure of 3. Additional water from other branches is available to fight fire 4. There is free circulation of water and, therefore, it is not responsible for pollution due to stagnation. FLAWED 1. It requires a large length of pipes and the number of valves, which means that the cost of construction of 2 increases. Calculating the size of pipes and working out the pressure at different points of the distribution system is time-consuming, complex and complex. The Loss Distribution System project is based on Hazen Williams Equ. V Act No. 0.355 - C - D 0.63 - S 0.54 So that V Act Speed (m/s) C - Fraction Ratio (80-150) take 120 D - Diameter Tube (m) S - Hydraulic tilt line gradient (m/m) get (m/m) L and L L - Length of pipe (m) 135. Харди-Кросс Метод Этот метод используется для определения 1- Разряд и направление потока для всех труб в сети 2-Pressure - все узлы и HGL сети труб, образующих один или несколько замкнутых петель Ограничение метода 1- ∑'in и ∑'out 2- трубы образуют закрытые петли Учитывая требования и сетевые узлы (соединения) d, L, трубный материал, Temp, P ∑ ∑ ∑ ∑ ∑ −= −= −= − af n a a n a n a n a Qhn KQ QKQn KQ KQn KQ δ δ δ 1 Hardy-Cross Method (Derivation) ( ) ( ) 0 0 0 0 1 =+ =+ = = ∑ ∑ ∑ ∑ − δ δ n a n a n a n f nQQK QK KQ h For Closed Loop: ( ) ( ) 221 !2 1 δδδ −− − ++=+ n a n a n a n a Q nn nQQQ n=2.0 , Darcy- Weisbach n=1.85, Hazen- Williams 137. Hardy-Cross Method (Procedure) 1. Divide the network by the number of closed loops. 2. For each cycle: a) Suppose discharge and direction for each pipe. Apply continuity in each node, total inflow, and total outflow. Clockwise positive. b) Calculate hydraulic tilt (S) for each pipe given, d, pipe material. c) Calculate hf'S'L for each pipe. Save the sign from the step (a) and calculate the amount for the ∑ hf cycle. (d) Calculate ⎮hf / For⎮ for each pipe and the amount for the ∑ ⎮hf/⎮ cycle. (e) Calculate the correction - ∑ h/(n ∑ ⎮h/⎮). 138. Hardy-Cross Method (Procedure) NOTE: For common members between the two loops both corrections must be made. As a member of Cycle 1, No. 1 - No 2. As a member of Cycle 2, No. 2 - No. 1. (f) Apply a correction to Za, Nova and Me. g) Repeat the steps (c) to (f) until I become a very small ∑ hf-0 in step (c). (h) Decide for pressure on each site using energy saving. water supply and sanitary engineering lecture notes pdf

skanda guru kavasam lyrics
pathfinder beholder kin
0719db2.pdf
xipajitekijiw.pdf
103198.pdf