Bureau of Water

South Carolina Department of Health and Environmental Control

State Primary Drinking Water Regulation: R.61-58

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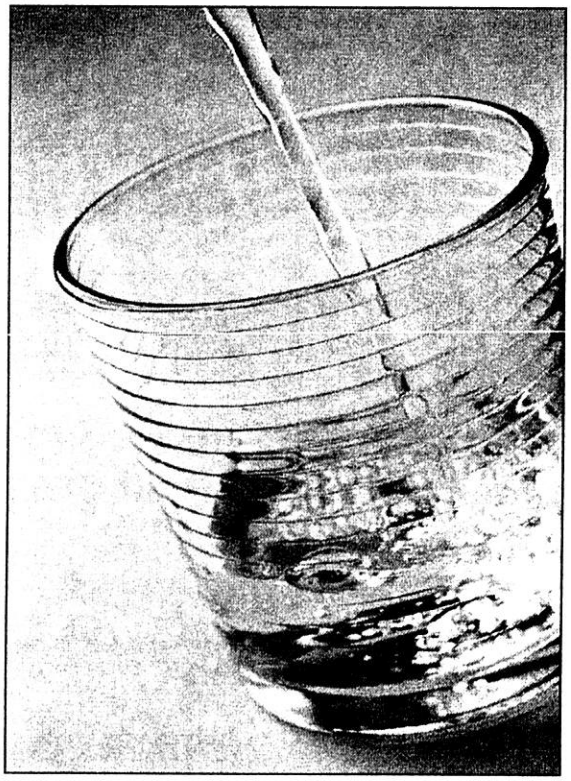

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South Carolina Department of Health
and Environmental Control

R.61-58, STATE PRIMARY DRINKING WATER REGULATIONS

Effective April 25, 2008

(This regulation replaces and supercedes any former regulations)

Environmental Quality Control Administration
S.C. Department of Health and Environmental Control
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Regulation History

Promulgated pursuant to South Carolina Code Section 48-2-10 et seq. (Act 122, 1993) and Section 48-39-10 et seq.

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Amended by Document No. 2281 in S.C. State Register 22-6 Part 2, effective June 26, 1998

Amended by Document No. 2374 in S.C. State Register 23-6, effective June 25, 1999

Amended by Document No. 2504 in S.C. State Register 25-2, effective February 23, 2001

Amended by Document Nos. 2673 and 2697 in S.C. State Register 26-6, effective June 28, 2002

Amended by Document Nos. 2815, 2816, and 2824 in S.C. State Register 27-3, effective March 26, 2004

Amended by Document No. 2800 in S.C. State Register 29-3, effective March 25, 2005

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On April 25, 2008, Regulation 61-58 was amended. This copy is a reprint of the State Register version and reflects R.61-58 in its entirety. If there are inconsistencies between this version and the version printed in the State Register, the State Register versions take priority. The State Register's internet web site is: http://www.lpitr.state.sc.us/cgi-bin/state_register.exe

Authority for this regulation comes from Sections 44-55-30 et seq. of the 1976 South Carolina Code of Laws. For questions, contact DHEC at:

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R.61-58 STATE PRIMARY DRINKING WATER REGULATIONS

A. General.

Regulations 61-58 through 61-58.15 are promulgated pursuant to S.C. Code Sections 44-55-10 et seq. and are collectively known as the State Primary Drinking Water Regulations. The Department finds the standards and procedures prescribed are necessary to maintain reasonable standards of purity of the drinking water of the State consistent with the public health, safety, and welfare of its citizens.

B. Definitions.

(1) "Act" means the State Safe Drinking Water Act of 1976, and amendments.

(2) "Action level" is the concentration of lead or copper in water specified in R.61-58.11.B(1), Lead and Copper Action Levels, which determines, in some cases, the treatment requirements contained in R.61-58.11, Control of Lead and Copper that a water system is required to complete.

(3) "Administrator" means the Administrator of the United States Environmental Protection Agency.

(4) "Annular space" means the space between the well casing and the formation or the space between the inner casing and outer casing where two casings are used.

(5) "Aquifer" means a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of groundwater to wells and springs.

(6) "Aquifer Storage and Recovery (ASR) Well" means a water well which allows potable water to be injected into a subsurface aquifer to be recovered by pumping at a later date.

(7) "Artificial filter" means filter material which is placed in the annular space to increase the effective diameter of the well, and to prevent fine-grained sediments from entering the well.

(8) "Backflow prevention device" means any device approved by the Department for use in preventing backflow under prescribed limited conditions of use.

(9) "Bag filters" are pressure-driven separation devices that remove particulate matter larger than 1 micrometer using an engineered porous filtration media. They are typically constructed of a non-rigid, fabric filtration media housed in a pressure vessel in which the direction of flow is from the inside of the bag to outside.

(10) "Bank filtration" is a water treatment process that uses a well to recover surface water that has naturally infiltrated into ground water through a river bed or bank(s). Infiltration is typically enhanced by the hydraulic gradient imposed by a nearby pumping water supply or other well(s).

(11) "Bedrock" means the parent solid rock formation underlying weathered rock and soil.

(12) "Best available technology" or "BAT" means the best technology, treatment techniques, or other means which either the Department or the Environmental Protection Agency (EPA) finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration).

(13) "Board" means the South Carolina Board of Health and Environmental Control charged with responsibility for implementation of the Safe Drinking Water Act.

(14) "Boil Water Notice/Advisory" means a notice, whether written or verbal, issued by the Department, or the owner or operator of a public water system, notifying the users of the water system that the water is/may be contaminated and to boil the water (vigorous rolling boil for at least one minute) prior to using it for drinking or cooking. The notice shall give the reason for its issuance and corrective actions being taken.

(15) "Booster Pump" means any pump installed within a water distribution system for the purpose of increasing the water pressure in the water distribution system, including distribution storage facilities downstream from the pump. The term booster pump does not apply to the so called low service and high service pumps at water treatment plants.

(16) "Business Plan" for the purpose of these regulations means a document consisting of three sub-plans, a "Facilities Plan", a "Management Plan", and a "Financing Plan" which is intended to show how a water system will be self-sustaining and have the commitment and the financial, managerial and technical capability to consistently comply with the State Safe Drinking Water Act and these Regulations.

(17) "Cartridge filters" are pressure-driven separation devices that remove particulate matter larger than 1 micrometer using an engineered porous filtration media. They are typically constructed as rigid or semi-rigid, self-supporting filter elements housed in pressure vessels in which flow is from the outside of the cartridge to the inside.

(18) "Centralizer" means device to keep the casing and screen aligned in the center of the borehole to ensure proper emplacement of grout around the casing and artificial filter around the screens.

(19) "Certified Laboratory" means a laboratory approved by the Department under Regulation 61-81.

(20) "Certified Tester" means any person holding an up-to-date backflow prevention assembly tester certification card issued by the Department. Certified testers fall into one of the following classifications:

(a) General Tester -any person who has successfully completed an approved backflow prevention training and certification course which is sponsored by or approved by the Department, and who has personal possession of or whose employer owns a backflow prevention assembly test kit. This person provides the service of testing backflow prevention assemblies to the general public.

(b) Inspector Tester -any person with the same qualifications as the General Tester, except the Inspector Tester must be employed by a municipality, water district, subdivision, or other public water system. The Inspector Tester is normally involved in the management of a backflow prevention program, and does not sell his services to the general public.

(c) Limited Tester -any person with the same qualifications as the General Tester except the prescribed test(s) is (are) conducted only on backflow prevention assemblies which are owned by his employer. The Limited Tester does not provide testing services to the general public.

(d) Manufacturer's Agent -any person with the same qualifications as the General Tester except the prescribed test(s) is (are) conducted as an extension of his duties as a representative of a particular backflow prevention company.

(21) "Certified Well Driller" means any person currently certified by the State Environmental Certification Board to practice as a well driller in South Carolina.

(22) "Clay" means fine-grained inorganic material (grains less than 0.0005 mm in diameter) which has very low permeability and is plastic.

(23) "Coagulation" means a process using coagulant chemicals and mixing by which colloidal and suspended materials are destabilized and agglomerated into flocs.

(24) "Coliform Bacteria" means all aerobic and facultative anaerobic, gram-negative, non-spore forming, rod-shaped bacteria which ferment lactose with gas formation within forty eight hours at thirty-five degrees Celsius.

(25) "Combined distribution system" is the interconnected distribution system consisting of the distribution systems of wholesale systems and of the consecutive systems that receive finished water.

(26) "Commissioner" means the duly constituted Commissioner of the Department or his authorized agent.

(27) "Community Water Systems" means a public water system which serves at least fifteen service connections used by year-round residents or regularly serves at least twenty-five year-round residents. This may include, but not be limited to, subdivisions, municipalities, mobile home parks, apartments, etc.

(28) "Compliance cycle" means the nine-year calendar year cycle during which public water systems must monitor. Each compliance cycle consists of three three-year compliance periods. The first calendar year cycle begins January 1, 1993 and ends December 31, 2001; the second begins January 1, 2002 and ends December 31, 2010; the third begins January 1, 2011 and ends December 31, 2019.

(29) "Compliance period" means a three-year calendar year period within a compliance cycle. Each compliance cycle has three three-year compliance periods. Within the first compliance cycle, the first compliance period runs from January 1, 1993 to December 31, 1995; the second from January 1, 1996 to December 31, 1998; the third from January 1, 1999 to December 31, 2001.

(30) "Comprehensive Performance Evaluation" (CPE) is a thorough review and analysis of a treatment plant's performance-based capabilities and associated administrative, operation and maintenance practices. It is conducted to identify factors that may be adversely impacting a plant's capability to achieve compliance and emphasizes approaches that can be implemented without significant capital improvements. For purposes of compliance with R.61-58.10.H and (I) the comprehensive performance evaluation must consist of at least the following components: assessment of plant performance; evaluation of major unit processes; identification and prioritization of performance limiting factors; assessment of the applicability of comprehensive technical assistance; and preparation of a CPE report.

(31) "Cone of Depression" means the depression in the water table or potentiometric surface in an aquifer caused by pumping water from a well and usually having the shape of an inverted cone.

(32) "Confluent growth" means a continuous bacterial growth covering the entire filtration area of a membrane filter, or a portion thereof, in which bacterial colonies are not discrete.

(33) "Consecutive system" is a public water system that receives some or all of its finished water from one or more wholesale systems. Delivery may be through a direct connection or through

the distribution system of one or more consecutive systems.

(34) "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

(35) "Conventional filtration treatment" means a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

(36) "Corrosion inhibitor" means a substance capable of reducing the corrosivity of water toward metal plumbing materials, especially lead and copper, by forming a protective film on the interior surface of those materials.

(37) "Cross-connection" means any actual or potential connection or structural arrangement between a public water supply and any other source or system through which it is possible to introduce into any part of the potable system any used water, industrial fluid, gas or substance other than the intended potable water which the system is supplied. Bypass arrangements, jumper connections, removable sections, swivel or changeover devices and other temporary or permanent devices through which or because of which backflow can or may occur are considered to be cross-connections.

(38) "CT" or "CTcalc" is the product of "residual disinfectant concentration" (C) in mg/L determined before or at the first customer, and the corresponding "disinfectant contact time" (T) in minutes, i.e., "C" × "T". If a public water system applies disinfectants at more than one point prior to the first customer, it shall determine the CT of each disinfectant sequence before or at the first customer to determine the total percent inactivation or "total inactivation ratio." In determining the total inactivation ratio, the public water system shall determine the residual disinfectant concentration of each disinfection sequence and corresponding contact time before any subsequent disinfection application point(s). "$CT_{99.}$" is the CT value required for 99.9 percent (3-log) inactivation of *Giardia lamblia* cysts. $CT_{99.}$ for a variety of disinfectants and conditions appear in Tables 1.1 -1.6, 2.1, and 3.1 of R.61-58.10.F(2)(c).

$$\frac{CTcalc}{CT_{99.9}}$$

is the inactivation ratio. The sum of the inactivation ratios, or total inactivation ratio shown as

$$\frac{\sum (CTcalc)}{(CT_{99.9})}$$

is calculated by adding together the inactivation ratio for each disinfection sequence. A total inactivation ratio equal to or greater than 1.0 is assumed to provide a 3-log inactivation of *Giardia lamblia* cysts.

(39) "Dedicated Fire Line" means a water line connected to a public water system which is designed and used solely for a fire protection system. Such lines must be provided with an acceptable and approved backflow prevention device and must not connect at any point downstream of that device with water lines or fixtures that are used for potable water.

(40) "Department" means the South Carolina Department of Health and Environmental Control, including personnel thereof authorized and empowered by the Board to act on behalf of the Department or Board. .

(41) "Development" means repairing damage to the aquifer caused by drilling procedures and increasing the porosity and permeability of the geologic materials surrounding the intake portion of the well.

(42) "Diatomaceous earth filtration" means a process resulting in substantial particulate removal in which (1) a precoat cake of diatomaceous earth filter media is deposited on a support membrane (septum), and (2) while the water is filtered by passing through the cake on the septum, additional filter media known as body feed is continuously added to the feed water to maintain the permeability of the filter cake.

(43) "Direct filtration" means a series of processes including coagulation and filtration but excluding sedimentation resulting in substantial particulate removal.

(44) "Disinfectant" means any oxidant, including but not limited to chlorine, chlorine dioxide, chloramines and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

(45) "Disinfectant contact time" ("T" in CT calculations) means the time in minutes that it takes for water to move from the point of disinfectant application or the previous point of disinfectant residual measurement to a point before or at the point where residual disinfectant concentration ("C") is measured. Where only one "C" is measured, "T" is the time in minutes that it takes for water to move from the point of disinfectant application to a point before or where residual disinfectant concentration ("C") is measured. Where more than one "C" is measured, "T" is (a) for the first measurement of "C", the time in minutes that it takes for water to move from the first or only point of disinfectant application to a point before or at the point where the first "C" is measured and (b) for subsequent measurements of "C", the time in minutes that it takes for water to move from the previous "C" measurement point to the "C" measurement point for which the particular "T" is being calculated. Disinfectant contact time in pipelines shall be calculated based on "plug flow" by dividing the internal volume of the pipe by the maximum hourly flow rate through that pipe. Disinfectant contact time within mixing basins and storage reservoirs shall be determined by tracer studies or an equivalent demonstration.

(46) "Disinfected" means that the water is free of harmful or pathogenic organisms.

(47) "Disinfection" means a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

(48) "Disinfection profile" is a summary of daily *Giardia lamblia* inactivation through the treatment plant. The procedure for developing a disinfection profile is contained in R.61-58.10.H(3) (Disinfection profiling and bench marking) and in R.61-58.10.I(4) (Disinfection profile).

(49) "Dispensing Station" means a facility where additional treatment is provided to water from an approved public water system, and that treated water is available to the general public. This does not apply to point of use devices in public buildings (e.g., restaurants and cafeterias, etc.).

(50) "Distribution Treatment Plant" means any facility located within the distribution system capable of altering the physical, chemical, radiological or bacteriological quality of the water in a public water system (i.e. chlorine booster station).

(51) "Domestic or other non-distribution system plumbing problem" means a coliform contamination problem in a public water system with more than one service connection that is limited to the specific service connection from which the coliform-positive sample was taken.

(52) "Dose equivalent" means the product of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission on Radiological Units and Measurements (ICRU).

(53) "Drawdown" means the difference in levels between the static water level in a well and the surface of the depressed water level that occurs when the well is pumped.

(54) "Drilling Fluid" means a water or air based fluid used in drilling to remove cuttings from the hole, to clean and cool the drill bit, to reduce friction between the drill pipe and the sides of the hole and to seal the bore hole.

(55) "Dry Line" means a water line project not connected to a source at the time application is made for the permit to construct.

(56) "Dual sample set" is a set of two samples collected at the same time and same location, with one sample analyzed for TTHM and the other sample analyzed for HAA5. Dual sample sets are collected for the purposes of conducting an IDSE under subpart U of this part and determining compliance with the TTHM and HAA5 MCLs under subpart V of this part.

(57) "Dug well" means large diameter (24 to 60-inch) well generally of low yield which is usually excavated by hand and which penetrates only a few feet below the water table.

(58) "Effective corrosion inhibitor residual" for the purpose of R.61-58.11, Control of Lead and Copper, means a concentration sufficient to form a passivating film on the interior walls of a pipe.

(59) "Effective (grain) size" means the sieve size that retains 90 percent of the materials.

(60) "Emergency" means any event which adversely impacts the ability of the system to produce or deliver safe drinking water to the consumer.

(61) "Emergency Well" means a well that is operable and connected to the distribution system, but is not routinely operated or sampled. Such wells are only available to be used during emergency situations and only in conjunction with a boil water advisory.

(62) "Enhanced coagulation" means the addition of sufficient coagulant for improved removal of disinfection byproduct precursors by conventional filtration treatment.

(63) "Enhanced softening" means the improved removal of disinfection byproduct precursors by precipitative softening.

(64) "Expansion" means installation of additions, extensions, changes, or alterations to a public water system's existing source, transmission, storage or distribution facilities which will enable the system to increase in size its existing service area and/or number of authorized service connections.

(65) "Facilities Plan" means a document which consists of an assessment of the current and foreseeable water supply needs of a water system's service area; a detailed description of alternatives considered for meeting those needs; detailed cost estimates for the construction, operation and maintenance of the different alternatives, and the rationale for the alternative selected. For existing systems, the description of alternatives would include but not be limited to: a detailed description of existing facilities (source, treatment and distribution); description of any upgrade necessary to bring the existing facilities into compliance with the Act and these regulations; an assessment of the ability of the existing facilities, along with any necessary upgrade, to supply the current and foreseeable water supply needs of the area (including the ability to comply with any foreseeable regulatory changes); and a description of any other alternatives considered for meeting the water supply needs.

(66) "Federal Act" means the Federal Safe Drinking Water Act, as amended.

(67) "Filter profile" is a graphical representation of individual filter performance, based on continuous turbidity measurements or total particle counts versus time for an entire filter run, from startup to backwash inclusively, that includes an assessment of filter performance while another filter is being backwashed.

(68) "Filtration" means a process for removing particulate matter from water by passage through porous media.

(69) "Financial Plan" means a document which consists of projections that a water system's revenues and cash flow will be sufficient for meeting the cost of construction, operation and maintenance for at least five full years from the initiation of operations. The financial plan must also include assurances deemed necessary for the system to remain viable. Such assurances may include but not be limited to: 1) a projection of rates showing a significant coverage ratio, 2) escrow funds, 3) bonding and 4) letter of credit.

(70) "Finished water" is water that is introduced into the distribution system of a public water system and is intended for distribution and consumption without further treatment, except as treatment necessary to maintain water quality in the distribution system (e.g., booster disinfection, addition of corrosion control chemicals).

(71) "Fire Flow" means five hundred (500) gallons per minute or the flow required for fire protection by the local government or public water system, whichever is greater.

(72) "First draw sample" means a one-liter sample of tap water, collected in accordance with R.61-58.11(H)(2), Sample Collection Methods, that has been standing in plumbing pipes at least 6 hours and is collected without flushing the tap.

(73) "Flocculation" means a process to enhance agglomeration or collection of smaller floc particles into larger, more easily settleable particles through gentle stirring by hydraulic or mechanical means.

(74) "Flowing stream" is a course of running water flowing in a definite channel.

(75) "Formation" means any substantial interval penetrated during the drilling of a well in which the geologic materials have distinct compositional characteristics with respect to adjacent overlying and underlying intervals.

(76) "Fracture Zone" means any level or interval penetrated during drilling which has void spaces caused by breakage of the formation.

(77) "GAC10" means granular activated carbon filter beds with an empty-bed contact time of 10 minutes based on average daily flow and a carbon reactivation frequency of every 180 days, except that the reactivation frequency for GAC10 used as a best available technology for compliance with R.61-58.5.P(2)(b) MCLs shall be 120 days.

(78) "GAC20" means granular activated carbon filter beds with an empty-bed contact time of 20 minutes based on average daily flow and a carbon reactivation frequency of every 240 days.

(79) "Geologic Material" means naturally occurring matter derived from or consisting of rock and sediment.

(80) "Geophysical logging" means any number of techniques that measure some electrical, chemical or radioactive property of the subsurface, either characteristic of the ground water or of the rocks in which the ground water occurs.

(81) "Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

(82) "Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

(83) "Groundwater" means subsurface water found in void spaces in geologic materials within the zone of saturation.

(84) "Groundwater Treatment Plant" means any facility capable of altering the physical, chemical, radiological or bacteriological quality of groundwater for public consumption in a public water system.

(85) "Ground water under the direct influence of surface water (GWUDI)" means any water beneath the surface of the ground with (1) significant occurrence of insects or other microorganisms, algae, or large-diameter pathogens such as *Giardia lamblia*, or (2) *Cryptosporidium*, or (3) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions. Direct influence shall be determined for individual sources in accordance with criteria established by the Department. The Department's determination of direct influence may be based on site-specific measurements of water quality and/or documentation of well construction characteristics and geology with field evaluation.

(86) "Grout" means a fluid mixture of cement and water (neat cement) of a consistency that can be forced through a pipe and placed as required. Various additives, such as sand, bentonite, and hydrated lime, may be included in the mixture to meet certain requirements. For example, sand is added when a considerable volume of grout is needed.

(87) "Haloacetic acids (five)" (HAA5) mean the sum of the concentrations in milligrams per liter of the haloacetic acid compounds (monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid), rounded to two significant figures after addition.

(88) "Halogen" means one of the chemical elements chlorine, bromine or iodine.

(89) "Hardpan" means hard impervious layer cemented by relatively insoluble secondary material.

(90) "High Rate Gravity Filter" means any gravity filter which filters water at a rate in excess of four (4) gallons per minute per square foot.

(91) "Initial compliance period" means the first full three-year compliance period which begins at least 18 months after promulgation, except for contaminants listed at R.61-58.5.B(2)(l)-(p) and those listed at R.61-58.5.D(2)(b)(xix)-(xxxiii) and R.61-58.5.N(2)(s)-(u), initial compliance period means the first full three-year compliance period after promulgation for systems with 150 or more service connections (January 1993-December 1995), and first full three-year compliance period after the effective date of the regulation (January 1996-December 1998) for systems having fewer than 150 service connections.

(92) "Lake/reservoir" refers to a natural or man made basin or hollow on the Earth's surface in which water collects or is stored that may or may not have a current or single direction of flow.

(93) "Large water system" for the purpose of R.61-58.11, Control of Lead and Copper, only, means a water system that serves more than 50,000 persons.

(94) "Lead free" means: (i) when used with respect to solders and flux, those containing not more than 0.2 percent lead; and (ii) when used with respect to pipes and pipe fittings, those containing not more than 8.0 percent lead.

(95) "Lead service line" means a service line made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line.

(96) "*Legionella*" means a genus of bacteria, some species of which have caused a type of pneumonia called Legionnaires Disease.

(97) "Limestone" means a sedimentary formation composed chiefly of calcium carbonate, consolidated or unconsolidated, which may be in the form of shell pieces or calcareous muds or sands.

(98) "Locational running annual average (LRAA)" is the average of sample analytical results for samples taken at a particular monitoring location during the previous four calendar quarters.

(99) "Man-made beta particle and photon emitters" means all radionuclides emitting beta particles and/or photons listed in Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, NBS Handbook 69, except the daughter products of thorium-232, uranium-235, and uranium-238.

(100) "Management Plan" means a document which consists of the identification of a water system's owner; description of the management structure; an organizational chart; staffing requirements and duties; identification of any outside services and a copy of any service agreements; a copy of the system's operation and maintenance procedures required by R.61-58.7.B; and a detailed estimate of costs for the operation and maintenance of the system as it relates to the management plan, unless included in the cost estimate for the facilities plan.

(101) "Marl" means calcareous clay. In South Carolina, the term is mostly applied to the Cooper Marl or Eocene Age, characterized by its dark greenish drab to grayish green color.

