REGULATIONS
OF THE
BOARD OF HEALTH
COMMONWEALTH OF VIRGINIA

Governing the Disposal of Sewage

BUREAU OF ENVIRONMENTAL HEALTH
STATE DEPARTMENT OF HEALTH
RICHMOND, VIRGINIA

1971

As authorized by Section 32-6, 9, 64, 65, 66, 67, 68, Code of Virginia, the State Board of Health is authorized in conformity with the provisions of Title 9, Chapter 1.1 to adopt, amend, and repeal rules and regulations for the purpose of carrying out the provisions of Chapter 1, governing the means of sewage disposal.

Also, relative to Section 66.1-44.18, 19, Code of Virginia, the State Board of Health in joint jurisdiction with the State Water Control Board is authorized to regulate sewage discharges.

Aproved by the State Board of Health on July 13, 1962
To become effective on October 1, 1962

Revised by the State Board of Health on June 13, 1963
To become effective on September 1, 1963

Revised by the State Board of Health on June 2, 1971
To become effective on July 1, 1971

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VIRGINIA STATE BOARD OF HEALTH
RICHMOND, VIRGINIA

RULES AND REGULATIONS FOR THE DISPOSAL OF SEWAGE IN THE COMMONWEALTH OF VIRGINIA

(Health Laws Reference-Title 32 Code of Virginia)

32-6 Rules and Regulations—The Board may make, adopt, promulgate and enforce reasonable rules and regulations from time to time requiring and providing for the subjects which follow in this chapter.

32.9 Sewage Disposal—The Board may regulate and prescribe the method or methods of disposal of sewage in this State. The Board is authorized and directed through joint studies with authorized representatives of common carriers, to consider control devices and to investigate possible devices where none exists to control the discharge of human wastes from common carriers.

32-64 Occupation of house without sanitary privy or closet in any city or incorporated town in the State and for a radius of one-half mile beyond the corporated limits thereof and elsewhere in the State whenever the local board of health shall deem it necessary, it shall be unlawful for the owner of any house or other building to be used as a human habitation to occupy or to rent or lease the same for occupancy by any person, firm or corporation, or for any person, firm or corporation to occupy same until such house shall have been supplied with a sanitary privy or closet of such form as to comply with the law. If any landlord shall fail to supply any house of his with a sanitary privy or closet as required by this section, his tenant shall supply the same in conformity with the orders of a health officer or health inspector and may deduct the cost thereof from any sum due to landlord for rent.

32-65 Certain camps and public buildings to have sanitary closets or privies—it shall be unlawful to maintain or to rent or lease any recreation or construction camp, or to use any building for educational purposes, or to permit the use of any building or tent for protracted meetings, until such camps or buildings are supplied with sanitary closets or privies.

32-66 Tenant or lessor not to neglect privies or closets—It shall be unlawful for any tenant or lessor of premises properly supplied with such a sanitary privy or closet to neglect it or to allow it to cease to be sanitary within the meaning of 32-67.

32-67 Meaning of "sanitary closet or privy"—For the purpose of the three preceding sections a "sanitary closet or privy" is deemed to be any one which provides for the disposal of human wastes or excrements in such a manner that they shall not be accessible to flies or obviously endanger a source of drinking water.

32-68 Penalty for violations as to privies or closets—Any person, firm or corporation violating any provision of sections 32-64 to 32-66 shall be deemed guilty of a misdemeanor and, upon conviction thereof, shall be fined not less than five dollars nor more than twenty-five dollars, and each week's failure to comply with any provision of such sections shall be deemed a separate offense.

ARTICLE 4. REGULATION OF SEWAGE DISCHARGES

§ 62.1-44.18. Sewerage systems, etc., under joint supervision of Board and Department of Health.—(1) All sewerage systems and sewage treatment works shall be under the general supervision of the State Department of Health and the Board jointly.

(2) The State Department of Health shall, when requested, consult with and advise the authorities of cities, towns, sanitary districts, and any owner having or intending to have installed sewage treatment works as to the most appropriate type of treatment, but the Department shall not prepare plans, specifications, or detailed estimates of cost for any improvement of an existing or proposed sewage treatment works.

(3) It shall be the duty of the owner of any such sewerage system or sewage treatment works from which sewage is being discharged into any State waters to furnish, when requested by the Board, to the State Department of Health from time to time information with regard to the quantities and character of the raw and treated sewage and the operation results obtained in the removal and disposal of organic matter and other pertinent information as is required. The State Department of Health shall furnish the Board with such available information as the Board requires.

§ 62.1-44.19. Approval of plans and specifications.—(1) Before any owner erects, constructs, opens, expands or operates a sewerage system or sewage treatment works designed to serve more than four hundred persons, and which will have a potential discharge or actual discharge to State waters, such owner shall file in duplicate with the State Department of Health a copy of pertinent plans, specifications, maps and such other information as may be required, in scope and detail satisfactory to the Department and the Board.