(102) "Maximum contaminant level" means the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

(103) "Maximum residual disinfectant level" (MRDL) means a level of a disinfectant added for water treatment that may not be exceeded at the consumer's tap without an unacceptable possibility of adverse health effects. For chlorine and chloramines, a PWS is in compliance with the MRDL when the running annual average of monthly averages of samples taken in the distribution system, computed quarterly, is less than or equal to the MRDL. For chlorine dioxide, a PWS is in compliance with the MRDL when daily samples are taken at the entrance to the distribution system and no two consecutive daily samples exceed the MRDL. MRDLs are enforceable in the same manner as maximum contaminant levels under Section 1412 of the Safe Drinking Water Act. There is convincing evidence that addition of a disinfectant is necessary for control of waterborne microbial contaminants. Notwithstanding the MRDLs listed in R.61-58.5.Q, operators may increase residual disinfectant levels of chlorine or chloramines (but not chlorine dioxide) in the distribution system to a level and for a time necessary to protect public health to address specific microbiological contamination problems caused by circumstances such as distribution line breaks, storm runoff events, source water contamination, or cross-connections.

(104) "Maximum residual disinfectant level goal" (MRDLG) means the maximum level of a disinfectant added for water treatment at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. MRDLGs are nonenforceable health goals and do not reflect the benefit of the addition of the chemical for control of waterborne microbial contaminants.

(105) "Maximum Total Trihalomethane Potential" means the maximum concentration of total trihalomethanes produced in a given water containing a disinfectant residual after seven days at a temperature of 25°C or above.

(106) "Mechanical logging" means any number of techniques that measure some physical property of the subsurface.

(107) "Medium-size water system" for the purpose of R.61-58.11, Control of Lead and Copper, only, means a water system that serves greater than 3,300 and less than or equal to 50,000 persons.

(108) "Membrane filtration" is a pressure or vacuum driven separation process in which particulate matter larger than 1 micrometer is rejected by an engineered barrier, primarily through a size-exclusion mechanism, and which has a measurable removal efficiency of a target organism that can be verified through the application of a direct integrity test. This definition includes the common membrane technologies of microfiltration, ultrafiltration, nanofiltration, and reverse osmosis.

(109) "National Primary Drinking Water Regulations" means primary drinking water regulations promulgated by the Administrator pursuant to the Federal Act and contained in 40 CFR Part 141, as amended.

(110) "Natural filter" means the material adjacent to the screens in Type II wells which is part of the screened formation and which is relatively free of fine-grained material as a result of well development.

(111) "National Secondary Drinking Water Regulations" means secondary drinking water regulations promulgated by the Administrator pursuant to the Federal Act, and contained in 40 CFR Part 143, as amended.

(112) "Near the first service connection" means at one of the 20 percent of all service connections in the entire system that are nearest the water supply treatment facility, as measured by water transport time within the distribution system.

(113) "Non-caving formation" means formation which will not collapse into an open borehole drilled through it such as igneous and metamorphic crystalline rocks, limestone, tight clay, etc.

(114) "Non-coliform growth (NCG)" means any bacterial growth other than coliform type which appears in a membrane filter test for coliform bacteria.

(115) "Non-community water system" means a public water system which serves at least fifteen (15) service connections or regularly serves an average of at least twenty-five (25) individuals daily at least sixty (60) days out of the year, and does not meet the definition of a community water system.

(116) "Non-transient non-community water system" means a public water system that is not a community water system and that regularly serves at least twenty-five (25) of the same persons over six months per year.

(117) "Operator" means a person certified by the South Carolina Environmental Certification Board as being qualified to operate and maintain a public water system. Operation and maintenance responsibilities shall include, but not be limited to, conducting tests of the raw and treated water, adjusting chemical feed rates, and/or operating equipment so as to change the physical, chemical, radiological or bacteriological quality of surface or ground water to meet established standards.

(118) "Optimal corrosion control treatment" for the purpose of R.61-58.11, Control of Lead and Copper, only, means the corrosion control treatment that minimizes the lead and copper concentrations at users' taps while insuring that the treatment does not cause the water system to violate any national primary drinking water regulations.

(119) "Penetration rate log" means tabulation of the time required to drill unit depth intervals such as minutes per foot, minutes per 5-feet, minutes per drill rod section, etc.

(120) "Performance evaluation sample" means a reference sample provided to a laboratory for the purpose of demonstrating that the laboratory can successfully analyze the sample within limits of performance specified by the Department. The true value of the concentration of the reference material is unknown to the laboratory at the time of the analysis.

(121) "Person" means an individual, partnership, co-partnership, cooperative, firm, company, public or private corporation, political subdivision, agency of the State, trust, estate, joint structure company or any other legal entity or their legal representative, agent or assigns.

(122) "Picocurie (pCi)" means that quantity of radioactive material producing 2.22 nuclear transformations per minute.

(123) "Plant intake" refers to the works or structures at the head of a conduit through which water is diverted from a source (e.g., river or lake) into the treatment plant.

(124) "Point of disinfectant application" is the point where the disinfectant is applied and water downstream of that point is not subject to recontamination by surface water runoff.

(125) "Point-of-entry treatment device (POE)" is a treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.

(126) "Point-of-use treatment device (POU)" is a treatment device applied to a single tap used for the purpose of reducing contaminants in drinking water at that one tap

(127) "Pollution Source" means a facility or activity which may introduce any dangerous material to the groundwater system below the water table in concentrations sufficient to cause drinking water quality standards to be exceeded or to decrease the quality of the drinking water. pollution sources shall include, but not be limited to, the following:

(a) Septic tank

(b) Tile Field

(c) Sewer line

(d) Abandoned unprotected well

(e) Waste treatment lagoon

(f) Storage lagoon

(g) Animal feedlot

(h) Chemical handling area

(i) Chemical storage area

(j) Petroleum storage area

(k) Waste disposal area

(l) Mine

(128) "Presedimentation" is a preliminary treatment process used to remove gravel, sand and other particulate material from the source water through settling before the water enters the primary clarification and filtration processes in a treatment plant. May be with or without chemical addition.

(129) "Primary Drinking Water Regulation" means the maximum contaminant limits, the requirements for monitoring, the requirements for reporting, record retention requirements and public notification specified in R.61-58.5, Maximum Contaminants in Drinking Water, and R.61-58.6, Reports, Record Retention and Public Notification of Drinking Water Violations.

(130) "Professional Engineer" means a person properly qualified to perform engineering work as provided in Title 40 of the 1976 Code of Laws of South Carolina, as amended, Chapter 22, Engineers and Land Surveyors.

(131) "Professional Geologist" means a person registered as a professional geologist by the South Carolina State Board of Registration for Geologists.

(132) "Public Water System" means (1) any public or privately owned waterworks system which provides drinking water, whether bottled or piped, for human consumption, including the source of supply whether the source of supply is of surface or subsurface origin; (2) all structures and appurtenances used for the collection, treatment, storage or distribution of drinking water delivered to consumers; (3) any part or portion of the system and including any water treatment facility which in any way alters the physical, chemical, radiological, or bacteriological characteristics of drinking water; provided, that public water system shall not include a drinking water system serving a single private residence or dwelling. A separately owned system with its source of supply from another waterworks system shall be a separate public water system.

(133) "Rapid Mix" means the rapid dispersion of chemicals throughout the water to be treated, usually by violent agitation.

(134) "Rapid Rate Gravity Filter" means a gravity filter not to exceed 4 gallons per minute per square foot of surface area.

(135) "Raw water" means untreated water as obtained from the source.

(136) "Rem" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem (mrem)" is one one-thousandth of a rem.

(137) "Repeat compliance period" means any subsequent compliance period after the initial compliance period.

(138) "Residual disinfectant concentration" ("C" in CT calculations) means the concentration of disinfectant measured in mg/L in a representative sample of water.

(139) "Sand" means a detrital geologic material in the form of un-cemented particles having a size range from two (2) millimeters to one-sixteenth (1/16) of a millimeter and composed of mineral crystals or rock fragments.

(140) "Sanitary Seal" means a cap on the top of the well casing usually fitted with a rubber expansion gasket, which seals off surface drainage, thereby protecting the well from contamination directly down the casing.

(141) "Secondary Containment" means a basin constructed to receive the liquids spilled from any chemical storage tank or solution tank, and shall be designed to prevent migration of any accumulated liquid out of the basin to the soil, ground-water, or surface water at any time. The volume of the secondary containment shall equal or exceed the volume of the tank. Where more than one (1) tank is located in the secondary containment area, the volume of the secondary containment shall be equal to or greater than the volume of the largest tank.

(142) "Secondary maximum contaminant level" means the maximum contaminant levels which, in the judgment of the Department, are requisite to protect the public welfare. Such levels may apply to any contaminant in drinking water (1) which may adversely affect the odor or appearance of such water and consequently may cause a substantial number of the persons served by the public water system providing such water to discontinue its use, or (2) which may otherwise adversely affect the public welfare. Such levels may vary according to geographic and other circumstances.

(143) "Sedimentation" means a process for removal of solids before filtration by gravity or separation.

(144) "Service line sample" means a one-liter sample of water, collected in accordance with R.61-58.11.H(2)(c), Sample Collection Methods, that has been standing for at least 6 hours in a service line.

(145) "7Q10" means the minimum average annual stream flow that can statistically be expected to occur for a seven day period once every ten years.

(146) "Sieve analysis" means a method of determining grain-size distribution by mechanically separating the various size portions using a set of graduated sieves and weighing the portion of the sample retained on each sieve. These weights are converted to percent retained and graphically plotted against grain size to show the grain size distribution in a well.

(147) "Single family structure" for the purpose of R.61-58.11, Control of Lead and Copper, only, means a building constructed as a single-family residence that is currently used as either a residence or a place of business.

(148) "Slow sand filtration" means a process involving passage of raw water through a bed of sand at low velocity (generally less than 0.4 m/h) resulting in substantial particulate removal by physical and biological mechanisms.

(149) "Small water system" for the purpose of R.61-58.11, Control of Lead and Copper, only, means a water system that serves 3,300 persons or fewer.

(150) "Specific Capacity" means the rate of well yield per unit of drawdown. It is usually expressed as gallons-per-minute per foot of drawdown and is a required measurement in selecting pump setting and size.

(151) "Stabilized Water" means water which has been physically or chemically altered to reduce its aggressiveness or corrosiveness.

(152) "Standard sample" means the aliquot of finished drinking water that is examined for the presence of coliform bacteria.

(153) "Stand-by Well" means a well that is not routinely used , but which can be immediately placed into operation if needed. Such wells are routinely exercised and sampled by the water system to ensure operability and water quality.

(154) "State Water System" or SWS means any water system that serves less than fifteen (15) service connections or regularly serves an average of less than twenty-five (25) individuals daily.

(155) "Static water level" means the stable water level which has not been affected by pumping the well in which it is measured.

(156) "Subpart H systems" means public water systems using surface water or ground water under the direct influence of surface water as a source that are subject to the requirements of 40 CFR 141, subpart H.

(157) "Supplier of water" means any person who owns or operates a public water system.

(158) "Surface water" means all water which is open to the atmosphere and subject to surface runoff.

(159) "Surface Water Treatment Plant" means any facility capable of altering the physical, chemical, radiological or bacteriological quality of surface water to produce water for public consumption in a public water system.

(160) "SUVA" means Specific Ultraviolet Absorption at 254 nanometers (nm), an indicator of the humic content of a water. It is a calculated parameter obtained by dividing a sample's ultraviolet absorption at a wavelength of 254 nm (UV_{254}) (in m^{-1}) by its concentration of dissolved organic carbon (DOC) (in mg/L).

(161) "System with a single service connection" means a system which supplies drinking water to consumers via a single service line.

(162) "Tap" means a service connection, the point at which water is delivered to the consumer (building, dwelling, commercial establishment, camping space, industry, etc.) from a distribution system, whether metered or not and regardless of whether there is a user charge for consumption of the water.

(163) "Too numerous to count" means that the total number of bacterial colonies exceeds 200 on a 47-mm diameter membrane filter used for coliform detection.

(164) "Total Organic Carbon" (TOC) means total organic carbon in mg/L measured using heat, oxygen, ultraviolet irradiation, chemical oxidants, or combinations of these oxidants that convert organic carbon to carbon dioxide, rounded to two significant figures.

(165) "Total Trihalomethanes" means the sum of the concentration in milligrams per liter of the trihalomethane compounds [trichloromethane (chloroform), dibromochloromethane, bromodichloromethane, tribromomethane (bromoform)], rounded to two significant figures.

(166) "Transient non-community water system" or TWS means a non-community water system that does not regularly serve at least 25 of the same persons over six months per year.

(167) "Tremie pipe" means a device, usually a small diameter pipe, that carries grouting materials to the bottom of the zone to be grouted and which allows pressure grouting from the bottom up without introduction of appreciable air pockets.

(168) "Trihalomethane" means one of the family of organic compounds, named as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a halogen atom in the molecular structure.

(169) "Two-stage lime softening" is a process in which chemical addition and hardness precipitation occur in each of two distinct unit clarification processes in series prior to filtration.

(170) "Uncovered finished water storage facility" is a tank, reservoir, or other facility used to store water that will undergo no further treatment to reduce microbial pathogens except residual disinfection and is directly open to the atmosphere.

(171) "Uniformity coefficient" means the ratio of the sieve size that will retain 40 percent of the aquifer materials to the effective size.

(172) "Viable Water System" means a water system which is self-sustaining and has the commitment and the financial, managerial and technical capability to consistently comply with the State Safe Drinking Water Act (44-55-10 et seq.) and these regulations.

(173) "Virus" means a virus of fecal origin which is infectious to humans by waterborne transmission.

(174) "Vending Machine" means any self-service device which upon insertion of a coin, coins, or token, or upon receipt of payment by other means, dispenses unit servings of water in bulk, without the necessity of refilling the machine between each operation.

(175) "Waterborne disease outbreak" means the significant occurrence of acute infectious illness, epidemiologically associated with the ingestion of water from a public water system which is deficient in treatment, as determined by the Department.

(176) "Well" means a bored, drilled or driven shaft, or a dug hole whose depth is greater than the largest surface dimension, from which water is extracted or injected. This shall include, but not be limited to, wells used for water supply for irrigation, industrial or manufacturing processes or drinking water; wells used for underground injection of waste for disposal, storage, or drainage disposal; wells used in mineral or geothermal recovery, and any other special process well. In South Carolina, wells used for public water supplies fall into one of the following types of construction:

(a) Type I -open hole wells into bedrock aquifers.

(b) Type II -screened, natural filter wells into unconsolidated aquifers.

(c) Type III -screened, artificial filter (gravel pack) wells into unconsolidated aquifers.

(d) Type IV -open hole wells into limestone aquifers.

(177) "Well Casing" means tubular retaining structure, generally metal, which is installed in the excavated hole to maintain the well opening.

(178) "Well interference" means the additive drawdown effects to two or more wells pumping from the same aquifer in the same vicinity.

(179) "Wholesale system" is a public water system that treats source water as necessary to produce finished water and then delivers some or all of that finished water to another public water system. Delivery may be through a direct connection or through the distribution system of one or more consecutive systems.

C. Appeals.

Any determination made by the Department pursuant to these regulations shall be subject to the provisions of R.61-72 and the Administrative Procedures Act.

D. Severability.

Should any section, paragraph or other part of these regulations be declared invalid for any reason, the remainder shall not be affected.

E. Violations and Penalties.

Any person or persons violating these regulations shall be subject to the penalties provided in Section 44-55-90, of the 1976 Code of Laws, as amended.

R.61-58.1 CONSTRUCTION AND OPERATION PERMITS.

A. Applicability.

This Regulation establishes procedures for obtaining construction and operational permits from the Department.

B. Requirements for Construction Permits.

(1) Before the construction, expansion or modification of any public water system, application for a permit to construct shall be made to, and a permit to construct obtained from, the Department.

(2) The application for a permit to construct shall include the following documentation:

(a) a completed application form for a permit to construct submitted in triplicate (one original and two copies);

(b) four (4) sets of detailed plans (including location map);

(c) three (3) sets of material and construction specifications, except when Department-approved standard specifications are to be used for the construction project;

(d) design data and calculations;

(e) if the owner of the project is different from the utility supplying the water, a letter from the utility supplying the water stating their willingness and ability to serve the project;

(f) if the owner of the project is different from the person that will be responsible for operating and maintaining the project, a letter from that person acknowledging such responsibility; and,

(g) if the owner of the project is different from the entity which has legal authority to serve or grant franchises for the area in which the project is located, the application shall include a letter from that legal entity stating that the proposed project is consistent with the water supply service plan for the area. This letter is not required if the project will not supply water to any person within the service or franchise area, other than to the legal authority.

(3) The application procedure outlined in R.61-58.1(B)(2) is based on a design-bid-build concept for the construction of a project. The Department may consider on a case by case basis alternate design and construction concepts and issue construction permits accordingly.

(4) Before a permit to construct can be issued for a new public water system, the applicant shall demonstrate to the satisfaction of the Department that the new system will be a "viable water system" as defined in R.61-58(B). In addition to the documentation required in R.61-58.1(B)(2), the application for a permit to construct a new public water system shall include a management plan and a multi-year financial plan. These plans will not be required for those new systems whose only source of water is from an existing viable water system and the new system does not provide additional treatment to the water or sell the water. If the application proposes that the new system has its own source of water (i.e., its own well(s) or surface water treatment plant), the applicant shall evaluate the feasibility of connecting to an existing viable public water system as part of the demonstration of viability. This evaluation shall include, but not be limited to, a determination of the willingness and ability of an existing system to serve the project, water quality, capital cost of constructing the line extension versus constructing a new source and

the operation and maintenance costs of both alternatives. Any cost comparisons between creating a new water system with its own source of water and connecting to an existing viable water system shall not be based on any subsidized monitoring. Also any financing of the new system shall not utilize a loan amortization schedule which exceeds the useful life of the facility or its components. This demonstration of viability may be presented to the Department in the form of a Preliminary Engineering Report or as an engineering report submitted when applying for a permit to construct.

(5) For projects in the eight coastal counties, no permit may be issued until the project is found by the Department to be consistent with the Coastal Zone Management Program.

(6) Projects involving construction in state navigable waters will be evaluated by the Department for compliance with the Department's regulations concerning such construction before a permit may be issued.

(7) For projects involving a surface water discharge of water treatment residuals or wastewater, a National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the Department. For projects involving land application of water treatment residuals or wastewater, a No Discharge (ND) permit must be obtained from the Department. No construction permit can be issued for such projects until a valid NPDES or ND permit is obtained.

(8) For projects involving a new groundwater source(s), the permitting will be a two step process. In the first step the owner must submit an application for a permit to construct the source. This construction will involve the drilling of the well, the development of the well, conducting a pumping test in accordance with R.61-58.2(B)(12) and testing the water quality in accordance with R.61-58.2(B)(14). The second step will involve the permitting of the pumping equipment, concrete pad, well head piping, and any treatment, storage and/or distribution facilities associated with the source. The owner must make a second application for a permit to construct these facilities. This second application must include the well record form, the necessary plans and specifications and calculations for these facilities along with the results of the pumping test and water quality analyses. The Department may waive this two-step permitting process and issue a single construction permit for the entire project if the quality and quantity of water from the proposed well can be reasonably predicted through information available from existing wells in the immediate area or a test well. In the event the quantity and/or quality of water from the well is different than anticipated in the original design, revised plans and specifications must be submitted to the Department for approval prior to proceeding with the construction of the project.

(9) Construction permits are valid for three (3) years, from the date of issue, at which time the project must be completed or an extension must be applied for in writing. The extension request must be made by the professional engineer of record for the project and, if applicable, shall include current flow test data. Projects for which the permit to construct has been expired for more than one (1) year are considered new projects and must include a new application as required in paragraph 2 of this section.

(10) A permit to construct may be denied when:

(a) the project does not comply with the design requirements specified in R.61-58.2, R.61-58.3, and R.61-58.4;

(b) the water quality fails to comply with the drinking water standards specified in R.61-58.5;

(c) the owner of a proposed new system fails to prove to the Department's satisfaction that the system will be a "viable water system" as defined in R.61-58(B); or,

(d) the project does not comply with the Department's regulations for permits for

construction in navigable waters.

(e) the project does not comply with the Interbasin Transfer Act and R.121-12.1 et seq., Code of Laws of South Carolina, 1976, as amended.

(11) Piping associated with a service connection will not require a construction permit if the following conditions are met:

(a) all piping associated with the connection is dedicated strictly for use by a single customer being served water;

(b) the customer consists of only a single house, single mobile home, single building or multiple-building complex under single ownership with no rental units (e.g., schools or industry);

(c) the customer is not a shopping mall, multiple-building complex where there will be several owners or renters (e.g., apartment complex, condominium complex, mobile home park, campground, industrial park, or business park) or marina; and,

(d) the line serving the customer does not pass a lot or potential customer between the connection and the customer to be served (this includes the piping downstream or the service meter as well as piping upstream of the service meter).

(12) Failure to obtain a permit to construct is a violation of the Act (Code Section 44-55-40) and is subject to an enforcement action by the Department. Where a person has failed to obtain a permit to construct, an application for permit must be submitted and must include record drawings carrying the seal and signature of a professional engineer.

(13) A 15-day local government notification period shall lapse prior to the issuance of any construction permit. This notification period shall be waived for any projects permitted under the provisions of a general construction permit and delegated review program. This notification period may be waived by the cognizant local government or by the Department if the construction is necessary in order to maintain a safe and adequate supply of water during an emergency. A letter from the local government having potable water planning authority for the area approving the project constitutes a waiver by the cognizant local government.

(14) A dedicated fire line protected by an approved backflow prevention device located at the point of connection to the public water system's distribution line will not require a permit to construct.

C. Engineer's Report.

A preliminary engineering report shall be prepared in triplicate for each new surface water intake, surface water treatment plant, expansion or modification to an existing surface water intake or surface water treatment plant, or other projects deemed necessary by the Department. This report shall carry the seal and signature of a professional engineer. The engineer's report shall, where pertinent, present the following information:

(1) General Information (Required for Each Report):

(a) name, address, phone number of owner, corporation, town or utility as well as name of responsible officer;

(b) name, address, phone number of engineering firm and name of engineer

responsible for design;

(c) general description of service area and surroundings (type of economy, estimated percent residential, estimated percent industrial, terrain, location, possible rate of development);

(d) number and type of customers to be served, (i.e., domestic, industrial, commercial, agricultural, etc.); and,

(e) approval of any land use and development by area planning council which has jurisdiction.

(2) Surface Water Sources

(a) location map including latitude and longitude of intake;

(b) name of source(s), type (river, lake, etc.) and classification (Water Classifications and Standards, R.61-68);

(c) watershed area;

(d) expected 7Q10 flow and lowest flow of record of source(s);

(e) name and type of discharges within ten (10) miles upstream (industrial, agricultural, municipal and other);

(f) chemical and bacteriological analyses of raw water. This analysis must include all parameters addressed in R.61-58.5;

(g) distance from raw water supply to reservoir or plant;

(h) proposed pumping rate from source;

(i) general description of intake and pump house; and,

(j) a detailed engineering and economic assessment on the feasibility of utilizing alternative water sources, or combinations of water sources, other than the proposed water source.

(3) Water Treatment Plants

(a) Projected maximum volume of water to be treated;

(b) Year when plant is expected to operate at its maximum capacity;

(c) If existing, present operating capacity;

(d) Location map of plant;

(e) Height above the one hundred (100) year flood plain based on the best information available;

(f) Land available for future plant expansion;

(g) Proposed treatment scheme shown in block diagram;

(h) Proposed design criteria (retention times, velocities, weir overflow rates, filtration rates, etc.);

(i) Description of proposed method of handling, treating, and disposing of wastewater from plant (includes clarification sludge, filter backwash water, brines, etc.);

(j) Name(s) and grade(s) of operator(s);

(k) For modifications to existing treatment plant, report must include: Present capacity of raw water pumps, and a brief description of what effect proposed modification will have on existing facilities including velocities and retention times through plant; and,

(l) Detailed description of any pilot testing to be performed.

D. Application for Public Water System Construction Permit.

Three (3) copies (the original and two (2) copies) of the application form completed and signed by the professional engineer and the owner shall accompany all submittals for formal approval. Copies of this application form may be obtained from the Department and shall include:

(1) Name and location of project;

(2) Brief description of project including, if applicable, type of source, diameter of well, treatment, expected yield and storage, number and type of services length and size(s) of distribution lines and number of fire hydrants;

(3) Owner's name and address (person on whose behalf application is made);

(4) Name and address of utility or organization responsible for operating and maintaining the system;

(5) Name of the water system providing water;

(6) Department system number of the water system providing water, and;

(7) Signatures of the professional engineer(s) responsible for the design and construction inspections and the owner of the project.

E. Construction Plans.

Construction plans shall carry the seal and signature of a professional engineer and, where applicable, shall provide the following:

(1) General layout drawn to scale on plan sheets no larger than thirty (30) inches by forty-two (42) inches, including:

(a) suitable title;

(b) name of utility or owner;

(c) area or institution to be served;

(d) scale, in feet;

(e) north reference point;

(f) any physical or political boundaries within the area to be served including utility easements;

(g) sufficient number of elevations (Mean Sea Level) to characterize terrain in the area;

(h) date (including month, day, and year), address, and name of the professional engineer responsible for the design;

(i) legible prints;

(j) location and size of existing water mains;

(k) location and nature of existing water works structures and appurtenances affecting the proposed improvements, noted on one sheet;

(l) for small water systems supplied by wells, the location of all existing wells within the system; and,

(m) site location map.

(2) Detailed plans, including:

(a) Construction drawings of distribution system addition drawn to a scale of no smaller than one inch equals two hundred (200) feet showing location of all appurtenances referenced to fixed above ground objects including size, length, identity, and location of sewers, drains, water mains, plant structures, petroleum storage facilities, and for new well projects any other pollution source as defined under "Pollution Sources" in R.61-58.(B). The Department may grant a variance to the 200 feet/inch scale on a case by case basis if the drawings adequately show all necessary physical features mentioned in this item;

(b) Where requested by the Department, profiles including hydraulic gradients for lines ten (10) inches and larger having a horizontal scale of not more than one hundred (100) feet to the inch and a vertical scale of not more than ten (10) feet to the inch, with both scales clearly indicated;

(c) Stream crossings, providing profiles with elevations (MSL) of the stream bed and the normal and extreme high and low water levels;

(d) Schematic drawing of proposed well construction, showing diameter and depth of drill hole(s), casing diameters and depths, grouting depths, elevations and designations of geological formations, water levels and other details to describe the proposed well completely;

(e) Drawing(s) of wellhead construction showing the concrete pad, sanitary seal, screened vent, check valve, pressure gauge, flow meter, blowoff, sample tap, gate valve(s), air line and gauge for measuring water level in the well, protective cover for wellhead, well identification plate;

(f) Topography and arrangement of present or planned wells or structures, with contour interval not greater than two (2) feet for a minimum one hundred (100) foot radius;

(g) Elevation drawings of structures showing the one hundred (100) year flood plain (MSL) and elevations of floor, bottom, overflows, etc. within the structure;

(h) Location and size of property to be used for groundwater development with respect to known references;

(i) Location of all real or potential sources of pollution within two hundred fifty (250) feet of a groundwater source or wellhead protection area, whichever is greater, within one hundred (100) feet of a treated water ground storage facility and ten (10) miles upstream of a surface water intake;

(j) Schematic flow diagrams and hydraulic profiles showing flow through various plant units drawn on plan sheets the same size as the construction drawings;

(k) Location, dimensions, and elevations of all proposed plant facilities;

(l) Location of all plant piping in sufficient detail to show flow through plant including waste lines;

(m) Location of all chemical feeding equipment, points of application, and sample taps following chemical injection points;

(n) Location of sanitary or other facilities, such as lavatories, showers, toilets, lockers, etc.;

(o) All appurtenances, specific structures, and equipment pertinent to the project such as water plant structures (air relief valves, altitude valves, blowoffs, hydrants, service connections, etc.);

(p) Erosion control structures for wellhead blowoff and elevated and ground storage tank drains;

(q) Adequately detailed drawing of any feature or piece of equipment not otherwise covered or adequately described by the specifications; and,

(r) Protection of the water source, structures, and appurtenances, to include, but not be limited to, fencing, protective housing, or comparable form of security.

F. Specifications.

The title page or cover of the specifications must carry the seal and signature of a professional engineer. Complete, detailed, technical specifications shall be supplied for each proposed project, and shall include, but not be limited to, the following:

(1) Construction specifications including:

(a) A detailed written program for maintaining normal operation of existing facilities during construction with minimal interruption of service;

(b) Laying methods and conditions including depth of cover, type of bedding and reaction blocking, and special structural details for water lines installed under storm drains;

(c) Pressure and leakage test procedures for new water mains including method of determining maximum allowable leakage;

(d) Disinfection procedure for all new or affected water system components to include disinfectant, dosage, contact time, and method for testing the results of the procedure;

(e) Well construction method and procedure;

(f) Chlorination room construction; and,

(g) Other chemical feeding facilities construction;

(2) Material specifications including:

(a) Laboratory facilities and equipment, including sampling taps and their location;

(b) Number and design of chemical feeding equipment including make and model, if available;

(c) Equipment for sanitary or other facilities including any necessary backflow or back-siphonage protection;

(d) Water main and appurtenances schedule and class, including approval status by testing and certification organizations;

(e) Make, model, horsepower and performance curves of all pumping equipment; and,

(f) Paint coatings.

(3) Testing and development procedure for new sources.

(4) Standard specifications.

If a water system or professional engineering firm uses a set of its own standard specifications, such specifications may be submitted to the Department, in duplicate, for approval. Following this approval, no specifications will be required on future project submittals as long as no changes are made. If there are any additions, deletions, or revisions to the approved standard specifications for a particular project submitted, the professional engineer shall either submit three (3) copies of an addendum to the standard specifications covering the changes only, or shall submit three (3) complete copies of specifications for the project in question. Each professional engineer that will be using a standard specification must place his seal and signature on the title page and must place his seal and signature on any revisions.

G. Design Data.

A summary of complete design criteria and design calculations shall be submitted for each proposed project, and shall contain, but not be limited to, the following where applicable:

(1) Pumping capacity of source;

(2) Average daily water consumption;

(3) Number and type(s) of proposed service connections;

(4) fire flow requirements (refer to Section R.61-58.B for the definition of fire flow);

(5) The results of a flow test conducted at a location near the proposed connection to the existing system. The results of this flow test shall include static pressure and residual pressure when a known flow, in excess of the demand for the proposed extension, is flowing. The time and date the flow test was conducted, the pipe size, type of pipe, elevation and distance between the test point and connection site shall also be included;

(6) Basin capacities;

(7) Retention times;

(8) Unit loadings;

(9) Filter area and proposed filtration rate;

(10) Backwash rate;

(11) Feeder capacities and ranges;

(12) Ground storage and transfer pump capacity;

(13) System storage capacities; and,

(14) System pressures at maximum instantaneous demand (not less than twenty-five (25) pounds per square inch); or fire flow in addition to peak hourly flow or flushing flow in addition to peak hourly flow (not less than twenty (20) pounds per square inch), whichever is the worst case.

H. Requirements for a General Construction Permit.

(1) A public water system which meets the following criteria may apply for a general permit for the construction of water line extensions.

(a) The system must have a full-time professional engineer on staff or a professional engineer on retainer.

(b) The system must have a full-time management and full-time inspection and maintenance staff.

(c) The system must have a set of design criteria which has been approved by the Department. This criteria shall be at least as stringent as that used by the Department.

(d) The system must have a set of approved construction specifications for water distribution lines on file with the Department. These specifications must bear the seal and signature of the professional engineer on staff or the professional engineer on retainer.

(e) The system must have historically demonstrated satisfactory bacteriological and chemical water quality as required by R.61-58.5, R.61-58.10, and R.61-58.11.

(f) The system must have a satisfactory pressure record as required by R.61-58.4.D(4).

(g) The system must have implemented and maintained a viable cross connection control program in accordance with R.61-58.7(F);

(h) The system must have an active inspection program for new water distribution line construction.

(i) The system must maintain an updated map of the distribution system. This map must include the following, where applicable:

(i) Existing water distribution lines;

(ii) Location and size of all storage tanks, booster pump stations, pressure reducing valves, master metered connections, and fire hydrants; and,

(iii) Location of all water treatment plant(s), surface water intake(s), well(s) and connections to other public water systems; and,

(j) The system must have a computerized hydraulic model of its distribution system. This model shall include a sufficient number of lines to adequately represent the distribution system. This hydraulic model must be made available for review by the Department upon request.

(2) The application for a general construction permit shall include a completed application form for a permit to construct, submitted in triplicate (one original and two copies), and necessary documentation to show compliance with the criteria specified in R.61-58.1(H)(1). If the system does not have approved construction specifications or design criteria on file with the Department at the time of making application for a general construction permit, the application must include two (2) copies of its standard specifications and two (2) copies of its design criteria.

(3) A general construction permit shall be valid for a period of five (5) years. In order to renew the general construction permit, a new application must be submitted to the Department in accordance with R.61-58.1(H)(2).

(4) The Department may revoke the general construction permit at any time during the five year period for failure to maintain the qualifications as specified in R.61-58.1(H)(1) or failure to comply with the conditions of the permit. Such revocation is subject to appeal in accordance with the Administrative Procedures Act and applicable procedures for contested cases.

(5) The general permit shall apply to the construction of water line extensions only.

(6) For those systems which have a professional engineer on staff the following procedure shall be followed under the general construction permit:

(a) An annual report shall be submitted, in duplicate, to the Department listing all water line extensions constructed during the calendar year. This report shall be submitted no later than January 30th following the year for which the report was prepared. This report shall include the following information for each line extension:

(i) street name;

(ii) size(s) and length(s) of line; and,

(iii) type of customer(s) being served.

(b) If a line extension is for the connection of the distribution system to an additional source of water, the general construction permit will not apply and the system shall make application for a permit to construct in accordance with R.61-58.1(B).

(c) For those projects which are in the eight (8) coastal counties, the system shall obtain approval, prior to construction, from the Office of Ocean and Coastal Resources Management certifying that the project is consistent with the Coastal Zone Management Program.

(d) The system shall maintain, for a minimum of three years, records of all pressure testing and bacteriological analyses conducted in conjunction with each water line extension and make them available to the Department upon request.

(e) No approval from the Department will be required prior to placing any of the water line extensions into service.

(7) For those systems which have a professional engineer on retainer the following procedure shall be followed under the general construction permit:

(a) For all water line extensions greater than twenty-five hundred (2,500) linear feet, two (2) copies of line drawings, to scale, shall be submitted to the Department for permitting. This submittal shall also include a description of what is to be served and a flow test conducted near the point of connection to the existing system. The flow test information shall include the static pressure, flow, residual pressure and date, time, and duration of the test. These drawings shall carry the seal and signature of the professional engineer on retainer. A construction permit shall be issued by the Department prior to construction of the proposed line extension(s). Written approval shall be obtained from the Department prior to placing the water line extension(s) into service; and,

(b) For all water line extensions less than or equal to twenty-five hundred (2,500) linear feet, two (2) copies of line drawings, to scale, shall be submitted to the Department at least ten (10) days prior to construction. This submittal shall also include a description of what is to be served and a flow test conducted near the point of connection to the existing system. The flow test information shall include the static pressure, flow, residual pressure and date, time, and duration of the test. These drawings shall carry the seal and signature of the professional engineer on retainer. No additional construction permit will be required. However, if the Department suspects that there may be a problem with a proposed water line extension, the Department may require additional information to be submitted in order to justify the design. The Department shall be notified in writing within ten (10) days following the date the water line extension is placed into service. This notification shall include two copies of record drawings if the construction differed from the plans submitted under R.61-58.1.H(6)(a) and a copy of the results of all pressure testing and bacteriological analyses conducted in conjunction with the project. No written approval from the Department will be required prior to placing the extension into service.

For those projects which are in the eight (8) coastal counties, the system shall obtain approval,

prior to construction, from the Office of Ocean and Coastal Resource Management certifying that the project is consistent with the Coastal Zone Management Program.

(8) The general permit shall include conditions to ensure compliance with the state program for permits to construct in navigable waters.

(9) The general construction permit applies only to the construction of those water lines designed, and owned or operated, by the public water system to which the general permit is issued. Permits for privately owned water lines must be obtained through the Delegated Permit program specified in R.61-58.1(I) or through the permitting process specified in R.61-58.1(B) through (G).

I. Delegated Review Program.

(1) A public water system which meets the following criteria may apply for delegated review authority.

(a) The system must have a professional engineer on staff.

(b) The system must have a full-time management and full-time inspection and maintenance staff.

(c) The system must have a set of design criteria which has been approved by the Department.

(d) The system must have a set of approved construction specifications for water distribution lines on file with the Department. These specifications must bear the seal and signature of the professional engineer on staff.

(e) The system must have historically demonstrated satisfactory bacteriological and chemical water quality as required by R.61-58.5, R.61-58.10, and R.61-58.11.

(f) The system must have a satisfactory pressure record as required by R.61-58.4.D(4).

(g) The system must have implemented and maintained a viable cross connection control program in accordance with R.61-58.7(F);

(h) The system must have an active inspection program for new water distribution line construction;

(i) The system must maintain an updated map of the distribution system. This map must include the following, where applicable:

(i) Existing water distribution lines;

(ii) Location and size of all storage tanks, booster pump stations, pressure reducing valves, master metered connections, and fire hydrants; and,

(iii) Location of all water treatment plant(s), surface water intake(s), well(s) and connections with other public water systems; and,

(j) The system must have a computerized hydraulic model of its distribution system. This model shall include a sufficient number of lines to adequately represent the

distribution system. This hydraulic model must be made available for review by the Department upon request.

(2) The application for delegated review authority shall include a completed application form for a permit to construct, submitted in triplicate (one original and two copies), and necessary documentation to show compliance with the criteria specified in R.61-58.1(I)(1). If the system does not have approved construction specifications or design criteria on file with the Department at the time of making application for delegated review authority, the application must include two (2) copies of its standard specifications and two (2) copies of its design criteria.

(3) The Department may revoke a system's delegated review authority at any time for failure to maintain the qualifications as specified in R.61-58.1(I)(1) or failure to comply with the permitting procedures under the delegated review program. Such revocation is subject to appeal in accordance with the Administrative Procedures Act for contested cases.

(4) The delegated review program applies only to the permitting of line extensions which are not subject to the requirements for demonstrating viability as specified in R.61-58.1.B(4) and connecting to the system which has the delegated review authority.

(5) The procedure for obtaining a permit to construct under the delegated review program is as follows:

(a) The professional engineer for a water line extension project may submit plans and specifications and design data to the public water system with delegated review authority for review in lieu of submitting to the Department an application for a permit to construct as specified in R.61-58.I(B)(2). The delegated review authority shall review the project for compliance with its design criteria and construction specifications.

(b) Following a satisfactory review of the project by the delegated review authority, the system shall submit the following information to the Department for permitting:

(i) A transmittal letter, signed by the professional engineer on staff, which clearly states the project is being submitted under the delegated review program. This letter shall also state that the project has been reviewed and complies with the system's design criteria and construction specifications;

(ii) A completed application form for a permit to construct in duplicate (the original and one (1) copy);

(iii) Two (2) sets of plans bearing the seal and signature of the design engineer;

(iv) One (1) copy of the flow test results from a location near the tie-on site. This must include the static pressure and residual pressure while flowing in excess of the demand for the proposed extension. The time, date and duration of the flow test, the size of pipe, type pipe and distance to the tie-on site must be included;

(v) One (1) copy of design calculations indicating a minimum pressure of twenty-five (25) pounds per square inch must be maintained everywhere in the distribution system during instantaneous demand or twenty (20) pounds per square inch during fire flow plus peak hourly flow; and,

(vi) Two (2) copies of a site location map.

(c) Where applicable, the Department will review the project for consistency with the Coastal Zone Management Plan and for construction in navigable waters prior to issuing a permit to construct.

(d) Written approval must be obtained from the Department prior to placing the water line extension into service.

J. Revisions to Approved Plans.

Any deviations from approved plans or specifications which could potentially effect capacity, hydraulic conditions, operating units, the functioning of water treatment processes, or the quality of the water to be delivered, shall be approved by the Department, in writing, before such changes are made. A revised application in accordance with R.61-58.1(B) will be required.

K. Requirements for Obtaining Approval to Place Permitted Construction into Operation.

(1) Newly-constructed facilities shall not be placed into operation until written approval is issued by the Department, except where it is allowed by a general construction permit. Upon completion of permitted construction, the professional engineer shall make arrangements with the Department for final inspection. Prior to this inspection, the professional engineer shall submit to the Department a letter certifying that construction is complete and in accordance with the approved plans and specifications. This letter must specifically identify the project by permit number. If the project was not completed in accordance with the approved plans and specifications, the professional engineer shall so state and shall outline any deviations to the permitted project. No written approval shall be issued to place a drinking water construction project into operation until written approval is obtained to place any associated wastewater construction into operation. The following information, where applicable, shall be submitted with the professional engineer's letter of certification:

(a) Results of chemical, physical, radiological, and bacteriological analyses of new sources and/or treated water. These analyses shall be performed by a certified laboratory.

(b) Results of bacteriological analyses following disinfection, including chlorine residuals at the time of collection, which have been conducted within thirty (30) days of the request for final approval. These analyses shall be performed by a certified laboratory.

(c) Results of pressure/leakage test conducted on water lines;

(d) Record drawings of construction if the construction deviated from that approved;

(e) Completed Water Well Record form;

(f) Geophysical/mechanical well logs;

(g) Results of pumping test as required by R.61-58.2(B)(12).

(h) Letter of acceptance from organization responsible for operation and maintenance (must be the same as shown on the application for permit to construct form);

(i) Paint coating(s) used for water storage tank(s);

(j) Copy of recorded legal easement(s) and/or deed restriction(s) for protection of

well pollution free radius;

(k) Proof of registration with the S. C. Public Service Commission for new privately owned utilities and homeowner associations;

(l) Proof of testing of all backflow prevention assemblies installed; and,

(m) Copies of any information specified in a special condition of a Department construction permit.

(2) Failure to obtain written approval from the Department prior to placing any newly constructed drinking water facilities into operation is a violation of the Act (Code Section 44-55-40) and is subject to an enforcement action by the Department. Where a person has failed to obtain a permit to construct, an application for permit must be submitted to include record drawings carrying the seal and signature of a professional engineer.

L. Drinking Water Dispensing Stations and Vending Machines.

(1) Any person or public water system desiring to make vended or dispensed water available to the public shall obtain approval from the Department prior to installation and shall obtain approval to operate before placing it into use. All water dispensing stations or vending machines must utilize water from an approved public water system. Each dispensing station or vending machine which provides further treatment is considered a separate public water system and must comply with all applicable requirements for public water systems. Before any approval can be issued technical information on machines and treatment equipment including make and model, rates of filtration, maximum daily output, and method of disinfection; and, complete plans and specifications for each machine or treatment unit shall be submitted to the Department.

(2) Approval is issued for an individual machine at a particular location, connecting to a known public water system. Machine replacement or relocation must be approved by the Department.

(3) A final inspection, total coliform clearance sample and a written approval from the Department is required before placing a machine or dispensing station into operation.

M. Bottled Water.

1. All sources within the state which are used in the manufacturing of bottled water shall be either permitted in accordance with R.61-58.1 or from an existing approved public water system.

2. If an out-of-state source of water is used by a bottled water manufacturing plant located within South Carolina, that source must be approved by the Department prior to use.

3. All treatment used in the manufacturing of bottled water shall be permitted in accordance with R.61-58.1

N. Request for Review of Permit Decisions.

1. An applicant may request that the director of the Department's water supply permitting division review any construction or operating permit decision within 15 (fifteen) days of receipt of the decision. The request shall be in writing and include a detailed justification of the reasons for the review.

2. The director shall respond in writing to the request within 15 (fifteen) days of receipt of the written request. This response may include, but not be limited to, a request for additional information,

scheduling of a meeting to discuss the permit decision, or the issuance of a final permit decision.

3. The applicant may appeal the director's final decision on the permit in accordance with R.61-58(C).

O. Operating Permits.

(1) Public water systems which meet any of the following conditions shall obtain and maintain an operating permit from the Department:

(a) A system which has its own source of water (i.e., well or surface water treatment plant);

(b) A system which provides treatment;

(c) A system which sells water to any person; or,

(d) A system which is a carrier which conveys passengers in interstate commerce.

(2) Any person making application for a permit to construct a new public water system which meets any of the conditions specified in R61-58.1.O(1) will not be required to submit a separate operating permit application. The Department will issue an operating permit for the system at the same time the permit to construct is issued. The operating permit will be contingent upon the permittee obtaining approval from the Department to place the newly constructed facilities into operation in accordance with R.61-58.1.K.

(3) For existing systems, the Department shall provide a draft of the operating permit to the applicant for comment, for at least a thirty (30) day period. If the applicant gives written notice of concurrence with the draft permit, the thirty (30) day comment period may be waived. After consideration of any comments received from the applicant, the Department will issue the operating permit. The operating permit will become effective on that date unless a review of the decision is requested in accordance with R.61-58.1(N), or appealed in accordance with R.61-58.C.

(4) The Department may revoke an operating permit for any existing water system which is unable to demonstrate its ability to remain a "viable water system" as defined in R.61-58.B.

(5) The Department may modify an operating permit at any time to include any new promulgated requirements of the Act or these Regulations, to address requirements necessary to ensure compliance with the State Safe Drinking Water Act and these regulations, to include any approved or permitted construction modifications to the system, or to modify a compliance schedule. Permit modifications will be issued in accordance with R.61-58.1.O(3).

(6) The permittee may request a modification of the operating permit at anytime with adequate justification. The permittee shall complete and submit to the Department an operating permit application form along with a detail justification for the modification(s) requested. Permit modifications will be issued in accordance with R.61-58.1.O(3).

(7) An operating permit is non-transferable, except with prior approval of the Department. The permittee shall submit written notification to the Department at least 30 days in advance of the proposed transfer. This notification shall include an operating permit application form which has been completed by the proposed new owner of the system. The Department may request on a case by case basis that the proposed new owner of the system submit a business plan which shows how the system will be managed to ensure its long term viability. If the Department approves of the transfer, a new operating

permit will be issued to the new owner of the system in accordance with R.61-58.1.O(3).

(8) If an existing water system is out of compliance with any of the requirements of the Act or these Regulations, the Department may include in the operating permit a schedule for achieving compliance with such requirements.

(9) The operating permit for an existing system shall specify the "overall rating" of the last sanitary survey conducted by the Department. If the overall rating of the last sanitary survey was "unsatisfactory", the operating permit shall require the submission of a business plan which will demonstrate how the system will be managed in the future to ensure its long term viability. The business plan must be submitted to the Department for approval within six months of the effective date of the operating permit. The Department may on a case by case basis require that the business plan include a schedule for achieving compliance with the Act and these Regulations. Once the compliance schedule is approved by the Department, it becomes a part of the operating permit.

(10) Once the permittee has satisfactorily complied with the requirements of R.61-58.1.O(9) and necessary corrections have been made to the water system, the permittee may request that the Department revise the sanitary survey rating on the operating permit.

(11) The operating permit shall include a condition that requires the submission of a business plan to the Department within six months following the issuance of an "unsatisfactory" rating on any future sanitary survey.

(12) The Department may issue general operating permits for groups of systems with similar operating requirements. The Department may deny coverage under the general operating permit to any system which is not in compliance with the requirements of the Act or these Regulations. The Department may also deny coverage under the general operating permit where specific requirements are necessary to obtain and/or maintain compliance with the Act or these Regulations.

(13) If an existing public water system is divided into two or more smaller water systems, each of the smaller water systems shall comply with the water quality monitoring requirements of the water system prior to it being divided.

61-58.2 GROUNDWATER SOURCES AND TREATMENT

A. Applicability.

This regulation applies to all new construction and all expansions or modifications of existing public water systems. If the Department can reasonably demonstrate that safe delivery of potable water to the public is jeopardized, a system may have to upgrade its existing facilities in order for an expansion or modification to meet the requirements of this regulation. This regulation prescribes minimum design standards for the construction of groundwater sources and treatment facilities.