(2) The Department shall thereupon notify the Board that it has received the plans and other data. If the plans involve facilities from

which there is or is to be a discharge to State waters, the application shall be given public notice by publication once a week for two successive weeks in a newspaper of general circulation in the county or city where the certificate is applied for by such other means as the Board may prescribe. Upon completion of advertising, the Board shall advise the Department of the standards of quality applying to such State waters and the treatment requirements necessary to prevent contravening such standards of water quality.

(3) The Department shall then review the plans without delay and file with the Board within two months one copy and a report in which the plans are approved or disapproved. If they are not approved, the report shall state what modifications, if any, or changes will be required for approval.

(4) The Board shall review the plans and the report from the Department and make a ruling within two months approving or disapproving the plans and stating the grounds for conditional approval or disapproval. If they are approved, the Board shall grant a certificate authorizing construction of the facilities.

(5) Any owner operating under a valid certificate issued by the Board who fails to meet water quality standards established by the Board solely as a result of a change in water quality standards or in the law shall provide the necessary facilities approved by the Board within a reasonable time to meet such new requirements. The Board may amend such a certificate, or revoke it and issue a new one to reflect such facilities after proper hearing, with at least thirty days notice to the owner of the time, place and purpose thereof. If such revocation or amendment of a certificate is mutually agreeable to the Board and the owner involved, the hearing and notice may be dispensed with.

(6) The Board shall revoke the certificate in case of a failure to comply with all such requirements and may issue a special order under § 62.1-44.15(8).

(7) Nothing in this section shall limit the power of the Board and the Department in the control of sewerage systems or sewage treatment works serving less than four hundred persons.

PART I—GENERAL PROVISIONS

ARTICLE 1. DEFINITIONS

The following definitions shall apply in the interpretation and enforcement of these regulations:

SECTION A. Health Commissioner

Shall mean the chief executive officer of the State Board of Health or his authorized agent.

SECTION B. Person

Shall mean an institution, public or private corporation, individual partnership, or other entity.

SECTION C. Sewage

Shall mean the human excrement, kitchen, laundry, shower, lavatory, or industrial liquid wastes as may be present from residences, buildings, vehicles, industrial establishments, or other places.

SECTION D. Permit

Shall mean a written permit issued by the Health Commissioner authorizing the construction or repair of a sewerage system.

SECTION E. Sewerage System

Shall mean all or any part of a device, mechanism or instrumentation designed and constructed to collect, receive, and/or treat and dispose of sewage.

SECTION F. Approved Sewerage System

Shall mean a sewerage system approved by the Health Commissioner.

SECTION G. Building Drain

Shall mean that part of the lowest piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning 3 feet outside the building wall.

SECTION H. Building Sewer

Shall mean that part of the horizontal piping of a drainage system which extends from the end of the building drain, and which receives the discharge of the building drain, and conveys it to a public sewer, private sewer, individual sewerage system or other point of disposal.

SECTION I. Sewage Disposal and/or Treatment Methods

For the purpose of these regulations an approved method of sewage disposal shall be deemed to be

(a) A flush toilet or sanitary closet installed according to the Commonwealth of Virginia, State Board of Health, Official Plumbing Standards and Regulations, which has been connected to an approved sewerage system, or

(b) An approved Sanitary Privy which is to include vault privy, septic privy, incinerating privy, or

(c) An approved Dumping Station

SECTION J. Temporary

Shall mean overnight use or occupancy, or major portion thereof.

SECTION K. Dumping Station

A specially designed sewerage system for the disposal of sewage and other liquid wastes from self-contained camping units.

ARTICLE 2. TEMPORARY OR PERMANENT OCCUPATION OR USE

SECTION A. It shall be unlawful for the owner of any house, trailer, tent, or other structure, or vehicle whether self-propelled or not, and used as a place of temporary or permanent habitation; any warehouse, public building or other public or private place where human beings congregate or are employed, in the Commonwealth of Virginia, to use or occupy, or to rent or lease the same for use or occupancy by any person, firm or corporation, or for any person, firm or corporation to use or occupy the same unless and until such place or places, as outlined, shall have been supplied or equipped with an inspected and approved method of sewage disposal and/or treatment.

ARTICLE 3. PERMITS

SECTION A. Valid Permit

It shall be unlawful for any person to construct, alter or extend, or to allow construction, alteration or extension to a sewerage system in the Commonwealth of Virginia unless a valid permit has been issued for that system by the Health Commissioner in the name of a specific person for a specific location.

SECTION B. Applying for Permit

Application for a permit must be made to the Health Commissioner. The Health Commissioner shall require such tests, plans and/or specifications as he deems necessary to determine the adequacy and desirability of the system. Such information shall be made a part of the permit.

SECTION C. Approval of Permit

When the Health Commissioner is satisfied that a proposed design is adequate for the conditions under which a system is to be installed and used, a written permit to proceed with construction shall be issued by him and shall contain the signature of the owner or the owner's agent.

SECTION D. Denial of Permit

When the Health Commissioner determines that a proposed design is inadequate, or soil or geological conditions are such to preclude safe and proper operation of the desired installation, he will deny, in writing, a permit to proceed with construction and specify the reason(s) for denial.