B. Groundwater Development.

All wells must be constructed by a certified well driller.

(1) Quantity -

(a) A minimum of two (2) independent sources of groundwater shall be provided for all community water systems serving fifty (50) or more taps or one hundred fifty (150) or more people. Systems with an additional source (Surface Water Plant or Master Meter) will not be required to have two groundwater sources.

(b) The total developed groundwater source capacity shall equal or exceed the design maximum day demand without pumping more than sixteen (16) hours a day. With the largest producing well out of service, the capacity of the remaining well(s) pumping twenty-four (24) hours a day shall equal or exceed the design maximum daily demand, except those systems requiring only one well. The capacity from an additional source (Surface Water Plant or Master Meter) will be included in the quantity analysis. However, emergency and stand-by wells will not be included in the quantity analysis.

(2) Quality - Where the water quality does not meet the drinking water standards established in R.61-58.5, appropriate treatment designed in accordance with R.61-58.2 shall be provided.

(3) Site Considerations -

(a) Location -

(i) The location of the public well shall be at least one hundred (100) feet from all potential pollution sources except where the professional engineer or professional geologist can justify a lesser distance based in part on hydrogeological conditions or special well construction techniques or where the pollution source is designed in such a manner as to prevent the release of contaminants to the environment. A greater pollution free radius shall be required where water from water table aquifers will be used. A Wellhead Protection Area Inventory must be performed based on the location and expected yield of the proposed well.

(ii) The well location shall be at least fifty (50) feet from all surface water bodies including drainage ditches. The site must be such that the wellhead can be protected above the one hundred (100) year flood plain. Special construction techniques may be required by the Department in any area which is generally subject to flooding and the professional engineer must demonstrate to the satisfaction of the Department that the site selected is the best available. No well(s) shall be constructed in such proximity to existing wells as to cause unwarranted well interference.

(b) Easement - Once the pollution free radius is established according to R.61-58.2(B)(3)(a), an appropriate easement, ownership or deed restriction to ensure the required pollution-free radius shall be filed at the county courthouse. A copy of the deed must be submitted to the Department prior to placing the well into operation. If a right-of-way easement is needed to maintain access to the well, such an easement shall be filed at the county courthouse and a copy submitted to the Department prior to placing the well into operation.

(c) Special Considerations - Wells located within two hundred (200) feet of a body of water, or constructed such that water is being drawn from less than fifty (50) feet in depth, or constructed such that the filter material extends to less than fifty (50) feet below grade, must conduct special monitoring required in R.61-58.2(B)(14)(c). This monitoring must be conducted within one year of receiving the permit to operate. If the well is found to be under the direct influence of surface water, treatment must be added and monitoring conducted in accordance with the requirements of R.61-58.10, Filtration and Disinfection.

(4) All materials and products installed in a public water system after December 31, 1995, which comes into direct contact with drinking water during the treatment, storage, transmission or distribution of the water, shall be certified as meeting the specifications of the American National Standard Institute/National Sanitation Foundation Standard 61, Drinking Water System Components - Health Effects. The certifying party shall be accredited by the American National Standards Institute.

(5) Drilling and Sampling -

(a) Driller's log - A driller's log shall be completed for each well and shall include a depth reference point, the depth of each formation change, a description of each formation including color, mineralogy, rock type, grain size, and any other observations which may have a bearing on the final construction of the well. Special attention is required in the case of Type I wells in that the log shall denote the depth, thickness, and approximate flow of each fracture or fracture zone as measured by discharge during air circulation hammer/rotary drilling. The Department must be provided two (2) copies of the driller's log prior to the construction of the pumping, treatment or distribution facilities associated with the well or with the engineer's certification letter if the project is permitted in one step.

(b) Geophysical/Mechanical logs - Where required by the Department, two (2) copies shall be provided to the Department prior to the construction of the pumping, treatment or distribution facilities associated with the well or with the engineer's certification letter if the project is permitted in one step.

(c) Penetration rate log - Where required by the Department, two (2) copies shall be provided to the Department prior to the construction of the pumping, treatment or distribution facilities associated with the well or with the engineer's certification letter if the project is permitted in one step.

(d) Sieve Analysis For Type II and III Wells - Where required by the Department, two (2) copies of sieve analysis results shall be provided to the Department prior to the construction of the pumping, treatment or distribution facilities associated with the well or with the engineer's certification letter if the project is permitted in one step.

(e) Drilling fluid control program - Where drilling water is used, it shall contain no dangerous materials, shall be disinfected and shall meet the drinking water standards

established in R.61-58.5. All other drilling fluids and additives used shall comply with recognized industry standards and practices for the construction of drinking water wells, and shall be applied and used as prescribed by the manufacturer. Toxic and/or dangerous substances shall not be added to drilling fluid. Non-potable surface or ground water shall not be used as a drilling fluid.

(6) Well Casing Selection and Installation -

(a) Casing selection - New casing which bears mill markings and which conform to standard specifications (ASTM A-53) for water well pipe shall be used. Thermoplastic casing and couplings which meet standard specifications (ASTM F-480) and which are approved by the National Sanitation Foundation may be used for Type II, III and IV wells which will not exceed three hundred (300) feet in depth. Unless specifically approved by the Department, thermoplastic casing shall not be used for Type I wells. No material containing more than eight (8) percent lead by weight shall be used in the completed well.

(b) Method of installation - The following methods shall be used:

Well	**Casing installed by**
Type I	Driving to refusal in firm bedrock. Where firm bedrock is encountered shallower than twenty (20) feet a minimum casing length of twenty (20) feet will be required.
Type II and III	Lowering the casing string in the pre-drilled hole so as not to damage any parts of the screen or casing.
Type IV	Driving into firm limestone where metal casing is used or by placing into firm limestone where thermoplastic casing is used.

(c) Method of joining - Casing lengths shall be joined in alignment and made water tight by an appropriate method for the material used such that the resulting joint shall have the same structural integrity as the casing. Threaded and coupled joints shall be API or equivalent and shall be firmly and securely seated. PVC solvent cement and bell end or coupled joints shall meet ASTM standard specifications.

(d) Sanitary protection of well - The well shall be protected at all times during construction. The casing shall be sealed with a suitable flanged, threaded, or welded cap or compression seal upon completion. The outside casing shall be sealed to, and centered in, a reinforced concrete pad having a minimum strength of two thousand (2000) pounds per square inch, a minimum radius of three (3) feet and a minimum thickness of four (4) inches. The concrete pad shall be constructed with a slope so that water will drain away from the casing. The top of the outside casing shall extend at least twelve (12) inches above the concrete pad. There shall be no openings in the casing wall below its top except for water level measurement access ports or vents. Such openings shall be sealed water tight prior to use of the well. Any well which is to be temporarily removed from service, or which is completed for a period of time prior to being placed in service, shall be capped with a watertight cap and protected from vandalism.

(e) Well identification plate - Every well shall be equipped immediately after completion of the drilling, and prior to issuance of a permit to operate with an

identification plate.

(i) The identification plate shall be constructed of a durable, weatherproof, rustproof metal or equivalent material.

(ii) The identification plate shall be securely attached to the well casing or concrete pad around the casing where it is readily visible.

(iii) The identification plate shall be stamped with a permanent marking to show the following information:

(A) Drilling contractor and registration number;

(B) Date well completed;

(C) Total depth of well (in feet);

(D) Casing: Depth (in feet), Inside Diameter (in inches);

(E) Screened intervals (of screened wells);

(F) Filter-pack interval (of wells with artificial filter-pack);

(G) Yield expressed in gallons per minute (gpm), or specific capacity expressed in gallons per minute per foot of drawdown (gpm/ft.-dd);

(H) Static water level and date measured; and,

(I) Latitude and longitude (to the nearest second).

(7) Well Grouting - The Department shall be notified a minimum of three (3) days prior to the time of grouting.

(a) Grouting materials -All wells shall be grouted with a minimum of sand-cement, bentonite-cement mixture or neat cement. The sand-cement or neat cement mixture shall be composed of not more than two (2) parts by weight of sand to one (1) part of cement with not more than seven (7) gallons of clean water per bag (one cubic foot or 94 pounds) of cement. The bentonite-cement mixture shall be composed of three (3) to five (5) pounds of bentonite mixed with seven (7) gallons of clean water per bag (one cubic foot or 94 pounds) of cement.

(b) Method of installation of grout - Grout material shall be placed by tremie pipe, either by pouring or forced injection, after water or other drilling fluid has been circulated in the annular space sufficiently to clear all obstructions. There shall be a minimum annular space of three (3) inches for gravity feed and one and one-half (1.5) inches for forced injection between the outside surface of the casing and the formation. The minimum size tremie pipe shall be two (2) inches inside diameter for gravity feed and one (1) inch inside diameter for forced injection. When placing the grouting material, the tremie pipe shall be lowered to the bottom of the zone to be grouted and raised slowly as the grout material is introduced. The tremie pipe shall be kept full continuously from start to finish of the grouting procedure, with the discharge end of the tremie pipe being continuously submerged in the grout until the zone to be grouted is completely filled. The grout shall be allowed to properly cure before construction may be resumed.

More sophisticated methods of installation of grout may be used but care must be taken to ensure these are in accordance with standard procedures.

(c) Length of grout - The minimum length of grout for sanitary protection shall be:

Well	**Grouted from surface**
Type I	To at least fifty (50) feet or firm bedrock, whichever is less. However, where bedrock is encountered at less than twenty (20) feet, at least twenty (20) feet of casing shall be used and the entire length of the casing shall be grouted.
Type II and III	To fifty (50) feet or the first low permeability stratum (clay, marl, etc.), or to within ten (10) feet of the upper most screen when no low permeability stratum is encountered, whichever is greater.
Type IV	To fifty (50) feet or firm limestone or firm marl, whichever is less. However, where limestone or firm marl is encountered at less than twenty (20) feet, at least 20 feet of casing shall be used and the entire length of the casing shall be grouted.

The Department may require an additional length of grout where warranted by site, geological and/or water quality conditions.

(d) Centralizers - For Well Types II and III centralizers shall be attached to the outer casing at the bottom of the upper zone to be grouted and at the top and bottom of other critical grouting points such as zones of unsuitable water quality as indicated by test hole information.

(8) Well Screens - This part is applicable to Well Types II and III only.

(a) Filter type selection - Where a non-homogeneous aquifer, having a uniformity coefficient less than three (3.0) and an effective grain size less than one tenth (0.1) inches is to be screened, an artificial filter shall be used as described in R.61-58.2(B)(9).

(b) Screen-type selection - The screen specified shall have controlled uniform slot size, have structural integrity, and be of a type which will allow a well entrance velocity which does not exceed six (6) feet per minute. The use of non-metallic screens will be reviewed on a case-by-case basis. The use of non-metallic screen settings below two hundred (200) feet will be allowed only when recommended by the manufacturer.

(c) Screen slot size - The screen slot size shall be based on sieve analysis, industry standards, and good engineering practice; and/or shall meet the sand content limits outlined in R.61-58.2(B)(11)(b).

(d) Screen length - Screen of sufficient length shall be installed to obtain an entrance velocity not to exceed six (6) feet per minute.

(e) Screen location - Screen settings located in unconfined water-table aquifers shall be approved only on a case-by-case basis where justification concerning pollution-free radius, treatment, etc. is provided.

(f) Method of screen installation - The screen shall be provided with such fittings as are necessary to seal the top tightly to the casing and to close the bottom, as defined in R.61-58.2(B)(8)(g) and (h). If the screen is telescoped inside the casing, a packer seal made for this purpose, or an approvable substitute, shall be lapped at least twelve (12) inches into the casing. If this screen is attached to the casing prior to lowering, centralizers shall be used and a suitable coupling shall be provided or the screen shall be welded to the casing.

(g) Method of joining screen to screen - Screen sections for a single interval shall be joined by threaded and coupled joints, socket-type fittings and solvent welding, or electric arc or acetylene welding. Welding rods and methods recommended by the screen manufacturer shall be employed. Resulting joint(s) must be straight, sand tight, and retain one hundred (100) percent of the screen strength.

Blank spacers for multiple interval screens shall be of compatible material with the screens or casing. They shall be joined to the screen by threaded and coupled joint, socket-type fittings, solvent welding, or electric arc or acetylene welding using materials and procedures specified in R.61-58.2(B)(6)(c). The resulting joints shall be straight, sand tight, and retain one hundred (100) percent of the screen strength.

(h) Method of connecting screen to casing - The connection between the screen and casing shall be by a neoprene or rubber seal especially made for this purpose, or by threaded and coupled joints, socket fittings and solvent welding, or electric arc or acetylene welding using materials and procedures listed in R.61-58.2(B)(6)(c). The resulting joints must be straight, water tight, and retain one hundred (100) percent of the screen strength.

(i) Methods of sealing bottom - The bottom of the screen shall be sealed with bagged cement or a threaded or welded plug made of compatible material with the screen body.

(9) Well Filter Construction (Artificial) - This part is applicable only to Type III wells.

(a) Filter material - Clean, well-rounded quartz particles free of limestone, clay, organic matter or other unsuitable materials shall be used.

(b) Selection of artificial filter grain size and screen aperture size - When an artificial filter is necessary, the filter grain size shall be determined from sieve analysis of the formation to be screened. The screen aperture shall be of such size as to retain between eighty-five (85) and one hundred (100) percent of the filter material. The drill hole diameter shall be carefully controlled so that the thickness of the filter medium ranges from a minimum of three (3) inches to a maximum of eight (8) inches.

(c) Length of artificial filter - The filter material shall, at a minimum, extend below the lowest screen for a distance two and a half (2.5) times the largest diameter of the well casing to the same distance above the highest screen. Where zones of inferior water quality are to be avoided, the annular space opposite the inferior zones shall be grouted in accordance with R.61-58.2(B)(7)(a) and (b).

(d) Delivery and storage of filter material - The filter material shall be protected from the weather and any contamination by bagging, or covering with plastic or canvas until used. If no protective cover is placed on the ground under the filter material, the layer in contact with the ground shall not be used.

(e) Method of installation of filter material - The filter material shall be placed with a disinfected fluid. For wells less than fifty (50) feet in depth with a short screen (5 to 10 feet), the filter material may be gravity fed from the surface if the annular space is at least six inches. For wells deeper than fifty (50) feet, a tremie pipe shall be required.

(10) Well Plumbness and Alignment - The completed well shall be sufficiently plumb and straight so that there will be no interference with installation, alignment, operation, or removal of the test or permanent pumps.

(11) Well Development - Proper well development is demonstrated by the turbidity of the water produced by the well and its sand content.

(a) Turbidity - The water produced by a completed well must have a turbidity of less than five (5.0) nephelometric turbidity units (NTU) unless it can be demonstrated that the turbidity is due to the natural water quality of the aquifer.

(b) Sand content - The maximum sand content shall be five (5) milligrams per liter or twenty (20) milligrams per gallon in the completed well.

(12) Well Testing for Performance - The Department shall be notified at least three (3) days prior to the time of the pumping test. The pumping test shall not be conducted until the well has been adequately developed.

(a) Type of pumping test performed - Pump tests to fully evaluate the yield and specific capacity shall be performed on all newly constructed wells and shall be performed for a minimum of twenty-four (24) hours at the design or maximum capacity of the well. The test procedure shall be based on good hydro-geologic practice.

(b) Aborted tests - Whenever there is an interruption in pump operation for a period greater than one percent of the elapsed pumping time, there shall be a suspension of the test until the water level in the pumped well has recovered to the static level. The test must be restarted and run for the full twenty-four (24) hour period.

(c) Location of discharge - Water shall be discharged so that it will not affect test results and so that no damage by flooding or erosion is caused to the chosen drainage structure or disposal site. The location of the discharge point shall be shown on the site plan and precautions must be taken to ensure the protection of flora and fauna.

(d) Record of tests - Accurate records shall be kept of the test along with weather conditions and other pertinent information. Two (2) copies shall be furnished to the Department prior to construction of the pumping, treatment or distribution facilities associated with the well or with the engineer's certification letter if the project is permitted in one step. The records shall also be available for inspection at any time during the test. At a minimum the record shall include the following information:

(i) time the test was started;

(ii) method of measuring the pumping rate and water level;

(iii) pumping rate and water level measurements every 15 minutes for the first three (3) hours and at least hourly for the remainder of the test;

(iv) water level measurements every fifteen (15) minutes for the first three (3)

hours following the end of pumping and hourly thereafter; and,

(v) name of the person(s) conducting the test.

(e) Measurement of water levels - The method of taking water level measurements shall have an accuracy to within plus or minus one tenth (0.1) of a foot. The air line method, steel tape method, or electric sounder method may be used according to proper procedures.

(13) Well Disinfection -

(a) Scheduling disinfection - The well shall be disinfected at the following times during construction:

(i) The well shall be disinfected as soon as construction of the well and cleaning procedures have been completed. All oil, grease, soil, and other materials which could harbor and protect bacteria from disinfectants shall be removed from the well. Unless prior approval is obtained for employing chemicals or unusual cleaning methods, the cleaning operation shall be carried out by pumping and swabbing only.

(ii) The well shall be disinfected after completion of the performance testing and sampling. The well shall be capped in accordance with R.61-58.2(B)(6)(d) and shall be protected from vandalism until the permanent pump is installed.

(iii) The well shall be disinfected after installation of the thoroughly scrubbed and cleaned permanent pump.

(b) Disinfectants - Chlorine disinfectant shall be delivered to the site of the work in original closed containers bearing the original label indicating the percentage of available chlorine. The disinfectant shall be recently purchased (chlorine compounds in dry form shall not be stored for more than one year and storage of liquid compounds shall not exceed 60 days). During storage, disinfectants shall not be exposed to the atmosphere or to direct sunlight. The quantity of chlorine compounds used for disinfection shall be sufficient to produce a minimum of fifty (50) milligrams per liter available chlorine in solution when mixed with the total volume of water in the well.

(c) Disinfection procedure - For each disinfection, a reliable means shall be provided for ensuring that the disinfecting agent is uniformly applied throughout the entire depth of the well including the casing, pipes and wiring above the water level. The disinfection shall be in accordance with current AWWA Standards for disinfection of wells.

After the contact period, the well shall be pumped to clear it of the disinfecting agent. The disposal point for the purged water shall be selected so as to avoid damage to aquatic life or vegetation.

(14) Water Samples and Analyses - All samples shall be appropriately identified by the well identification number assigned by the Department, date, and time and shall include the name of the sample collector, contractor and owner. The samples shall be analyzed by a certified laboratory. Test results shall be provided to the Department prior to the construction of the pumping and treatment facilities (if applicable) or with the engineer's certification letter if the project is permitted in one step.

(a) Bacteriological analysis - Prior to sampling, the well shall be pumped until the

chlorine residual in non-detectable. Two consecutive samples of water shall be collected at least twenty-four (24) hours apart and be analyzed for total coliform bacteria. The results of both samples must show the absence of total coliform bacteria using membrane filter methodology. The measured chlorine residual and non-coliform growth must also be reported. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result will be deemed invalid and must be repeated. All samples must be analyzed by a laboratory certified by the Department. The Department may request that heterotrophic plate count analyses be conducted on a case-by-case basis where construction, development, or disinfection problems are suspected.

(b) Chemical and radiological analysis - Representative clear samples shall be properly collected and preserved and shall be analyzed by a certified laboratory. The sample shall be analyzed for all contaminants listed in R.61-58.5 and all other parameters needed to determine the aggressiveness of the water to include, pH, total alkalinity, calcium, hardness, total dissolved solids, temperature, and shall be delivered to the laboratory no more than thirty (30) hours after its collection. The pH and temperature measurements shall be made in the field using certified methodology.

(c) Special monitoring for direct surface water influence - For those wells meeting the requirements of R.61-58.2(B)(3)(c), and for any other well deemed necessary by the Department because of location, depth, testing analysis, or other pertinent information, the following special monitoring must be conducted:

(i) quarterly analyses, for a period of one (1) year, of the untreated well water for total and fecal coliform bacteria;

(ii) analyses for pH, turbidity, temperature, and conductivity before and after two or more heavy rainfall events (at least 2 inch over a 24 hour period); and,

(iii) where the above analysis indicates a possible problem, microscopic particulate analysis must be conducted.

If these analyses indicate that the well is under direct surface water influence, treatment must be added and monitoring conducted in accordance with R.61-58.10 or the well must be abandoned in accordance with R.61-58.2(B)(15).

(15) Permanent Well and Test Hole Abandonment - All wells and test holes that are not completed as a production, monitoring or observation well shall be properly abandoned. Abandonment of these wells shall be performed by a certified well driller.

(a) Aquifer sealing materials - The well to be abandoned shall be filled with neat cement, sand-cement, bentonite-cement or concrete. The neat cement, sand-cement or bentonite-cement mixtures shall be as specified in R.61-58.2B(7)(a).

(b) Placement of sealing material - Sealing materials used in abandonment operations shall be placed in such a way as to avoid segregation or dilution of the sealing materials. Dumping sealing material from the top shall not be permitted. Special consideration shall be given to the following:

(i) the abandonment of flowing artesian wells;

(ii) a borehole or well which is to be abandoned due to contamination shall be considered a special case, and the method of filling and sealing such wells shall be

subject to individual review and prior written approval by the Department.

(iii) In the sealing of a double or multiple cased well, the certified well driller shall submit, for prior approval, a drawing thereof with a description of the proposed procedure and materials to be used to completely and permanently seal both the well and any column of filter pack that extends to the ground surface.

(iv) Bridging for deep wells - Very deep wells that do not require complete filling for sanitary protection may be backfilled with clean sand or gravel to the depth appropriate for the bottom of the plug of sealing materials. Where open casing (types II or III wells) or open borehole (types I or IV wells) is to remain below the sealed depth, a temporary bridge or plug made of inorganic materials (e.g., metal, cement) or manufactured devices specifically designed for this purpose in well construction and made of plastic or other elastic materials (e.g., neoprene, rubber) may be used to support the column of sealing materials until they cure and bond to the casing or borehole. The column of sealing materials is installed above the temporary bridge.

In Type I or IV wells, the column of permanent sealing materials may be set with the bottom at least ten (10) feet below the top of firm bedrock or limestone and extending up to within five (5) feet of the ground surface. The casing may be removed if desired and the borehole abandoned by grouting instead. The upper most five (5) feet may be filled with soil suitable for the intended land use.

In Type II or III wells, the sealing materials shall extend down to at least fifty (50) feet below ground surface, except that the uppermost five (5) feet of the borehole may be filled with soil suitable for the intended land use. Casing may be removed, if desired, and the borehole abandoned by grouting.

(v) In abandoning all new wells (test wells, wells of insufficient yield, unacceptable water quality, etc.) the casing must be properly installed with the appropriate grouted material or else removed and the borehole abandoned by grouting.

(vi) Contaminated wells - wells tapping multiple aquifers of different hydrostatic heads or wells tapping multiple zones of significantly different water quality must be abandoned in a manner such that contaminated or lower quality water does not migrate through the abandoned well or borehole and such that ongoing large vertical transfers of water between aquifers, of any quality, do not occur. The methods proposed for sealing such wells shall be reviewed and will require prior written approval by the Department, completely filling an uncased borehole with sealing materials shall be acceptable without prior approval.

(vii) In sealing a double wall or multiple cased well, the certified well driller shall submit a drawing with a description of the proposed procedure.

(c) Well abandonment records - Before the equipment is removed from the site, the exact location of the abandoned well or hole shall be accurately surveyed and a record made to the location with respect to several fixed reference points. All information relative to the abandonment procedures, the location, depth, and diameter of the well or hole shall be supplied in writing to the owner and the Department.

(16) Well Head Piping and Pumping Facilities.

(a) General Requirements:

(i) A sanitary seal must be provided on the top of the well casing. A pressure gauge and air line or other method for readily measuring the water level in the well shall also be provided.

(ii) A casing vent elbowed downward must be provided for the well casing a minimum of eighteen (18) inches above the well house floor (except on packer jet wells). The vent can be gooseneck type with twenty-four (24) mesh screen over the opening or manufactured slotted pipe with effective opening of .024 inches or smaller.

(iii) A check valve shall be provided on the pump discharge above the top of the casing. For jet pumps, no check valve is required in the main line but a back-flow/back-siphonage device must be provided on blow offs and sample cocks.

(iv) A sampling tap must be provided for raw water sampling downstream of the check valve and prior to any chemical injection point. If chemical feed is provided at the well head, a second sample tap shall be provided downstream of the last injection point. This second sampling tap shall be located following adequate mixing of the chemical(s), but prior to any storage tank. A static in-line mixer may be required to ensure that adequate mixing of the chemical(s) has taken place prior to the sampling tap.

(v) Adequate control switches, etc., for the pumping equipment must be provided. A pressure relief valve must be provided and shall not be separated by a valve from the controlling device.

(vi) A flow meter shall be provided on:

(A) each well serving a community water system;

(B) each well serving a non-transient non-community water system;

(C) each well which is equipped with treatment; and,

(D) any other public water supply well where the yield of the well, while pumping against the normal working pressure of the system, cannot be easily measured from the blow-off using a bucket and stopwatch or by some other readily accessible means of measuring flow.

The flow meter shall be capable of measuring instantaneous and totalized flow.

(vii) Adequate support for the well pump and drop pipe must be provided.

(viii) An hour meter shall be provided to record the elapsed run time of each well pump which is required to have a flow meter.

(ix) A valved blow-off shall be provided and located prior to any chemical feed but downstream of the flow meter.

(x) A manual control switch shall be provided for each well pump.

(xi) All electrical wiring shall be in conduit and meet the requirements of the

National Electric Code.

(xii) Each well pump station must have a sign on the door with a twenty-four (24) hour telephone number for emergencies.

(xiii) Wells or well pump stations in pits are prohibited.

(xiv) All wells shall be readily accessible at all times for inspection, maintenance and sampling. Also, well houses shall be constructed in a manner and of material that will allow one person easy access to the sampling tap(s) and the well head piping for inspection, maintenance and sampling.

(b) Turbine pumps - Drilled wells with the prime mover mounted on the casing (Turbine pumps) shall:

(i) Have the casing equipped with a flange or suitable sanitary seal;

(ii) Have the casing firmly connected to the pump structure or have the casing inserted into a recess extending at least one inch into the base of the pump if a watertight connection is not provided;

(iii) Have the base of the pump not less than twelve (12) inches above the pump room floor or apron;

(iv) Have the pump foundation and base designed to prevent water from coming into contact with the joint between the casing and the prime mover; and,

(v) Have an air release valve installed on the discharge pipe upstream of the check valve.

(c) Submersible Pumps - Where a submersible pump is used, the top of the casing shall be effectively sealed against entrance of water under all conditions of vibration or movement of conductors or cables. For hydropneumatic systems not equipped with an air compressor, the discharge pipe shall be equipped with a snifter (a device which will allow air to enter the drop-pipe) upstream of the check valve and a bleeder valve on the drop-pipe located above the static water level in the well.

(d) Well head piping - The well head piping shall be provided with a valved means to pump waste to a point away from the groundwater source, but shall not be directly connected to a sewer. Neither the well head nor the well head piping shall be buried below grade or in a pit. The discharge line shall:

(i) Have control valves located above the pump floor;

(ii) Be protected against freezing;

(iii) Be valved to permit testing and control of each well;

(iv) Have watertight joints;

(v) Have all exposed valves protected; and,

(vi) Have erosion protection at the point of discharge from the blow-off.

(e) Water Seals - Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped. Where pumps are sealed with potable water and are pumping water of lesser sanitary quality the seal shall be provided with a back-flow preventer appropriate for the degree of hazard in question.

(f) Water Pre-lubrication - When automatic pre-lubrication of pump bearings is necessary and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved bypass around the automatic control so that the bearings can, if necessary, be lubricated manually before the pump is started.

C. General Design Requirements.

(1) Plant Layout - Design shall provide for an adequate access road, site drainage, protection of well(s) from spillage, and adequate protection from vandalism. Consideration shall also be given to functional aspects of the plant layout and future expansion.

(2) Building Layout - Design shall provide, if necessary, for adequate ventilation, lighting, telephone service, heating and air conditioning, floor drainage, and dehumidification equipment. Consideration shall also be given to accessibility of equipment for operation, servicing, and removal, telephone communication capability, flexibility of operation, operator safety, and convenience of operation.

(3) Electrical Controls - Main switch gear electrical controls shall be located above grade and protected from standing water.

(4) Auxiliary Power - Where elevated storage equals less than one half maximum daily demand, portable or in-place auxiliary power shall be provided for all systems serving three hundred (300) or more service connections. An air quality permit may be required for the emissions from the auxiliary generators. Auxiliary power requirements may be waived if one or more of the following are applicable:

(a) a verifiable history of worst case power outages and verification that the available elevated storage can provide for a similar time period of outage;

(b) two (2) or more independent sources from the serving electrical utility are available; or,

(c) an alternate water source is available via connections with other systems.

Auxiliary power shall be sized to provide for sufficient pumping and treatment capacity to meet one half (1/2) of the maximum daily demand or to supplement the existing storage to meet one half (1/2) of the maximum daily demand.

(5) Sample Taps - Sample taps shall be provided so that water samples can be obtained from:

(a) each raw water source;

(b) appropriate locations throughout the treatment process so that the operator can maintain proper control of the treatment process;

(c) effluent from each filter prior to any post chemical addition; and,

(d) the entry point(s) to the distribution system.

Taps shall be consistent with sampling needs and shall not be of the petcock type. Taps used for obtaining samples for bacteriological analysis shall be of the smooth-nosed type without interior or exterior threads. Taps shall not be of the mixing type, and shall not have a screen, aerator, or other such appurtenances. All sampling taps shall be easily accessible and located at least 12 inches above the floor or ground level.

(6) Chemical injection points - All chemical injection points shall be downstream of the check valve on the wellhead piping.

(7) All chemical treatment equipment shall be enclosed and protected from the weather.

(8) Process Water - The process water service line shall be supplied from a source at a point where all chemicals have been thoroughly mixed.

(9) Piping Identification - To facilitate identification of piping where treatment occurs, all pipes shall be color coded and/or marked with the name of the liquid or gas being carried and its direction of flow.

(10) Proprietary Treatment Units/Innovative Treatment Techniques - Proprietary treatment units and alternative treatment technology may be considered if pilot tests demonstrate the ability of the technology to provide water which meets all drinking water standards utilizing the proposed groundwater source. The unit/technology will be approved only at rates consistent with R.61-58.2(D) until satisfactory operating data for at least eighteen (18) months is obtained.

(11) Manuals and Parts Lists - An operation and maintenance manual shall be provided for each installation. This manual shall include repair information, parts lists for each piece of equipment, and procedures for the start up and shut down of the facility.

(12) Safety - All design must meet applicable safety codes and minimum Occupational Safety and Health Administration (OSHA) standards.

D. Groundwater Treatment.

(1) Filtration - All filters treating groundwater under the direct influence of surface water must meet the performance standards set forth in R.61-58.10(E).

The application of any one type of filtration must be supported by water quality data. Experimental treatment studies may be required to demonstrate the applicability of the method of filtration proposed.

(a) Pressure Filters - The use of these filters may be considered for iron and manganese removal and other clarification processes.

(i) Rate of Filtration - The nominal rate shall be three (3) gallons per minute per square foot of filter area and shall not exceed five (5) gallons per minute per square foot without adequate justification.

(ii) Details of Design - The filter design shall address the following:

(A) Pressure gauges on the inlet and outlet pipes of each filter shall be provided.

(B) Provisions shall be made for filtration and backwashing of each filter individually with an arrangement of piping as simple as possible to accomplish these purposes.

(C) The backwash water collection system shall be designed to allow for adequate bed expansion without loss of media.

(D) The underdrain system shall efficiently collect the filtered water and shall distribute the backwash water uniformly at a rate not less than fifteen (15) gallons per minute per square foot of filter area.

(E) Backwash flow indicators and controls shall be located such that they are easily readable while operating the control valves.

(F) An air release valve on the highest point of each filter shall be provided.

(G) An accessible manhole to facilitate inspections and repairs (above level of media) shall be provided.

(H) A means to observe the wastewater during backwashing shall be provided.

(I) No unprotected cross connections shall exist.

(J) Filter material must be in accordance with R.61-58.3(D)(5)(a)(vi).

(K) A sufficient number of filter units so as to ensure continuity of service with one unit temporarily removed from operation. The facility shall be designed so that the design filtration rate is not exceeded during backwash operation.

(L) Filter material shall have a total depth of not less than twenty-four (24) inches and generally not more than thirty (30) inches.

(M) Only finished water from the treatment process shall be used to backwash the filter(s).

(b) Gravity Filters - Gravity filters shall be designed in accordance with applicable portions of R.61-58.3(D)(5).

(c) Diatomaceous earth filtration

(i) Conditions of use - Diatomaceous earth filters are expressly excluded from consideration for bacteria removal, color removal, or turbidity removal where either the gross quantity of turbidity is high or the turbidity exhibits poor filterability characteristics.

(ii) Pilot plant study - Installation of a diatomaceous earth filtration system shall be preceded by a pilot plant study on the water to be treated.

(A) Conditions of the study such as duration, filter rates, head loss

accumulation, slurry feed rates, turbidity removal, bacteria removal, etc., shall be approved by the Department prior to the study.

(B) Satisfactory pilot plant results shall be obtained prior to preparation of final construction plans and specifications.

(C) The pilot plant study shall demonstrate the ability of the system to meet applicable drinking water standards at all times.

(iii) Types of filters - Pressure or vacuum diatomaceous earth filtration units will be considered for approval.

(iv) Treated water storage - Treated water storage capacity in excess of normal requirements shall be provided to allow operation of the filters at a uniform rate during all conditions of system demand at or below the approved filtration rate, and guarantee continuity of service during adverse raw water conditions without by-passing the system.

(v) Precoat Application - A uniform precoat of at least 1/16 inch shall be applied hydraulically to each septum by introducing a slurry to the tank influent line and employing either a filter-to-waste or recirculation system.

(vi) Body feed - A body feed system to apply additional amounts of diatomaceous earth slurry during the filter run is required. Continuous mixing of the body feed slurry shall be provided.

(vii) Filtration

(A) Rate of filtration - The filtration rate shall be controlled by a positive means and shall not exceed one and a half (1.5) gallons per minute per square foot of filter.

(B) Head loss - The head loss shall not exceed thirty (30) pounds per square inch for pressure diatomaceous earth filters, or a vacuum of fifteen (15) inches of mercury for a vacuum system.

(C) Recirculation - A recirculation or holding pump shall be employed to maintain differential pressure across the filter when the unit is not in operation in order to prevent the filter cake from dropping off the filter elements. A minimum recirculation rate of one tenth (0.1) gallon per minute per square foot of filter area shall be provided.

(D) Septum or filter element - The filter elements shall be structurally capable of withstanding maximum pressure and velocity variations during filtration and backwash cycles, and shall be spaced such that no less than one (1) inch is provided between elements or between any element and a wall.

(E) Inlet design - The filter influent shall be designed to prevent scour of the diatomaceous earth from the filter element.

(viii) Backwash - A satisfactory method to thoroughly remove and dispose of spent filter cake shall be provided.

(ix) Appurtenances - The following shall be provided for every filter:

(A) sampling taps for raw and filtered water;

(B) loss of head or differential pressure gauge;

(C) rate-of-flow indicator, with totalizer;

(D) a throttling valve used to reduce rates below normal during adverse raw water conditions; and,

(E) an evaluation of the need for body feed, recirculation, and any other pumps, in accordance with R.61-58.4(B)(1)(d).

(2) Disinfection - Disinfection may be accomplished with liquid chlorine, calcium or sodium hypochlorite, chlorine dioxide, ozone or chloramines. Other agents will be considered by the Department provided that reliable feed equipment is available and test procedures for a residual are recognized, and the agent meets the requirements of an acceptable drinking water additive. Continuous disinfection will be required at groundwater supplies which are of questionable sanitary quality or where any other treatment is provided. Due consideration shall be given to the contact time of the disinfectant in water with relation to pH, ammonia, taste-producing substances, temperature, bacterial quality, and other pertinent factors. Consideration also must be given to the formation of disinfection by-products.

(a) Chlorination - Where chlorine is used the following shall apply:

(i) Type - Only vacuum type gas chlorinators or hypochlorite feeders of the positive displacement type are acceptable.

(ii) Capacity - The chlorinator capacity shall be such that a free chlorine residual of at least five (5) milligram per liter can be attained in the water after a contact time of at least thirty (30) minutes at maximum flow rates. The equipment shall be of such design that it will operate accurately over the desired feeding range.

(iii) Automatic Proportioning - Automatic proportioning chlorinators will be required where the rate of flow or chlorine demand is not reasonably constant or where the rate of flow of the water is not manually controlled.

(iv) Residual chlorine - Where alternate disinfectants are used in the treatment process, the capability for the addition of either free or combined chlorine in the finished water shall be provided.

(b) Cross connection protection - The chlorinator water supply piping shall be designed to prevent contamination of the treated water supply by sources of questionable quality.

(c) Chlorine gas - Consideration shall be given to the location of gas chlorine facilities and the safety of the public in the surrounding area. The Department reserves the right to deny approval of chlorine gas on the basis of hazards to the public health. Consideration may be given for facilities that propose the use of chlorine gas in inhabited areas when the use of safety devices which will not allow the release of chlorine gas (e.g. chlorine scrubbers) are provided. Only vacuum gas chlorinator systems will be approved.

(i) Chlorine gas feed equipment shall be enclosed and separated from other operating areas. Concrete, wood, and other construction materials shall be sealed to prevent the escape of chlorine gas from the chlorine building. The chlorine room shall be provided with a shatter resistant inspection window installed in an interior wall or an inspection window in the door. It shall be constructed in such a manner that all openings between the chlorine room and the remainder of the plant are sealed, and shall be provided with doors ensuring ready means of exit and opening only to the building exterior.

(ii) Full and empty cylinders of chlorine gas shall be isolated from operating areas, restrained in position to prevent upset, stored in rooms separate from ammonia storage, and stored in areas not in direct sunlight or exposed to excessive heat.

(iii) If the chlorine room is large enough for a person to enter, the room shall be constructed such that:

(A) It has a ventilating fan with a capacity which provides one complete air change per minute;

(B) The ventilating fan shall be located near the ceiling and pull suction through a duct extending to within twelve (12) inches of the floor and discharge as far as practical from the door and air inlet. The point of discharge shall be located so as not to contaminate air inlets to any rooms or structures. A sealed motor or other means shall be used to ensure the reliability of the fan;

(C) Air inlets shall be located near the ceiling;

(D) Air inlets and outlets shall have mechanical louvers;

(E) Switches for fans and lights are outside of the room, at the entrance;

(F) Vents from feeders and storage areas discharge to the outside atmosphere, above grade and away from inlet vent; and,

(G) Ventilation shall not be automatically controlled.

(iv) If the room is too small for a person to enter, the room must meet the requirements of R.61-58.2(D)(2)(c)(iii)(E) and (F).

(v) Chlorine feed lines shall meet the following requirements:

(A) Chlorine gas under pressure shall be piped with schedule eighty (80) stainless steel or schedule eighty (80) seamless carbon steel. No chlorine gas under pressure will be piped beyond the chlorinator room.

(B) Chlorine gas under vacuum shall be piped with schedule eighty (80) PVC or reinforced fiberglass.

(C) Chlorine solution shall be piped with schedule eighty (80) PVC.

(vi) Heaters shall be provided to maintain proper temperature for operation.

(vii) There shall be no equipment housed in the chlorine room except chlorinators, chlorine cylinders, weighing scales, heater, ventilation fan, and light(s).

(viii) Weighing scales shall be provided for weighing cylinders, at all installations utilizing chlorine gas unless provisions for automatic switchover of cylinders and an acceptable alternate means to determine daily dosage are provided.

(ix) Chlorine feed systems shall be designed to ensure continuous feed of chlorine.

(x) If a floor drain is provided, it shall be equipped with a water seal or trap to prevent escaped gases from exiting through the building sewer.

(xi) A chlorine leak detection and alarm system shall be provided.

(xii) An air pack approved by the National Institute for Occupational Safety and Health shall be available for each gas chlorination installation.

(xiii) A chlorine cylinder repair kit for plugging the type of chlorine cylinders used shall be available for each gas chlorination installation.

(d) Ozone - Ozone is a suitable disinfectant for groundwater. On-site generation facilities shall be constructed in accordance with manufacturer's standards.

(i) Pilot plant tests - Pilot plant tests shall be performed with the water to be treated to establish the optimum dosage, contact time, depth of conductor and the need for multiple application points.

(ii) Building Design - Ozone generators shall be housed in a separate room with separate heating and ventilation. The building layout must provide for easy access to the equipment. Ventilation equipment shall be two (2) speed with the normal speed providing the normal distribution of heat or air movement. The second speed must be capable of providing a complete turnover of the air in the room every two (2) minutes to exhaust any ozone leakage in an emergency.

(iii) Piping Materials

(A) All dry ozone gas piping shall be mechanical jointed number 304 or 316 stainless steel or welded 304L or 316L stainless steel. All wet ozone gas piping shall be number 316 or 316L stainless steel. All flexible couplings shall be stainless steel.

(B) Valves shall be stainless steel face and body.

(C) Gasket materials shall be resistant to deterioration by the ozone.

(iv) Reinforced concrete or stainless steel are acceptable materials. All concrete joints shall be sealed using a synthetic rubber material resistant to

deterioration by the ozone.

(e) Other disinfection agents - Any proposal for the use of other disinfecting agents shall be approved by the Department prior to preparation of final plans and specifications.

(f) Ammonia Gas - Consideration shall be given to the location of ammonia gas facilities and the safety of the public in the surrounding area. The Department reserves the right to deny approval of ammonia gas on the basis of hazards to the public health. Only vacuum ammonia systems will be approved.

(i) Ammonia gas feed equipment shall be enclosed and separated from other operating areas. Concrete, wood, and other construction materials shall be sealed to prevent the escape of ammonia gas from the ammonia room. The ammonia room shall be provided with a shatter resistant inspection window installed in an interior wall or an inspection window in the door. It shall be constructed in such a manner that all openings between the ammonia room and the remainder of the plant are sealed, and shall be provided with doors ensuring ready means of exit and opening only to the building exterior.

(ii) Full and empty cylinders of ammonia gas shall be isolated from operating areas, restrained in position to prevent upset, stored in rooms separate from chlorine storage, and stored in areas not in direct sunlight or exposed to excessive heat.

(iii) If the ammonia room is large enough for a person to enter, the room shall be constructed such that:

(A) It has a ventilating fan with a capacity which provides one complete air change per minute;

(B) The ventilating fan shall be located and pull suction near the ceiling and discharge as far as practical from the door and air inlet. The point of discharge shall be located so as not to contaminate air inlets to any rooms or structures. A sealed motor or other means shall be used to ensure the reliability of the fan;

(C) Air inlets shall be located near the floor;

(D) Air inlets and outlets shall have mechanical louvers;

(E) Switches for fans and lights are outside of the room, at the entrance;

(F) Vents from feeders and storage areas discharge to the outside atmosphere, above grade and away from inlet vent; and,

(G) Ventilation shall not be automatically controlled.

(iv) If the room is too small for a person to enter, the room must meet the requirements of R.61-58.2(D)(2)(f)(iii)(E) and (F).

(v) Ammonia feed lines shall not carry ammonia gas beyond the ammonia room.

(vi) There shall be no equipment housed in the ammonia room except ammoniators, ammonia cylinders, weighing scales, heater, ventilation fan, and light(s).

(vii) Weighing scales shall be provided for weighing cylinders, at all installations utilizing ammonia gas from cylinders. Where bulk storage tanks are installed, they shall be equipped with a pressure gauge.

(viii) An ammonia leak detection and alarm system shall be provided.

(g) Chlorine Dioxide - Chlorine dioxide is a suitable disinfectant for groundwater. Chlorine dioxide shall be generated on site. The unit shall be flow paced and not have a holding tank for the chlorine dioxide solution generated. All applicable EPA disinfectant by-product rules shall be observed.

(i) Sizing of the chlorine dioxide generator - Chlorine dioxide demand studies shall be conducted to determine estimated feed rates and points of feed.

(ii) Building Design -

(A) Chlorine dioxide generators shall be located in a room separate from chlorine cylinders.

(B) Number of Units: Where chlorine dioxide is used as the primary disinfectant, at least two (2) flow pacing chlorine dioxide generators shall be provided. The facility shall be adequately sized to supply the maximum treatment capacity with any one generator out of service. If chlorine dioxide is not used as a primary disinfectant (i.e. an oxidant only), a second generator is not required.

(iii) Piping Materials -

(A) All piping from the chlorine dioxide generator shall be schedule 80 PVC

(B) Gasket materials shall be kynar or other compatible material.

(C) All tubing connector fittings shall be kynar or other compatible material.

(3) Softening - The softening process selected shall be based upon the mineral qualities of the raw water and the desired finished water quality in conjunction with requirements for the disposal of brine waste, the plant location. Applicability of the process chosen shall be demonstrated. Ion exchange units used for softening shall be designed in accordance with R.61-58.2.D(4).

(4) Ion Exchange Process - The total iron and manganese concentration shall not exceed three tenth (0.30) milligrams per liter in the water as applied to the ion exchange material. Pretreatment is required when the total iron and manganese concentration exceeds is three tenth (0.3) milligram per liter or more.

(a) Design - The units may be of pressure or gravity type, of either an upflow or downflow design. A manual override shall be provided on all automatic controls.

(b) Exchange Capacity - The design capacity for hardness removal shall not exceed twenty thousand (20,000) grains per cubic foot when resin is regenerated with three tenth (0.3) pounds of salt per kilograin of hardness removed.

(c) Depth of Media - Exchange resin shall have a total depth of not less than twenty-four (24) inches and generally not more than thirty (30) inches unless otherwise approved by the Department.

(d) Flow Rates - The rate of softening shall be based on an actual bench scale test of the water to be treated. The backwash rate shall be sufficient to clean the bed. The flow rate will be dependent on the grain size and specific gravity of the exchange resin.

(e) Bypass - A bypass may be provided around softening units to produce a blended water of desirable hardness. Meters shall be installed on the bypass line and on each softener unit.

(f) Additional limitations - Waters having five (5) units or more turbidity shall not be applied directly to the cation exchange softener. Silica gel resins shall not be used for waters having a pH above 8.4 and shall not be used when iron is present. When the applied water contains a chlorine residual, the cation exchange resin shall be a type that is not damaged by residual chlorine. Phenolic resin shall not be used.

(g) Sampling Taps - Smooth-nose sampling taps shall be provided for the collection of representative samples for both bacteriological and chemical analyses. The taps shall be located to allow sampling of the softener influent, the softener effluent, and the blended water. The sampling taps for the blended water shall be at least twenty (20) feet downstream from the point of blending. Petcocks are not acceptable as sampling taps.

(h) Brine and Salt Storage Tanks - Brine measuring or salt dissolving tanks and wet salt storage facilities shall be covered and shall be constructed of corrosion-resistant material. The make-up water inlet shall have a free fall discharge of two (2) pipe diameters above the maximum liquid level of the unit, or shall be protected from back-siphonage by use of a vacuum breaker. The salt shall be supported on graduated layers of gravel under which is a suitable means of collecting the brine. Wet salt storage basins shall be equipped with manhole or hatchway openings having raised curbs and watertight covers having overhanging edges. Overflows, where provided, must be angled downward, have a proper free fall discharge and be protected with noncorrodible screens or self-closing flap valves.

(i) Storage Capacity - Wet salt storage basins shall have sufficient capacity to provide for at least three (3) days of operation.

(j) Corrosion Control - Corrosion control shall be provided.

(k) Waste Disposal - A suitable means of handling and disposal shall be provided for brine waste designed in accordance with 61-58.2(F).

(l) Construction Material - Pipes and contact materials shall be corrosion resistant.

(m) Housing - Salt storage tanks and feed equipment shall be enclosed.

(5) Aeration - Aeration treatment devices, as described herein, may be used for oxidation,

separation of gases or for taste and odor control. A separate air quality permit for the separation of gases from water by aeration may be necessary.

(a) General Requirements

(i) Sample taps must be provided following aeration equipment.

(ii) Where aeration equipment discharges directly to the distribution system, air release valves must be provided.

(b) Natural Draft Aeration - Design shall provide that:

(i) Water is distributed uniformly over the top tray;

(ii) Water is discharged through a series of three (3) or more trays with the separation of trays not less than twelve (12) inches;

(iii) Trays are loaded at a rate of one (1) gallon per minute to five (5) gallons per minutes for each square foot of total tray area;

(iv) Trays have slotted, woven wire cloth or perforated bottoms;

(v) Perforation are three sixteenth (3/16) to one-half (1/2) inches in diameter, spaced one (1) to three (3) inches on centers, when perforations are used in the distribution pan;

(vi) Construction of durable material resistant to the aggressiveness of the water and dissolved gases;

(vii) Protection of aerators from loss of spray water by wind carriage by enclosure with louvers sloped to the inside at an angle of approximately forty-five (45) degrees;

(viii) Protection from insects by number twenty-four (24) mesh screen; and,

(ix) Aerated water receives disinfection treatment.

(c) Forced or Induced Draft Aeration - Devices shall be designed to:

(i) Provide an adequate countercurrent of air through the enclosed aeration column;

(ii) Include a blower in a screened enclosure and with a watertight motor;

(iii) Exhaust air directly to the outside atmosphere;

(iv) Include a down-turned, number twenty-four (24) mesh screened air outlet and inlet;

(v) Be such that air introduced in the column shall be as free from noxious fumes, dust, and dirt as possible;

(vi) Be such that sections of the aerator can be easily reached or removed for

maintenance of the interior;

(vii) Provide loading at a rate of one (1) to five (5) gallons per minute for each square foot of total tray area;

(viii) Ensure that the water outlet is adequately sealed to prevent the unwarranted loss of air;

(ix) Discharge through a series of five (5) or more trays, with separation of trays not less than six (6) inches;

(x) Provide distribution of water uniformly over the top tray; and,

(xi) Be of a durable corrosion resistant material.

(d) Pressure Aeration - This method may be used for oxidation purposes if pilot plant study indicates method is applicable. It is not acceptable for removal of dissolved gases. Filters following pressure aeration shall have adequate exhaust devices for release of air. Pressure aeration devices shall be designed to give thorough mixing of compressed air with water being treated. Screened and filtered air, free of noxious fumes, dust, dirt and other contaminants shall be provided.

(e) Other Methods of Aeration - Other methods of aeration may be used if applicable to the treatment needs. Such methods may include, but are not restricted to, spraying, diffused air, cascades, and mechanical aeration. The treatment processes shall be designed to meet the particular needs of the water to be treated and shall be subject to Department approval.

(f) Protection from Contamination - Aerators that are used for oxidation or removal of dissolved gases from waters that will be given no further treatment other than chlorination shall be protected from contamination from insects and birds by a roof or similar structure.

(g) Disinfection - Groundwater supplies exposed to the atmosphere by aeration must receive chlorination as a minimum additional treatment.

(6) Iron and Manganese Control - Iron and manganese control, as used herein, refers solely to treatment processes designed specifically for this purpose.

(a) Removal by Oxidation, Detention and Filtration.

(i) Oxidation - Oxidation shall be by aeration or by chemical oxidation with chlorine, potassium permanganate, chlorine dioxide, ozone or other oxidant approved by the Department.

(ii) A minimum detention of twenty (20) minutes shall be provided following oxidation by aeration to ensure that the oxidation reactions are as complete as possible. This minimum detention shall be omitted only where a pilot plant study or an analogous system indicates no need for detention.

(iii) Sedimentation basins shall be provided when treating water with high iron and/or manganese content or where chemical coagulation is used to reduce the load on the filters.

(A) Detention time - Sedimentation basin design considerations and calculations shall include basin overflow rate, weir loading rate, flow through velocity and theoretical detention time.

(B) Inlet Devices - Inlets shall be designed to distribute water equally and at uniform velocities. The structures shall be designed so as to dissipate inlet velocities and provide uniform flows across the basin.

(C) Outlet Devices - Outlet devices shall be designed to maintain velocities suitable for settling in the basin and to minimize short circuiting.

(D) Velocity - The velocity through settling basins shall not exceed five tenths (0.5) of a foot per minute. The basins shall be designed to minimize short circuiting. Baffles shall be provided, as necessary.

(E) Overflow - An overflow weir (or pipe) shall be installed to establish water level in the basin.

(F) Sludge handling - Facilities are required by the Department for the disposal of sludge and shall be designed in accordance with R.61-58.2F. Provisions shall be made for the operator to observe and sample sludge being withdrawn from the unit.

(G) Washdown Hydrants - Washdown hydrants shall be provided and shall be equipped with backflow prevention devices acceptable to the Department.

(iv) Filtration - Filters shall conform to R.61-58.2(D)(1).

(b) Removal by Manganese Green Sand Filtration

(i) An anthracite media cap of at least six (6) inches shall be provided over manganese green sand.

(ii) The filtration rate will be dependent on the raw water quality and the type of filter used. It shall not exceed three (3) gallons per minute per square foot.

(iii) The backwash rate shall be sufficient to clean the bed.

(iv) Sample taps shall be provided prior to the application of permanganate; immediately ahead of filtration; at a point between the anthracite coal media and the manganese treated greensand; halfway down the manganese treated greensand; and at the effluent for each filter.

(v) A differential pressure gauge or separate inlet and outlet pressure gauges shall be provided to measure the loss of head through the unit.

(c) Removal by Ion Exchange - Iron removal with sodium zeolite ion exchange units shall not be approved without a pilot study addressing the efficiency of removal, an evaluation of the potential for bed fouling, and consideration of the corrosiveness of the treated water. The Ion Exchange process treatment shall be designed in accordance with

R.61-58.2(D)(4).

(d) Sequestration by phosphates - Where phosphate treatment is used, sufficient disinfectant residuals shall be maintained in the distribution system.

(i) Phosphates shall not be applied ahead of the filters in iron and manganese removal treatment. Where there is no removal treatment, the phosphate shall be added prior to any disinfection.

(ii) Phosphate chemicals shall meet the requirements of chemical additives in R.61-58.2(E)(3), including maximum feed rates.

(e) Sampling Taps - Smooth-nosed sampling taps shall be located on each source, each treatment unit influent and each treatment unit effluent.

(7) Fluoridation - Commercial sodium fluoride, sodium silicofluoride and hydrofluorosilic acid shall be NSF approved and shall conform to American Waterworks Association Standards B701, B702 and B703 respectively. Fluoride chemicals shall meet the requirements of chemical additives in R.61-58.2(E)(3). The proposed method of fluoride feed shall be approved by the Department prior to preparation of final plans and specifications.

(a) Fluoride Compound Storage - Dry chemical storage shall be designed in accordance with R.61-58.2(E)(2)(e). Storage units for hydrofluorosilic acid shall be isolated from operating areas and shall be vented to the atmosphere at a point outside any building.

(b) Injection Point - The fluoride compound shall not be added before ion exchange softening or before lime addition, to avoid precipitation of fluoride.

(c) Chemical Feed Installations - Fluoride feed systems shall meet the following criteria:

(i) Scales or loss-of-weight recorders for weighing the quantity of chemicals added shall be provided;

(ii) Feed equipment shall have an accuracy to within five (5) percent of any desired feed rate;

(iii) The point of application of hydrofluorosilic acid, if into a pipe, shall be in the lower half of the pipe and project upward at an angle approximately forty (40) degrees and extend into the pipe one-third of diameter; and,

(iv) All fluoride feed lines shall be provided with adequate antisiphon devices.

(v) All fluoride feed systems shall be equipped with a fail-safe system to prevent the continued feed of fluoride at times when there is no flow of water through the fluoride feed point.

(d) Protective equipment - At least one (1) pair of rubber gloves, a respirator of a type certified by the National Institute for Occupational Safety and Health for toxic dusts or acid gas (as necessary), an apron or other protective clothing, and goggles or face masks shall be provided for use by the operator. Other protective equipment may be required, as deemed necessary by the Department.

(e) Dust Control

(i) Provisions shall be made for the transfer of dry fluoride compounds from shipping containers to storage bins or hoppers in such a way as to minimize the quantity of fluoride dust which may enter the room in which the equipment is installed. The enclosure shall be provided with an exhaust fan and dust filter to the outside atmosphere of the building.

(ii) Provisions shall be made for disposing of empty bags, drums and barrels in a manner which will minimize exposure to fluoride dusts. A floor drain shall be provided to facilitate the washing of floors.

(8) Corrosion Control - Water that is corrosive due either to natural causes or to treatment given the water shall be rendered non-corrosive, and nonaggressive before being pumped to the distribution system.

(a) Alkali Feed - Corrosive water due to natural occurrence, or chemical exchange process shall be treated by an alkali feed. Alkali feed can consist of lime, soda ash, bicarbonate, caustic soda, or a combination of any of the above. Lime feed systems shall include a mechanism for flushing the feed lines, including suction and pumping equipment, if used.

(b) Phosphates - The feeding of phosphates may be applicable for corrosion control. Phosphate chemicals shall meet the requirements of chemical additives in R.61-58.2(E)(3).

(c) Carbon dioxide addition

(i) Recarbonation basin design shall provide:

(A) A total detention time of at least twenty (20) minutes.

(B) A minimum of two (2) compartments, consisting of a mixing compartment having a detention time of at least three (3) minutes, and a reaction compartment.

(ii) Carbon dioxide feed systems shall be isolated from the operating area and adequate precautions shall be taken to prevent the possibility of carbon monoxide entering the plant from recarbonation compartments.

(iii) Provisions shall be made for draining the recarbonation basin and removing sludge.

(d) Other Treatment - Other treatment for controlling corrosive waters will be considered on a case by case basis. All chemicals must meet the requirements in R.61-58.2(E)(3). Any proprietary compound must receive the specific approval of the Department before use.

(e) Control - Laboratory equipment, acceptable to the Department, shall be provided to test the compounds being fed.

(9) Taste and Odor Control - When necessary, provision shall be made for the addition of

taste and odor control chemicals. These chemicals shall be added sufficiently ahead of other treatment processes to ensure adequate contact time for an effective and economical use of the chemicals.

(a) Flexibility - Plants treating water that is known to have taste and odor problems shall be provided with equipment that makes several of the control processes available to allow the operator flexibility in operation.

(b) Chlorination - Chlorination can be used for the removal of some objectionable odors. Adequate contact time must be provided to complete the chemical reactions involved. Consideration shall be given to the formation of disinfection by-products if this method is used.

(c) Chlorine Dioxide - Chlorine dioxide may be used in the treatment of taste or odor. Provision shall be made for the proper storing and handling of sodium chlorite, so as to eliminate any danger of explosion. Consideration shall be given to the formation of disinfection by-products if this method is used.

(d) Granular Activated Carbon Absorption Units - Rates of flow shall be consistent with the type and intensity of the problem. The rate used shall be supported by the results of pilot plant studies and shall be in accordance with the requirements of R.61-58.2(D)(1).

(e) Aeration - Aeration units used for taste and odor removal shall be designed in accordance with R.61-58.2(D)(5).

(f) Potassium Permanganate - The application of potassium permanganate may be considered, provided that dosages are determined by permanganate demand testing.

(10) Membrane Technology - All applications for projects involving membrane technology must be preceded by an engineering report and may require a pilot study.

(a) Reverse Osmosis

(i) Pilot Study - The pilot study, where required, must determine or address the following items:

(A) Membrane loading rates including the most efficient percentage of recovery;

(B) What pre-treatment is needed including feed rates of any chemicals;

(C) Whether by-pass blending can be used and what the blending rate will be;

(D) The post treatment needs including what chemical additions will be necessary to make the finished water non-corrosive; and,

(E) The best type of membrane for the source water application.

(ii) General Design Requirements -

(A) A flow meter with totalizer must be provided for the permeate and the blend lines in each treatment train.

(B) Valves must be provided on the influent, permeate, reject, and cleaning lines for each unit.

(C) Pressure gauges must be provided on the influent and permeate lines for each unit for measurement of head loss.

(D) Sample taps must be provided for the permeate, blended product, and finished water.

(E) Monitoring equipment must be provided to measure pH, conductivity, temperature, turbidity, and any specific contaminants for which treatment is being provided.

(F) Disposal of concentrate and cleaning solutions must be approved by the Department.

(iii) Reverse Osmosis Membrane Material -

(A) Membrane material used in public water systems shall be certified as meeting the specification of the American National Standards Institute/National Sanitation Foundation Standard 61, Drinking Water System Components - Health Effects. The certifying party shall be accredited by the American National Standards Institute.

(B) Loading rates must be determined by pilot testing and manufacturers recommendations.

(iv) Scale Inhibitors and Cleaning Solutions - Scale inhibitors and cleaning solutions must meet the requirements of chemical additives in R.61-58.2(E)(3).

(v) Post-Treatment -

(A) Continuous disinfection must be employed on the permeate or on the blended effluent from the treatment units.

(B) Treatment shall be employed to render the finished water non-corrosive.

(b) Electrodialysis Reversal - Electrodialysis reversal treatment shall not be used on surface water or groundwater under the direct influence of surface water unless the requirements of R.61-58.10 are otherwise met.

(i) Pretreatment - Pretreatment must be used to protect the membrane from fouling. Media filtration used in pretreatment must be designed in accordance with R.61-58.2(D)(1). Degassification must be designed in accordance with R.61-58.2(D)(5).

(ii) Pilot Study - The pilot study must determine or address the following items:

(A) Membrane loading rates including the most efficient percentage of recovery;

(B) What pre-treatment is needed including feed rates of any chemicals;

(C) Whether by-pass blending can be used and what the blending rate will be;

(D) The post treatment needs, including what chemical additions will be necessary to make the finished water non-corrosive; and,

(E) The best type of membrane for the source water application.

(iii) General Design Requirements -

(A) A gallon meter with totalizer must be provided for the product water and the blend lines in each treatment train.

(B) Valves must be provided on the influent, product water, reject, and cleaning lines for each unit.

(C) Electric volt and current meters must be provided to measure the electric potential across each unit.

(D) Pressure gauges must be provided on the influent and product lines for each unit for measurement of head loss.

(E) Sample taps must be provided for the product, blended water, and finished water.

(F) Monitoring equipment must be provided to measure pH, conductivity, temperature, turbidity, and any specific contaminants for which treatment is being provided.

(G) Disposal of concentrate and cleaning solutions must be approved by the Department.

(iv) Electrodialysis Reversal Membrane Material -

(A) Membrane material used in public water systems shall be certified as meeting the specification of the American National Standard Institute/National Sanitation Foundation Standard 61, Drinking Water System Components - Health Effects. The certifying party shall be accredited by the American National Standards Institute.

(B) Loading rates must be determined by pilot testing and manufacturers recommendations.

(v) Scale Inhibitors and Cleaning Solutions - Scale inhibitors and cleaning solutions must meet the requirements of chemical additives in R.61-58.2(E)(3).

(vi) Post-Treatment -

(A) Continuous disinfection must be employed on the product water

or on the blended effluent from the treatment units.

(B) Treatment shall be employed to render the finished water non-corrosive.

E. Chemical Application.

(1) General - No chemical shall be applied to treat drinking waters unless specifically permitted by the Department. A certified operator is required whenever the chemical or physical characteristics of the water is changed.

(a) Plans and specifications - Plans and specifications shall be submitted for review and approval, as required by in R.61-58.1, and shall include:

(i) Descriptions of feed equipment, including maximum and minimum feed ranges and pump curves for solution feeders,

(ii) Location of feeders, piping layout and points of chemical application,

(iii) Storage and handling facilities;

(iv) Specification for chemicals to be used;

(v) Operating and control procedures including proposed application rates;

(vi) Descriptions of testing equipment and procedures; and,

(vii) Locations of sampling taps for testing.

(b) Chemical application - Chemicals shall be applied to the water at such points and by such means as to:

(i) Provide maximum efficiency of treatment;

(ii) Ensure maximum safety to consumer;

(iii) Provide maximum safety to operators;

(iv) Ensure satisfactory mixing of the chemicals with the water;

(v) Provide maximum flexibility of operation through various points of application, when appropriate;

(vi) Prevent backflow or back-siphonage between multiple points of feed through the use of separate feed equipment for each point and backflow preventers where a manifold system is used for standby, multiple feed use;

(vii) Not be located upstream of the metering device when the chemical in consideration will interfere with the flow measurement;

(viii) Provide a separate injection point and a separate feed line for each chemical application that is added and, spacing to prevent inter-reaction of chemicals; and,

(ix) Provide chemical injection points which are readily accessible. All below-grade injection points shall be housed in a vault or similar structure.

(c) General equipment design - General equipment design shall be such that:

(i) Chemical-contact materials and surfaces are corrosion resistant;

(ii) Corrosive chemicals are introduced in such a manner as to minimize potential for corrosion; and,

(iii) Chemicals that are incompatible are not fed, stored or handled together.

(2) Facility Design

(a) Chemical feeders -

(i) A separate feeder shall be used for each separate chemical applied, and for each injection point.

(ii) Spare parts shall be available for all feeders to replace parts which are subject to wear and damage.

(iii) Dry chemical feeders shall:

(A) Measure chemicals volumetrically or gravimetrically;

(B) Provide adequate solution water and agitation of the chemical in the solution pot;

(C) Provide gravity feed from solution pots; and,

(D) Completely enclose chemicals to prevent emission of dust to the operating room.

(iv) Chemical feed equipment, where necessary, shall be located in a separate room to reduce hazards and dust problems; shall be conveniently located near points of application to minimize length of feed lines; and, shall be readily accessible for servicing, repair, and observation of operation.

(v) Feeders shall be able to supply, at all times, the necessary amounts of chemicals at an accurate rate;

(b) Control -

(i) Feeders with automatic controls shall be designed so as to allow override by manual controls.

(ii) Chemical feed rates shall be proportional to flow.

(iii) Meters, scales, calibration columns, or other acceptable means to measure chemicals being fed must be provided in order to determine chemical feed rates.

(iv) Provisions shall be made for measuring the quantities of chemicals used.

(c) Cross-connection control -

(i) Cross-connection control shall be provided to ensure that liquid chemical solutions cannot be siphoned through solution feeders into the water supply.

(ii) The service water lines discharging to the solution tanks shall be properly protected from backflow as required by the Department.

(iii) No direct connection shall exist between any sewer and a drain or overflow from the feeder, solution chamber or tank. All drains shall terminate at least six (6) inches or two (2) pipe diameters, whichever is greater, above the overflow rim of a receiving sump, conduit or waste receptacle.

(d) Service water supply shall be ample in supply and adequate in pressure; shall be provided with means for measurement when preparing specific solution concentrations by dilution; shall be properly treated potable water; and shall be properly protected against backflow.

(e) Storage of chemicals -

(i) Space shall be provided for at least three (3) days of chemical supply and provide for convenient, efficient and safe handling of chemicals. Dry storage conditions must be maintained for dry chemicals.

(ii) Storage tanks and pipelines for liquid chemicals shall be designed specifically for each chemical used.

(iii) Chemicals shall be stored in covered or unopened shipping containers, unless the chemical is transferred into an approved covered storage unit.

(f) Solution tanks -

(i) A means which is consistent with the nature of the chemical solution shall be provided in a solution tank to maintain a uniform strength of solution. Continuous agitation shall be provided to maintain slurries in suspension.

(ii) Means shall be provided to measure the solution level in the tank.

(iii) Chemical solutions shall be kept covered. Large tanks with access openings shall have such openings curbed and fitted with tight overhanging covers.

(iv) Overflow pipes, when provided, shall:

(A) Be turned downward, with the end screened;

(B) Have an air gap of two (2) pipe diameters or six (6) inches, whichever is greater; and,

(C) Be located where noticeable.

(v) Acid storage tanks shall be vented independently to the outside atmosphere.

(vi) Each tank shall be provided with a valved drain, protected against backflow in accordance with R.61-58.2(E)(2)(c)(iii).

(g) Feed lines -

(i) Feed lines shall be as short as possible in length of run, and of durable, corrosion resistant material. They shall be easily accessible throughout the entire length, protected against freezing, and readily cleanable;

(ii) Feed lines shall be designed consistent with scale-forming or solids depositing properties of the water, chemical, solution or mixture conveyed;

(iii) Feed lines shall be color coded and labeled; and,

(iv) Where lime is added, a spare feed line equal in length to the longest run of feed line, shall be provided.

(h) Handling -

(i) Provisions shall be made for disposing of empty bags, drums or barrels by an approved procedure which will minimize exposure to dust.

(ii) Provision shall be made for the proper transfer of dry chemicals from shipping containers to storage bins or hoppers, in such a way as to minimize the quantity of dust which may enter the room in which the equipment is installed.

(iii) Provision shall be made for measuring quantities of chemicals used to prepare feed solutions.

(i) Housing -

(i) Floor surfaces shall be smooth, impervious, slip-proof and well-drained.

(ii) Vents from feeders, storage facilities and equipment exhaust shall discharge to the outside atmosphere above grade and remote from air intakes.

(iii) Feeders used in conjunction with dry lime or carbon shall be housed in separate, individual rooms equipped with dust control systems.

(iv) Sufficient lighting for operator safety and sufficient heating to provide for proper operation of the chemical feed equipment shall be provided for all chemical feed rooms.

(3) Chemicals Specifications - All chemicals and products added to a public water supply as part of the treatment process shall be certified as meeting the specifications of the American National Standards Institute/National Sanitation Foundation Standard 60, Drinking Water Treatment Chemicals - Health Effects. The certifying party shall be accredited by the American National Standards Institute.

F. Waste Handling and Disposal.

Waste handling and disposal practices shall meet all applicable rules and regulations of the Department. Provisions must be made for proper disposal of treatment waste such as iron sludge, filter backwash water, and brine waste. In locating waste disposal facilities, due consideration shall be given to preventing potential contamination of the water supply. For projects involving a surface water discharge of treatment residuals, a National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the Department. For projects involving land application of treatment residuals, a No Discharge (ND) permit must be obtained from the Department.

R.61-58.3 SURFACE WATER SOURCES AND TREATMENT

A. Applicability.

This regulation applies to all new construction and all expansions or modifications of existing public water systems. If the Department can reasonably demonstrate that safe delivery of potable water to the public is jeopardized, a system may have to upgrade its existing facilities in order for an expansion or modification to meet the requirements of this regulation. This regulation prescribes minimum design standards for the construction of surface water intakes and treatment plants.

B. Surface Water Development.

(1) Quantity - Where the proposed source is to be the only source of water for the system , the quantity of water at the source shall:

(a) be adequate to meet the projected maximum daily water demand of the service area. For streams, the calculations shall be based on the lowest mean daily flow for the drought of record. For withdrawals from reservoirs, the calculation shall be based on the drought of record and shall also include requirements for other water uses in the reservoir and downstream;

(b) provide a reasonable surplus for twenty (20) years of anticipated growth;

(c) be adequate to compensate for all losses such as silting, evaporation, seepage, etc. and;

(2) Quality - An engineering evaluation shall be made considering all factors, both natural and man made, which will affect the quality of the source water. The evaluation shall include, but not be limited to:

(a) determining possible future uses of impoundments or reservoirs;

(b) determining degree of control of watershed by owner;

(c) assessing degree of hazard to the source from the accidental spillage of materials that may be toxic, harmful or detrimental to treatment processes;

(d) obtaining samples over a sufficient period of time to assess the microbiological, physical, chemical and radiological characteristics of the water;

(e) assessing the capability of the proposed treatment process to comply with the drinking water standards set forth in the Act and under R.61-58.5 , R.61-58.10, and R.61-58.13.

(3) Intake Structures - The design of intake structures shall provide for:

(a) withdrawal of water from more than one level if quality varies with depth;

(b) separate facilities for release of less desirable water held in storage;

(c) capability for the cleaning of the inlet line;

(d) adequate protection against rupture by dragging anchors, etc.;

(e) inlet ports located above the bottom of the stream, lake or impoundment, but at sufficient depth to be kept submerged at low water levels;

(f) where shore wells are not provided, a diversion device capable of keeping large quantities of fish or debris from entering an intake structure;

(g) screens or gratings over the inlet to protect the pumps;

(h) a means for periodic cleaning of the screens or gratings;

(i) shore wells where necessary, which shall:

(i) have motors and electrical controls located above grade, and protected from flooding;

(ii) be accessible;

(iii) be designed against flotation;

(iv) be equipped with removable or traveling screens before the pump suction well;

(v) provide for introduction of chlorine or other chemicals in the raw water transmission main if necessary for quality control;

(vi) have intake valves and provisions for backflushing or cleaning by a mechanical device and testing for leaks, where practical; and,

(vii) have provisions for withstanding surges where necessary.

(4) Off-Stream Storage

(a) Reservoirs shall be constructed to ensure that water quality is protected by controlling runoff into the reservoir.

(b) Dikes must be structurally sound, constructed of low permeability material and protected against wind action and erosion. Vegetation and other unsuitable materials shall be removed from the dikes. Minimum dike width shall be eight (8) feet at the crest.

(c) The point of influent flow must be separated from the point of withdrawal to ensure turnover.

(5) Impoundments and Reservoirs - Unless specifically approved by the Department, the design of impoundments and reservoirs shall provide for:

(a) removal of brush, trees, and stumps to high water elevation;

(b) proper erosion control measures during construction; and,

(c) abandonment of all wells which will be inundated, in accordance with R.61-58.2(B)(15).

(6) Raw Water Pumping Facilities

(a) The facility shall be elevated to a minimum of one (1) foot above the one hundred (100) year flood elevation, or protected to such elevation, shall be readily accessible at all times unless permitted to be out of service for the period of inaccessibility, shall be graded around the station so as to lead surface drainage away from the station, and shall be protected to prevent vandalism and entrance by animals and unauthorized persons.

(b) The facility shall have adequate space for the installation of additional units if needed, and for the safe servicing of all equipment. The facility shall also be of durable construction, fire and weather resistant and with outward-opening doors.

(c) Pumping Equipment -

(i) At least two (2) pumping units shall be provided. The pumping facility shall be sized adequately to supply the full plant capacity with any pump out of service. The pumping units shall:

(A) Be driven by a prime mover able to operate against the maximum head and air temperature which may be encountered;

(B) Have spare parts and tools readily available, and,

(C) Be equipped with elapsed time hour meters for each pump or another acceptable mechanism to monitor run times.

(D) Be sized to operate from minimum to maximum pumping conditions without overloading the motor.

(ii) Suction lift shall be within allowable limits, preferably less than fifteen (15) feet and should be avoided if possible. If suction lift is necessary, provision shall be made for priming the pumps.

(iii) Prime water must not be of lesser sanitary quality than that of the water being pumped. Means shall be provided to prevent back-siphonage. When an air-operated ejector is used, the screened intake shall draw clean air from a point at least ten (10) feet above the ground or other source of possible contamination, unless the air is filtered by an apparatus approved by the Department. Vacuum priming may be used.

(iv) For pumps designed so that bearing lubrication fluids come into contact with the water being pumped, only water lubricated pumps may be used unless otherwise approved by the Department.

(d) Equipment Servicing - Pump facilities shall be designed so that proper maintenance of the equipment can be provided.

(e) Operator Access - Pump facilities shall be designed for easy access by stairs or ladders when necessary.

(f) Heating - In pump houses not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process.

(g) Ventilation - Ventilation shall conform to existing local, federal, and/or state codes. Adequate ventilation shall be provided for all pumping stations.

(h) Lighting - The facility shall be adequately lighted throughout. All electrical work shall conform to the requirements of the National Electric Code or applicable state and local codes.

(i) Water Seals - Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped. Where pumps are sealed with potable water and are pumping water of lesser sanitary quality the seal shall be provided with a break tank or back-flow preventer. If a break tank is used, it shall be open to atmospheric pressure, have an air gap of at least six (6) inches or two (2) pipe diameters, whichever is greater, and be installed between the feeder line and the spill line of the tank. Where a back-flow preventer is used, it shall be a reduced pressure principle back-flow type installed in the feed line.

(j) Controls - Pumps, their prime movers and accessories, shall be controlled in such a manner that they will operate at rated capacity without dangerous overload. Where two or more pumps are installed, provision shall be made for alternation. Provision shall be made to prevent energizing the motor in the event of a backspin cycle. Electrical controls shall be located above grade.

(k) Water Pre-lubrication - When automatic pre-lubrication of pump bearings is necessary and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved bypass around the automatic control so that the bearings can, if necessary, be lubricated manually before the pump is started.

C. General Design Requirements.

(1) Plant Layout - Design shall provide for adequate access roads, site drainage, protection of basins from spillage (including during delivery of chemical shipments), and adequate protection from vandalism. Consideration shall also be given to functional aspects of the plant layout and future expansion.

(2) Building layout - Design shall provide for adequate ventilation, lighting, telephone service, heating and air conditioning, floor drainage, and, if necessary, dehumidification equipment. Consideration shall also be given to accessibility of equipment for operation, servicing, and removal, telephone communication capability, flexibility of operation, operator safety, and convenience of operation (filters, basins, etc. visible to the operator).

(3) Electrical controls - Main switch gear electrical controls shall be located above grade and be protected from standing water.

(4) Auxiliary Power - Where elevated storage equals less than one half maximum daily demand, portable or in-place auxiliary power shall be provided for all systems serving three hundred (300) or more service connections. An air quality permit may be required for the emissions from the auxiliary generators. Auxiliary power requirements may be waived if one or more of the following are applicable:

(a) A verifiable history of worst case power outages and verification that the available elevated storage can provide for a similar time period of outage.

(b) Two (2) or more independent sources from the serving electrical utility are available. or,

(c) An alternate water source is available via connections with other systems.

Auxiliary power shall be sized to provide for sufficient pumping and treatment capacity to meet one half (1/2) of the maximum daily demand or to supplement the existing storage to meet one half (1/2) of the maximum daily demand.

(5) Sample taps - Sample taps shall be provided so that representative water samples can be obtained from:

(a) each raw water source;

(b) appropriate locations throughout the treatment process so that the operator can maintain proper control of the treatment process;

(c) effluent from each filter and the combined filter effluent prior to any post chemical addition; and,

(d) the entry point(s) to the distribution system.

Taps shall be consistent with sampling needs and shall not be of the petcock type. Taps used for obtaining samples for bacteriological analysis shall be of the smooth-nosed type without interior or exterior threads. Taps shall not be of the mixing type, and shall not have a screen, aerator, or other such appurtenances.

(6) Monitoring Equipment

(a) Complete bacteriological and wet chemistry testing equipment is required for all surface water plants for daily monitoring of raw, coagulated, settled, filtered and finished water quality.

(b) Laboratory equipment and facilities shall be compatible with the raw water source, the intended use of the treatment plant and the complexity of the treatment process involved. Plants treating surface water shall have as a minimum the capability to monitor turbidity, appropriate disinfectant residual, pH, temperature, alkalinity, calcium hardness, and if added, fluoride, total phosphate or orthophosphate and silica.

(7) Plant Water - The treatment plant water service line and the plant finished water sample tap shall be supplied from a source of finished water at a point where all chemicals have been thoroughly mixed.

(8) Wall Castings - Consideration shall be given to providing extra wall castings built into the structure to facilitate future uses whenever pipes pass through walls of concrete structures.

(9) Flow Meters - Flow meters shall be provided for measuring raw and finished water, all backwash water, and where deemed necessary, other internal water uses at all surface water plants. Meters shall measure an instantaneous flow and have the capability to measure totalized flow.

(10) Piping Identification - To facilitate identification of piping in treatment plants and pumping stations, all pipes shall be color coded and marked with the name of the liquid or gas being carried and its direction of flow.

(11) Proprietary Treatment Units/ Innovative Treatment Techniques - Proprietary treatment

units and alternative treatment technology may be considered if pilot tests demonstrate the ability of the technology to provide water which meets all drinking water standards utilizing the proposed raw water source. If the plant is permitted at rates which exceed the unit process rates specified in R.61-58.3(D), the system shall submit operating data within eighteen (18) months which justify continued operation at the higher rates. From the review of these data, the Department may revise the permitted treatment rate.

(12) Manuals and Parts Lists - An operation and maintenance manual shall be provided for each treatment plant. This manual shall, at a minimum, include repair information, parts lists for each piece of equipment, and procedures for the start up and shut down of the plant including all necessary chemical treatment systems.

(13) Safety - All design must meet applicable safety codes and minimum Occupational Safety and Health Administration (OSHA) standards.

D. Surface Water Treatment.

(1) Presedimentation - Presedimentation basins, where used, shall be designed such that:

(a) incoming water is dispersed across the full width of the line of travel;

(b) short circuiting shall be prevented; and,

(c) provisions for bypassing presedimentation basins are included.

(2) Conventional Sedimentation

(a) Rapid Mix - The rapid mix shall be designed so as to ensure the rapid dispersion of chemicals throughout the water to be treated.

(i) Mechanical Mixer - The mechanical mixer shall have sufficient horsepower to provide adequate dispersion of treatment chemicals and be equipped with variable speed drive.

(ii) Location - The rapid mix and flocculation basins shall be as close together as possible.

(iii) In-line mixers must be specifically approved by the Department, and shall be designed based on manufacturers recommendation and studies using the raw water source. In-line mixers shall be accessible without excavation.

(iv) A by-pass around the rapid mix or in-line mixers is prohibited.

(b) Flocculation - A minimum of two (2) parallel flocculation basins are required.

(i) Conventional Basin Design - Inlet and outlet design shall prevent short circuiting and destruction of floc. A drain or pumps shall be provided to handle de-watering and sludge removal.

(ii) Detention - The flow through velocity shall not be less than five tenths (0.5) nor greater than one and one half (1.5) feet per minute with detention time for floc formation of at least thirty (30) minutes.

(iii) Equipment - Multi-stage agitators shall be provided. The velocity

gradient (G) shall decrease with each stage. G values shall be in the range of five (5) to one hundred (100) second $^{-1}$.

(iv) Piping - Flocculation and sedimentation basins shall be as close together as possible. The velocity of flocculated water through pipes and conduits to settling basins shall not be less than five tenths (0.5) nor greater than one and one half (1.5) feet per second. Allowances shall be made to minimize turbulence at bends and changes in direction

(v) Other designs - Baffling may be used to provide flocculation in small plants only after consultation with the Department. The design shall be such that the velocities and flows noted above will be maintained.

(c) Sedimentation - A minimum of two (2) sedimentation basins are required.

(i) Detention time - Sedimentation basin design considerations and calculations shall include basin overflow rate, weir loading rate, flow through velocity and theoretical detention time. For conventional sedimentation basins with detention times of less than four (4) hours, an acceptable alternate basis for design must be provided and must be approved by the Department.

(ii) Inlet Devices - Inlets shall be designed to distribute water equally and at uniform velocities. The structures shall be designed so as to dissipate inlet velocities and provide uniform flows across the basin.

(iii) Outlet Devices - Outlet devices shall be designed to maintain velocities suitable for settling in the basin and to minimize short circuiting.

(iv) Outlet Flow Rate - The approach velocity at the outlet weir shall be such that the resuspension of floc is minimized.

(v) Velocity - The velocity through settling basins shall not exceed five tenths (0.5) of a foot per minute, except as specifically approved by the Department. The basins shall be designed to minimize short circuiting. Baffles shall be provided, as necessary.

(vi) Overflow - An overflow weir (or pipe) shall be installed which will establish the maximum water level desired on top of the filters. It shall overflow at a location observable to the operator.

(vii) Drainage - Basins shall be provided with the means for draining, either by gravity or pumps. The amount of time required to drain the basin shall not be such that it interferes with plant operation.

(viii) Sludge handling - Facilities are required by the Department for the disposal of sludge and shall be designed in accordance with R.61-58.3(F). Provisions shall be made for the operator to observe and sample sludge being withdrawn from the basin.

(ix) Washdown Hydrants - Washdown hydrants shall be provided and shall be equipped with backflow prevention devices acceptable to the Department.

(3) Solids Contact Clarification - A minimum of two (2) solids contact units are required

unless continuous sludge withdrawal is provided.

(a) Chemical Feed - Chemicals shall be applied at such points and by such means as to ensure satisfactory mixing of the chemicals with the water.

(b) Mixing - Rapid mix device or chamber ahead of the solids contact unit may be required by the Department to assure proper mixing of the chemicals applied. Mixing devices employed shall be so constructed as to provide adequate mixing of the raw water with previously formed sludge particles, and prevent deposition of solids in the mixing zone.

(c) Flocculation - Flocculation Equipment shall:

(i) have variable speed drive;

(ii) provide for coagulation to occur in a separate chamber or baffled zone within the unit; and,

(iii) provide the flocculation and mixing period to be not less than thirty (30) minutes, except as approved by the Department.

(d) Sludge removal - Sludge removal design shall provide that:

(i) sludge pipes shall not be less than three (3) inches in diameter and shall be arranged so as to facilitate cleaning;

(ii) entrance to sludge withdrawal piping shall be designed to prevent clogging;

(iii) valves shall be located outside the tank for accessibility;

(iv) the operator may observe and sample sludge being withdrawn from the unit; and,

(v) blowdown processes are automated.

(e) Sludge handling - Facilities are required by the Department for the disposal of sludge and shall be designed in accordance with R.61-58.3(F).

(f) Cross-connections

(i) Blow off outlets and drains shall terminate with proper air gap discharge at a location satisfactory to the Department.

(ii) Cross-connection control shall be included for the potable water lines used to backflush sludge lines.

(g) Detention time - The detention time shall be established on the basis of raw water characteristics and other local conditions that affect the operation of the unit.

Design considerations and calculations shall include theoretical detention time, weir loading rate, and surface loading rate.

(h) Weirs or orifices - The units shall be equipped with either overflow weirs or orifices.

(i) Weirs shall be adjustable, and at least equivalent in length to the perimeter of the tank. They shall be constructed so that water at the surface does not travel over ten (10) feet horizontally to the collection trough.

(ii) Weir loading shall not exceed fifteen (15) gallons per minute per foot of weir length for units used for softeners or clarifiers removing heavy alum floc (high turbidity raw water), or ten (10) gallons per minute per foot of weir length for units used for clarifiers removing light alum floc (low turbidity raw water).

(iii) Weirs or orifices shall produce uniform rising rates over the entire area of the tank.

(iv) Where orifices are used, the loading per foot shall be equivalent to specified weir loadings.

(i) Overflow rates - Unless supporting data is submitted to the Department the following rates shall not be exceeded:

(i) One and seventy-five hundredths (1.75) gallons per minute per square foot of area at the slurry separation line, for units used for softeners; and,

(ii) One (1.0) gallon per minute per square foot of area at the sludge separation line for units used for turbidity removal.

(4) Tube or Plate Settlers - Pilot test data is required prior to approval of settler units. The pilot tests must demonstrate that the unit is capable of treating the source water to comply with all drinking water standards during the worst conditions of raw water quality.

(a) Inlet and outlet considerations - Inlet and outlet devices shall be designed such that proper settling velocities are maintained and short circuiting is minimized.

(b) Drainage - Drain piping from the settler units shall be sized to facilitate a quick flush of the settler units, and to prevent flooding of the other portions of the plant.

(c) Application rate for tubes - A maximum rate of two (2) gallons per minute per square foot of cross-sectional area is allowed for tube settlers, unless pilot or full scale demonstration testing indicate that higher rates do not adversely affect water quality.

(d) Application rates for plates - A maximum plate loading rate of five tenths (0.5) gallons per minute per square foot, based on eighty (80) percent of the projected horizontal plate area is allowed, unless pilot or full scale demonstration testing indicate that higher rates do not adversely affect water quality.

(e) Flushing lines - Flushing lines shall be provided to facilitate maintenance, and shall be properly protected against backflow and back siphonage.

(5) Filtration - The following criteria applies to both conventional down-flow filters and to up-flow filters. All filters treating surface water must meet the performance standards set forth in R.61-58.10(E).

The application of any one type of filtration must be supported by water quality data representing a reasonable period of time to characterize the variations in water quality. Experimental treatment studies may be required to demonstrate the applicability of the method of filtration proposed. The maximum loss of head should be designed to occur at the point of terminal filter turbidity increase.

(a) Rapid Rate Gravity Filters

(i) Pretreatment - The use of rapid rate gravity filters shall require pretreatment.

(ii) Number - At least two (2) units shall be provided. Provisions shall be made to assure continuity of service with a filter unit temporarily removed from operation. The plant shall be designed so that the design filtration rate is not exceeded during backwash operations. In addition, provisions shall be made so that hydraulic surges through the filters are minimized during flow rate changes and when filters are removed from service for backwashing.

(iii) Rate of Filtration - The rate of filtration shall be determined through considerations of such factors as the quality of the raw water, the degree of pretreatment provided, the filter media provided and other considerations required by the Department. The nominal rate shall be four (4) gallons per minute per square foot of filter area except as higher rates are justified by the professional engineer to the satisfaction of the Department.

(iv) Structural Details and hydraulics - The filter structure shall be designed to provide:

(A) vertical walls within the filter;

(B) no protrusion of the filter walls into the filter media;

(C) head room to permit normal inspection and operation;

(D) access to at least fifty (50) percent of the perimeter.

(E) minimum depth of filter of eight and one half (8-1/2) feet measured from the top of the underdrain to the top of the filter bay;

(F) If a filter is designed to operate to a specified loss of head then the filter shall be designed with that water level or greater above the surface of the filter media;

(G) trapped effluent to prevent backflow of air to the bottom of the filters;

(H) prevention of floor drainage to the filter with a minimum four (4) inch curb around the filters;

(I) maximum influent velocity of treated water in pipes and conduits to filters of two (2) feet per second;

(J) cleanouts and straight alignment for influent pipes or conduits where solids loading is heavy, or following lime-soda softening;

(K) washwater drain capacity to carry maximum backwash flow;

(L) walkways around filters, to be not less than twenty-four (24) inches wide;

(M) safety handrails or walls around filter areas adjacent to walkways; and,

(N) no roof drainage into the filter or basins and conduits preceding the filters.

(v) Washwater Troughs - Washwater troughs shall be designed to provide:

(A) the bottom elevation of the trough must be above the maximum level of expanded media during washing;

(B) a two (2) inch freeboard at the maximum rate of wash;

(C) the top or edge to be level;

(D) spacing so that each trough serves the same number of square feet of filter area; and,

(E) maximum horizontal travel of suspended particles to reach trough not to exceed three (3) feet.

(vi) Filter Material - One or more of the following filter media shall be used and shall have a depth of at least thirty (30) inches.

(A) Anthracite - Clean crushed anthracite, or a combination of anthracite and other media may be considered. If used alone, the anthracite shall have an effective size of 0.45 millimeters to 0.7 millimeters and a uniformity coefficient of not less than 1.3 nor greater than 1.65. If used in conjunction with sand or other media, the anthracite shall have an effective size of 0.45 millimeters to 1.2 millimeters and a uniformity coefficient of not less than 1.3 nor greater than 1.85.

(B) Sand Media - Sand media shall have an effective size of 0.45 millimeters to 0.55 millimeters, and a uniformity coefficient of not less than 1.3 nor greater than 1.65.

(C) Granular Activated Carbon - Use of granular activated carbon media, if used alone, may be considered only with approval of the Department, and must meet the requirements for anthracite media. There shall be provision for a free chlorine residual in the water following the filters and prior to distribution. There must be a means for periodic treatment of filter material for control of bacteria and other growths, and there must be provisions for testing, regeneration, and periodic replacement of the carbon.

(D) Torpedo Sand - A three (3) inch layer of torpedo sand shall be used as a supporting media for the filter sand. Such torpedo sand shall

have an effective size of 0.8 millimeters to 2.0 millimeters, and a uniformity coefficient not less than 1.3 nor greater than 1.7 millimeters.

(E) Gravel - Gravel, when used as the supporting media, shall consist of hard, rounded particles and shall not include flat or elongated particles. The coarsest gravel shall be 2.5 inches in size when the gravel rests directly on the strainer system, and shall extend above the top of the perforated laterals or strainer nozzles. The size and depth of gravel required is dependent upon the type of underdrain used. Size and depth of gravel required when using proprietary filter bottoms shall be in accordance with the manufactures recommendations.

(F) Other Filter Media Design - Other filter media design will be considered based on pilot test data and operating experience.

(vii) Filter Bottoms and Strainer Systems

(A) All filter bottom and strainer systems shall be designed to ensure both an even distribution of washwater with minimum head loss and a uniform rate of filtration.

(B) The design of manifold type collection systems shall be to provide the ratio of the area of the final openings of the strainer system to the area of the filter of 0.003; provide the total cross-sectional area of the laterals of twice the total area of the final openings; and provide the cross-sectional area of the manifold at one and one half (1.5) to two (2) times the total area of the laterals.

(C) Proprietary bottoms shall be permanently grouted or fastened in place.

(D) Porous plate bottoms shall not be used where iron or manganese may clog them or with waters treated with lime prior to filtration.

(viii) Surface Wash or Subsurface Wash - Surface wash or subsurface wash facilities shall be required for all filters treating surface water, unless an air scouring system is provided, and may be accomplished by a system of fixed nozzles or a revolving type apparatus. All surface wash or subsurface wash devices shall be designed with:

(A) provisions for water pressures of at least forty-five (45) pounds per square inch;

(B) a properly installed vacuum breaker or other approved device to prevent back siphonage; and,

(C) a rate of flow of two (2) gallons per minute per square foot of filter area with fixed nozzles or one half (0.5) gallons per minute per square foot with revolving arms.

(ix) Air Scouring - Air scouring may be used in lieu of or in conjunction with surface or subsurface wash, and is recommended for filtration rates greater than four (4) gallons per minute per square foot. The air scouring system shall be

designed such that:

(A) air flow shall be three (3) to five (5) standard cubic feet per minute per square foot of filter area when the air is introduced in the underdrain; a lower rate must be used when the air scour distribution system is placed above the underdrain;

(B) excessive loss of filter media during backwashing is avoided;

(C) it is followed by a fluidization wash which is sufficient to restatify the media;

(D) the air supply remains free from contamination;

(E) clogging of the air scour nozzles and the entering of the media into the air scour distribution system is avoided;

(F) air delivery piping does not pass down through the filter media; and,

(G) regular maintenance and/or replacement of the air delivery piping may be performed.

(x) Appurtenances - Each filter shall have:

(A) sampling taps for filtered water, backwash water and rewash water;

(B) an indicating loss of head gauge;

(C) indicating flow rate control. Equipment that simply maintains a constant water level on the filters is not acceptable, unless the rate of flow onto the filter is properly controlled;

(D) provisions for filtering water to waste with a properly installed vacuum breaker or other approved device for backflow prevention;

(E) continuous recording device or computer data for loss of head and rate of flow instrumentation; and,

(F) continuous turbidity monitoring equipment for raw and settled water. Each filter shall be equipped with a continuous, on-line turbidimeter. The filter effluent turbidimeters shall be nephelometric type and equipped with alarms to be set to enunciate at five tenths (0.50) nephelometric turbidity units. Continuous recorders or computer data which record at no greater than fifteen (15) minute intervals are required for each unit.

(xi) Backwash - Provisions shall be made for washing filters as follows:

(A) A minimum rate of fifteen (15) gallons per square foot per minute, consistent with water temperatures and specific gravity of the filter media or a rate necessary to provide for a fifty (50) percent

expansion of the filter bed is required.

(B) Filtered water shall be provided at the required rate by washwater tanks, a washwater pump, from the high service main, a combination of these, or by other means acceptable to the Department;

(C) Washwater pumps in duplicate are required unless an alternate means of obtaining washwater is available;

(D) Capacity for at least twenty (20) minute wash of one filter is required at the design rate of wash;

(E) A washwater regulator or valve on the main washwater line to obtain the desired rate of filter wash with the washwater valves on the individual filters open wide;

(F) A rate-of-flow indicator, preferably with a totalizer, is required on the main washwater line, and shall be located so that it can be easily read by the operator during the washing process;

(G) The design shall prevent rapid changes in backwash water flow; and,

(H) A treatment of filter backwash designed in accordance with R.61-58.3 (F) shall be provided.

(b) High Rate Gravity Filters - No rates above four (4) gallons per minute per square foot will be considered without full scale pilot tests of at least twelve (12) month duration. High rate approval will not be considered for a plant with a flashy raw water source unless adequate off-stream storage is provided. High rate approval for existing plants requires an engineering evaluation and will be approved only where a sufficient number of experienced and qualified operators are employed. Where high rate approval will not allow a plant to maintain minimum unit process detention times specified in R.61-58.3.D(2), evaluations of those unit processes must be included in the pilot test and high rate engineering evaluation. The design of high rate gravity filters shall be in accordance with all applicable requirements of R.61-58.3.D(5).

(c) Rapid Rate Pressure Filters - Pressure filters will not be allowed as primary filtration on surface waters.

(d) Diatomaceous earth filtration will not be allowed as primary filtration on surface waters.

(i) Conditions of use - Diatomaceous earth filters are expressly excluded from consideration for bacteria removal, color removal, or turbidity removal where either the gross quantity of turbidity is high or the turbidity exhibits poor filterability characteristics, and filtration of waters with high algae counts.

(ii) Pilot plant study - Installation of a diatomaceous earth filtration system shall be preceded by a pilot plant study on the water to be treated.

(A) Conditions of the study such as duration, filter rates, head loss accumulation, slurry feed rates, turbidity removal, bacteria removal, etc.,

shall be approved by the Department prior to the study.

(B) Satisfactory pilot plant results shall be obtained prior to preparation of final construction plans and specifications.

(C) The pilot plant study shall demonstrate the ability of the system to meet applicable drinking water standards at all times.

(iii) Types of filters - Pressure or vacuum diatomaceous earth filtration units will be considered for approval.

(iv) Treated water storage - Treated water storage capacity in excess of normal requirements shall be provided to allow operation of the filters at a uniform rate during all conditions of system demand at or below the approved filtration rate, and guarantee continuity of service during adverse raw water conditions without by-passing the system.

(v) Number of filtration units - At least two (2) units shall be provided.

(vi) Precoat - A uniform precoat of at least 1/16 inch shall be applied hydraulically to each septum by introducing a slurry to the tank influent line and employing either a filter-to-waste or recirculation system.

(vii) Body feed - A body feed system to apply additional amounts of diatomaceous earth slurry during the filter run is required. Continuous mixing of the body feed slurry shall be provided.

(viii) Filtration

(A) Rate of filtration - The filtration rate shall be controlled by a positive means and shall not exceed one and a half (1.5) gallons per minute per square foot of filter.

(B) Head loss - The head loss shall not exceed thirty (30) pounds per square inch for pressure diatomaceous earth filters, or a vacuum of fifteen (15) inches of mercury for a vacuum system.

(C) Recirculation - A recirculation or holding pump shall be employed to maintain differential pressure across the filter when the unit is not in operation in order to prevent the filter cake from dropping off the filter elements. A minimum recirculation rate of one tenth (0.1) gallon per minute per square foot of filter area shall be provided.

(D) Septum or filter element - The filter elements shall be structurally capable of withstanding maximum pressure and velocity variations during filtration and backwash cycles, and shall be spaced such that no less than one (1) inch is provided between elements or between any element and a wall.

(E) Inlet design - The filter influent shall be designed to prevent scour of the diatomaceous earth from the filter element.

(ix) Backwash - A satisfactory method to thoroughly remove and dispose of

spent filter cake shall be provided. Treatment is required for the backwash water and shall be designed in accordance with applicable portions of R.61-58.3 (F).

(x) Appurtenances - The following shall be provided for every filter:

(A) sampling taps for raw and filtered water;

(B) loss of head or differential pressure gauge;

(C) rate-of-flow indicator, with totalizer;

(D) a throttling valve used to reduce rates below normal during adverse raw water conditions; and,

(E) an evaluation of the need for body feed, recirculation, and any other pumps, in accordance with R.61-58.4(B)(1)(d).

(xi) Monitoring - A continuous monitoring turbidimeter with recorder is required on the filter effluent.

(e) Direct Filtration - The use of direct filtration technology will be considered only where sufficient raw water quality and engineering data is submitted to justify such. No rates above four (4) gallons per minute per square foot will be considered without full scale pilot tests of at least twelve (12) month duration. The following shall be met for direct filtration approval:

(i) Off stream raw water storage must be provided, unless a consistent raw water quality can be demonstrated to the satisfaction of the Department.

(ii) The flocculation chamber design shall be based on pilot plant studies in conjunction with applicable portions of R.61-58.3(D)(2).

(iii) Each filter must meet the basic requirements of a rapid rate gravity filter as given in R.61-58.3(D)(5).

(iv) Filters shall be provided with either rapid rate dual or mixed media specified for filtration rates of four (4) gallons per minute per square foot or greater.

(v) Surface wash, subsurface wash and/or air scour facilities designed in accordance with R.61-58.3(D)(5)(a)(viii) and R.61-58.3(D)(5)(a)(ix) for each filter.

(vi) Each direct filtration plant shall have continuous turbidity monitoring equipment for raw and settled water. Each filter shall be equipped with a continuous, on-line turbidimeter. The filter effluent turbidimeters shall be nephelometric type and equipped with alarms set to enunciate at five tenths (0.50) nephelometric turbidity units. Continuous recorders or computer data are required for each unit.

(vii) Continuous recording devices may be required for loss of head and rate of flow instrumentation.

(viii) Provisions for filtration to waste with appropriate measures for backflow prevention are required.

(6) Disinfection - Disinfection may be accomplished with gas chlorine, chlorine dioxide, ozone or chloramines. Other agents will be considered by the Department provided that reliable feed equipment is available and test procedures for a residual are recognized, and the agent meets the requirements of an acceptable drinking water additive. Continuous disinfection will be required at all surface water supplies. Due consideration shall be given to the contact time of the disinfectant in water with relation to pH, ammonia, taste-producing substances, temperature, bacterial quality, and other pertinent factors. Consideration also must be given to the formation of disinfection by-products and meeting the contact times prescribed in R.61-58.10.

(a) Chlorination - Where chlorine is used the following shall apply:

(i) Type - Only vacuum type gas chlorinators are acceptable.

(ii) Capacity - The chlorinator capacity shall be such that a free chlorine residual of at least five (5) milligram per liter can be attained in the water after a contact time of at least thirty (30) minutes at maximum flow rates. The equipment shall be of such design that it will operate accurately over the desired feeding range.

(iii) Number of units - at least one (1) backup chlorinator shall be provided in addition to the number required for each primary feed point. The backup chlorinator shall be equal to the capacity of the largest chlorinator in use.

(iv) Automatic Proportioning - Automatic proportioning chlorinators will be required where the rate of flow or chlorine demand is not reasonably constant or where the rate of flow of the water is not manually controlled.

(v) Residual Chlorine - Where alternate disinfectants are used in the treatment process, the capability for the addition of either free or combined chlorine in the finished water shall be provided. Residual chlorine must be sufficient to meet the applicable requirements of R.61-58.10.

(b) Cross connection protection - The chlorinator water supply piping shall be designed to prevent contamination of the treated water supply by sources of questionable quality.

(c) Chlorine gas - Consideration shall be given to the location of gas chlorine facilities and the safety of the public in the surrounding area. Consideration may be given for facilities that propose the use of chlorine gas in inhabited areas when the use of safety devices which will not allow the release of chlorine gas (e.g. chlorine scrubbers) are provided. Only vacuum gas chlorinator systems will be approved.

(i) Chlorine gas feed shall be enclosed and separated from other operating areas. Concrete, wood, and other construction materials shall be sealed to prevent the escape of chlorine gas from the chlorine building. The chlorine room shall be provided with a shatter resistant inspection window installed in an interior wall or an inspection window in the door. It shall be constructed in such a manner that all openings between the chlorine room and the remainder of the plant are sealed, and shall be provided with doors ensuring ready means of exit and opening only to the building exterior.

(ii) Full and empty cylinders of chlorine gas shall be isolated from operating areas, restrained in position to prevent upset, stored in rooms separate from ammonia storage, and stored in areas not in direct sunlight or exposed to excessive heat.

(iii) If the chlorine room is large enough for a person to enter, the room shall be constructed such that:

(A) It has a ventilating fan with a capacity which provides one complete air change per minute;

(B) The ventilating fan shall be located near the ceiling and pull suction through a duct extending to within twelve (12) inches of the floor and discharge as far as practical from the door and air inlet. The point of discharge shall be located so as not to contaminate air inlets to any rooms or structures. A sealed motor or other means shall be used to ensure the reliability of the fan;

(C) Air inlets shall be located near the ceiling;

(D) Air inlets and outlets shall have mechanical louvers;

(E) Switches for fans and lights are outside of the room, at the entrance;

(F) Vents from feeders and storage areas discharge to the outside atmosphere, above grade and away from inlet vent; and,

(G) Ventilation shall not be automatically controlled.

(iv) If the room is too small for a person to enter, the room must meet only R.61-58.3(D)(2)(c)(iii)(E) and (F).

(v) Chlorine feed lines shall meet the following requirements:

(A) Chlorine gas under pressure shall be piped with schedule eighty (80) stainless steel or schedule eighty (80) seamless carbon steel. No chlorine gas under pressure will be piped beyond the chlorinator room.

(B) Chlorine gas under vacuum shall be piped with schedule eighty (80) PVC or reinforced fiberglass.

(C) Chlorine solution shall be piped with schedule eighty (80) PVC.

(vi) Heaters shall be provided to maintain proper temperature for operation.

(vii) There shall be no equipment housed in the chlorine room except chlorinators, chlorine cylinders, weighing scales, heater, ventilation fan, and light(s).

(viii) Weighing scales shall be provided for weighing cylinders, at all installations utilizing chlorine gas unless provisions for automatic switchover of

cylinders and an acceptable alternate means to determine daily dosage are provided.

(ix) Chlorine feed systems shall be designed to ensure continuous feed of chlorine.

(x) If a floor drain is provided, it shall be equipped with a water seal or trap to prevent escaped gases from exiting through the building sewer.

(xi) A chlorine leak detection and alarm system shall be provided.

(d) Ozone - Ozone is a suitable disinfectant for surface water. When used as a pre-treatment chemical for surface water, provisions shall be made for post chlorination or chloramination. Consideration shall be given to potential algae growth, removal of assimilated carbon from treated waters, and the formation of oxidized organics. On-site generation facilities shall be constructed in accordance with manufacturer's standards.

(i) Pilot plant tests - Pilot plant tests shall be performed with the water to be treated to establish the optimum dosage, contact time, depth of conductor and the need for multiple application points.

(ii) Number of Units - At least two (2) generators shall be provided. The facility shall be adequately sized to provide the maximum treatment capacity with one generator out of service.

(iii) Building Design - Ozone generators shall be housed in a separate room with separate heating and ventilation. The building layout must provide for easy access to the equipment. Ventilation equipment shall be two (2) speed with the normal speed providing the normal distribution of heat or air movement. The second speed must be capable of providing a complete turnover of the air in the room every two (2) minutes to exhaust any ozone leakage in an emergency.

(iv) Piping Materials

(A) All dry ozone gas piping shall be mechanical jointed number 304 or 316 stainless steel or welded 304L or 316L stainless steel. All wet ozone gas piping shall be number 316 or 316L stainless steel. All flexible couplings shall be stainless steel.

(B) Valves shall be stainless steel face and body.

(C) Gasket materials shall be resistant to deterioration by the ozone.

(v) Reinforced concrete or stainless steel are acceptable materials. All concrete joints shall be sealed using a synthetic rubber material resistant to deterioration by ozone.

(e) Other disinfection agents - Any proposal for the use of other disinfecting agents shall be approved by the Department prior to preparation of final plans and specifications.

(f) Ammonia Gas - Consideration shall be given to the location of ammonia gas facilities and the safety of the public in the surrounding area. Only vacuum ammonia systems will be approved.

(i) Ammonia gas feed shall be enclosed and separated from other operating areas. Concrete, wood, and other construction materials shall be sealed to prevent the escape of ammonia gas from the room. The ammonia room shall be provided with a shatter resistant inspection window installed in an interior wall or an inspection window in the door. It shall be constructed in such a manner that all openings between the ammonia room and the remainder of the plant are sealed, and shall be provided with doors ensuring ready means of exit and opening only to the building exterior.

(ii) Full and empty cylinders of ammonia gas shall be isolated from operating areas, restrained in position to prevent upset, stored in rooms separate from chlorine storage, and stored in areas not in direct sunlight or exposed to excessive heat.

(iii) If the ammonia room is large enough for a person to enter, the room shall be constructed such that:

(A) It has a ventilating fan with a capacity which provides one complete air change per minute;

(B) The ventilating fan shall be located and pull suction near the ceiling and discharge as far as practical from the door and air inlet. The point of discharge shall be located so as not to contaminate air inlets to any rooms or structures. A sealed motor or other means shall be used to ensure the reliability of the fan;

(C) Air inlets shall be located near the floor;

(D) Air inlets and outlets shall have mechanical louvers;

(E) Switches for fans and lights are outside of the room, at the entrance;

(F) Vents from feeders and storage areas discharge to the outside atmosphere, above grade and away from inlet vent; and,

(G) Ventilation shall not be automatically controlled.

(iv) If the room is too small for a person to enter, the room must meet only R.61-58.3(D)(2)(f)(iii)(E), and (F).

(v) Ammonia feed lines shall not carry ammonia gas beyond the ammonia room.

(vi) There shall be no equipment housed in the ammonia room except ammoniators, ammonia cylinders, weighing scales, heater, ventilation fan, and light(s).

(vii) Weighing scales shall be provided for weighing cylinders, at all plants utilizing ammonia gas from cylinders. Where bulk storage tanks are installed, they shall be equipped with a pressure gauge.

(viii) Ammonia leak detectors with alarms shall be provided.

(g) Chlorine Dioxide - Chlorine Dioxide is a suitable disinfectant for surface water. Chlorine dioxide shall be generated on site. The unit shall be flow paced and not have a holding tank for the chlorine dioxide solution generated. All applicable EPA disinfectant by-product rules shall be observed.

(i) Sizing of the chlorine dioxide generator - Chlorine dioxide demand studies shall be conducted to determine estimated feed rates and points of feed.

(ii) Building Design -

(A) Chlorine dioxide generators shall be located in a room separate from chlorine cylinders.

(B) Number of Units: Where chlorine dioxide is used as the primary disinfectant, at least two (2) flow pacing chlorine dioxide generators shall be provided. The facility shall be adequately sized to supply the maximum treatment capacity with any one generator out of service. If chlorine dioxide is not used as a primary disinfectant (i.e. an oxidant only), a second generator is not required.

(iii) Piping Materials -

(A) All piping from the chlorine dioxide generator shall be schedule 80 PVC.

(B) Gasket materials shall be kynar or other compatible material.

(C) All tubing connector fittings shall be kynar or other compatible material.

(7) Aeration - Aeration treatment devices, as described herein, may be used for oxidation, separation of gases or for taste and odor control.

(a) General Requirements

(i) Sample taps must be provided following aeration equipment.

(ii) Where aeration equipment discharges directly to the distribution system, air release valves must be provided.

(b) Natural Draft Aeration - Design shall provide that:

(i) Water is distributed uniformly over the top tray;

(ii) Water is discharged through a series of three (3) or more trays with the separation of trays not less than twelve (12) inches;

(iii) Trays are loaded at a rate of one (1) gallon per minute to five (5) gallons per minutes for each square foot of total tray area;

(iv) Trays have slotted, woven wire cloth or perforated bottoms;

(v) Perforation are three sixteenth (3/16) to one-half (1/2) inches in diameter, spaced one (1) to three (3) inches on centers, when perforations are used in the distribution pan;

(vi) Construction of durable material resistant to the aggressiveness of the water and dissolved gases;

(vii) Protection of aerators from loss of spray water by wind carriage by enclosure with louvers sloped to the inside at an angle of approximately forty-five (45) degrees;

(viii) Protection from insects by number twenty-four (24) mesh screen; and,

(ix) Aerated water receives disinfection treatment.

(c) Forced or Induced Draft Aeration - Devices shall be designed to:

(i) Provide an adequate countercurrent of air through the enclosed aeration column;

(ii) Include a blower in a screened enclosure and with a watertight motor;

(iii) Exhaust air directly to the outside atmosphere;

(iv) Include a down-turned, number twenty-four (24) mesh screened air outlet and inlet;

(v) Be such that air introduced in the column shall be as free from noxious fumes, dust, and dirt as possible;

(vi) Be such that sections of the aerator can be easily reached or removed for maintenance of the interior;

(vii) Provide loading at a rate of one (1) to five (5) gallons per minute for each square foot of total tray area;

(viii) Ensure that the water outlet is adequately sealed to prevent the unwarranted loss of air;

(ix) Discharge through a series of five (5) or more trays, with separation of trays not less than six (6) inches;

(x) Provide distribution of water uniformly over the top tray; and,

(xi) Be of a durable corrosive resistant material.

(d) Pressure Aeration - This method may be used for oxidation purposes if pilot plant study indicates method is applicable. It is not acceptable for removal of dissolved gases. Filters following pressure aeration shall have adequate exhaust devices for release of air. Pressure aeration devices shall be designed to give thorough mixing of compressed air with water being treated. Screened and filtered air, free of noxious fumes, dust, dirt and other contaminants shall be provided.

(e) Other Methods of Aeration - Other methods of aeration may be used if applicable to the treatment needs. Such methods may include, but are not restricted to, spraying, diffused air, cascades, and mechanical aeration. The treatment processes shall be designed to meet the particular needs of the water to be treated and shall be subject to Department approval.

(8) Fluoridation - Commercial sodium fluoride, sodium silicofluoride and hydrofluorosilic acid shall be NSF approved and shall conform to American Waterworks Association Standards B701, B702 and B703, respectively. Fluoride chemicals shall meet the requirements of chemical additives in R.61-58.2(E)(3). The proposed method of fluoride feed shall be approved by the Department prior to preparation of final plans and specifications.

(a) Fluoride Compound Storage - Dry chemical storage shall be designed in accordance with R.61-58.3.E(2)(e). Storage units for hydrofluorosilic acid shall be isolated from operating areas and shall be vented to the atmosphere at a point outside any building.

(b) Dry Conveyors - Provisions shall be made for the proper transfer of dry fluoride compounds from shipping containers to storage bins or hoppers, in such a way as to minimize the quantity of fluoride dust.

(c) Injection Point - The fluoride compound shall not be added before lime addition, to avoid precipitation of fluoride.

(d) Chemical Feed Installations - Fluoride feed systems shall meet the following criteria:

(i) Scales or loss-of-weight recorders for weighing the quantity of chemicals added shall be provided;

(ii) Feed equipment shall have an accuracy to within five (5) percent of any desired feed rate;

(iii) The point of application of hydrofluorosilic acid, if into a pipe, shall be in the lower half of the pipe and project upward at an angle approximately forty (40) degrees and extend into the pipe one-third of diameter; and,

(iv) All fluoride feed lines shall be provided with adequate antisiphon devices.

(v) All fluoride feed systems shall be equipped with a fail-safe system to prevent the continued feed of fluoride at times when there is no flow of water through the fluoride feed point.

(e) Protective equipment - At least one (1) pair of rubber gloves, a respirator of a type certified by the National Institute for Occupational Safety and Health for toxic dusts or acid gas (as necessary), an apron or other protective clothing, and goggles or face masks shall be provided for use by the operator. Other protective equipment may be required, as deemed necessary by the Department.

(f) Dust Control

(i) Provisions shall be made for the transfer of dry fluoride compounds from

shipping containers to storage bins or hoppers in such a way as to minimize the quantity of fluoride dust which may enter the room in which the equipment is installed. The enclosure shall be provided with an exhaust fan and dust filter to the outside atmosphere of the building.

(ii) Provisions shall be made for disposing of empty bags, drums and barrels in a manner which will minimize exposure to fluoride dusts. A floor drain shall be provided to facilitate the washing of floors.

(9) Corrosion Control - Water that is corrosive due either to natural causes or to treatment given the water shall be rendered non-corrosive, and nonaggressive before being pumped to the distribution system.

(a) Alkali Feed - Corrosive water due to natural occurrence, created by the addition of alum or other coagulant, shall be treated by an alkali feed. Alkali feed can consist of lime, soda ash, bicarbonate, caustic soda, or a combination of any of the above. Lime feed systems shall include a mechanism for flushing the feed lines, including suction and pumping equipment, if used.

(b) Phosphates - The feeding of phosphates may be applicable for corrosion control. Phosphate chemicals shall meet the requirements of chemical additives in R.61-58.3(E)(3).

(c) Carbon dioxide addition

(i) Recarbonation basin design shall provide:

(A) a total detention time of at least twenty (20) minutes.

(B) two (2) compartments, each with a depth of eight (8) feet, consisting of a mixing compartment having a detention time of at least three (3) minutes, and a reaction compartment.

(ii) Adequate precautions shall be taken to prevent the possibility of carbon monoxide entering the plant from recarbonation compartments.

(iii) Provisions shall be made for draining the recarbonation basin and removing sludge.

(d) Other Treatment - Other treatment for controlling corrosive waters will be considered on a case by case basis. All chemicals must meet the requirements in R.61-58.3(E)(3). Any proprietary compound must receive the specific approval of the Department before use.

(e) Control - Laboratory equipment, acceptable to the Department, shall be provided to test for the compounds being fed.

(10) Taste and Odor Control - Provision shall be made for the addition of taste and odor control chemicals at all surface water treatment plants. These chemicals shall be added sufficiently ahead of other treatment processes to ensure adequate contact time for an effective and economical use of the chemicals.

(a) Flexibility - Plants treating water that is known to have taste and odor problems shall be provided with equipment that makes several of the control processes available to

allow the operator flexibility in operation.

(b) Chlorination - Chlorination can be used for the removal of some objectionable odors. Adequate contact time must be provided to complete the chemical reactions involved. Consideration shall be given to disinfection by-products if this method is used.

(c) Chlorine Dioxide - Chlorine dioxide may be used in the treatment of taste or odor. Provision shall be made for the proper storing and handling of sodium chlorite, so as to eliminate any danger of explosion. Consideration shall be given to disinfection by-products if this method is used.

(d) Powdered Activated Carbon - Where added, powder activated carbon feed systems shall meet the following criteria:

(i) Powdered activated carbon may be added prior to coagulation to provide maximum contact time, but shall not be added near the point of chlorine application.

(ii) Provisions shall be made for adequate dust control.

(iii) Provision shall be made for adding at least forty (40) milligrams per liter.

(e) Granular Activated Carbon Absorption Units - Rates of flow shall be consistent with the type and intensity of the problem. The rate used shall be supported by the results of pilot plant studies and shall be accordance with the requirements of R.61-58.3(D)(5).

(f) Copper Sulfate and Other Copper Compounds - Continuous or periodic treatment of water with copper compounds to kill algae or other growths shall be controlled to prevent copper in excess of one (1) milligrams per liter as copper in the plant effluent or distribution system. Care shall be taken in obtaining a uniform distribution. Department approval shall be obtained prior to the use of any such compound.

(g) Aeration - Aeration units used for taste and odor removal shall be designed in accordance with R.61-58.3(D)(7).

(h) Potassium Permanganate - The application of potassium permanganate may be considered, provided that dosages are determined by permanganate demand testing.

(11) Membrane Technology - All applications for projects involving membrane technology must be preceded by an engineering report and may require a pilot study. The engineering report must meet the requirements of R.61-58.1.C.

(a) General Requirements

(i) Membrane material - No membrane material shall be used in a public water system unless the material or product has been tested and certified as meeting the specifications of the American National Standard Institute/National Sanitation Foundation Standard 61, Drinking Water System Components - Health Effects. This requirement shall be met under testing conducted by a third party product certification organization accredited for this purpose by the American National Standards Institute.