SECTION E. Appeal

An appeal in the form of a formal hearing shall be granted by the State Health Commissioner at the Madison Building if request is made in writing by certified mail and within 60 days of the denial of a permit. Such hearing shall be held at the State Health Department, Bureau of Environmental Health, 522 Madison Building, 109 Governor Street, Richmond, Virginia 23219. Within 30 days of the appeal hearing, if such hearing be requested, the State Health Commissioner shall, in writing, notify the appealant of the results of and the reasons for the decisions reached.

If the appealant does not desire to make a personal appearance at the formal hearing, the commissioner will decide the merits of case using the information and data which was furnished in denying the permit, and notify the appealant, in writing, the reasons for the decisions. Such notification shall be given within 30 days of the hearing date. Timely exhaustion of such administrative appeal and review shall be a necessary prerequisite to judicial review.

SECTION F. Voidance of Permit

1. Permits shall be null and void after 12 months from date of issuance, unless extended, in writing, by the Health Commissioner.

2. Permits shall be automatically cancelled when site conditions are changed from those shown on the permit.

3. Permits shall be automatically cancelled should facts later become known that a potential health hazard would be created by continuing installation.

ARTICLE 4. INSPECTIONS

SECTION A. Required Inspections

The Health Commissioner shall make such inspections as he may deem necessary during construction to determine compliance with these Rules and Regulations.

SECTION B. Installation

No part of any installation shall be covered or used until inspected and approved by the Health Commissioner. Any part of an installation which has been covered prior to approval shall be uncovered upon order of the Health Commissioner.

In extraordinary circumstances the Health Commissioner may give final approval to any system, although incomplete (i.e. sewer line not connected from house to septic tank) when reasonable professional judgement indicates a revisit is not practical or feasible. The inspection form shall indicate such waiver.

PART III—PIT PRIVY

ARTICLE 1. DESIGN AND CONSTRUCTION

SECTION A. Location

The privy may be placed near the home but shall be located with care to help prevent and avoid polluting nearby wells, shellfish waters, impounded waters, or streams. Table I identifies "MINIMUM DISTANCES." (See page 10.)

The privy shall be built in accordance with the current issue of the Virginia State Department of Health publication entitled "The Sanitary Pit Privy."

TABLE I

Minimum Horizontal Distance In Feet	Wells by Classification			Shell-Fish Waters†	Impounded Waters†	Streams†	Property Lines	Base-ments
	I*	II*	III‡					
5							X	
10								
20								X
35	X							
50		X		X	X	X		
100			X					

* Public Water Supply Standards—Division of Engineering, Bureau of Sanitary Engineering, Virginia State Health Department.

† If the water table rises within 2 feet of the surface of the ground, a standard sanitary privy shall not be located nearer than 100 feet of shellfish waters, impounded waters or a stream.

Vault privies when used near shellfish waters shall be installed with the concurrence of the Bureau of Shellfish Sanitation, Division of Engineering, Virginia State Health Department.

‡ It shall be presumed that a Class III well will be installed unless sufficient evidence and assurance is proffered.

PART III—SEPTIC TANK SYSTEM

ARTICLE 1. DESIGN CONSTRUCTION & LOCATION

SECTION A. Septic Tank

1. *Design*—Septic tanks shall be of an approved design as to length, width and depth or other pertinent dimensions so as to effectuate extended use.

2. *Size*—The minimum size of a septic tank shall be based upon a retention period of not less than 30 hours. Any tank receiving waste from a garbage disposal unit shall be increased in capacity by 50 percent.

All bedrooms shall be considered to have a minimum potential occupancy of two people.

The current water consumption rates as established by the Virginia State Department of Health, Division of Engineering, Bureau of Sanitary Engineering, shall be used as the basis for design and are outlined in Table II, "Minimum Daily Water Consumption Rates."

TABLE II

STATE DEPARTMENT OF HEALTH

Minimum Daily Water Consumption Rates

26 May 1970

		Gallons per Day
Dwellings, per person (*minimum* rates by fixture below)		
Kitchen sink	20	
Toilet	25	
Shower or tub	25	100
Wash basin	10	
Laundry	20	
High Schools with showers, per person		16
Elementary Schools without showers, per person		10
Motels @ 65 gals/person, minimum per room		130
Trailer Courts @ 3 persons/trailer, per trailer		300
Restaurants per seat which includes toilet wastes, but not air conditioning cooling water		50
Interstate or Through Highway Restaurant, per seat (BOD-mg/L500		180
Interstate Rest Areas—per person		5
Service Station per Vehicle Serviced		10
Factories per person per 8-hour shift exclusive of industrial wastes		15-35
Shopping Centers per 1000 sq. ft. of ultimate floor space		200-300
Hospital (water design)		300 g/bed/day
Hospital (sewage design)		300 g/bed/day
Nursing Homes per Bed Capacity		200
Nursing Homes (Homes for aged) where patient is ambulatory		100/bed
Doctors Office in Medical Center		500
Laundromats, 9 to 12 lb. machines, per machine (BOD mg/L500)		500
Community College (per student and faculty)		15
Swimming pools per swimmer		10
Theaters—Drive-In type, per car		5
Theaters—Auditorium type, per seat		5
Picnic Areas—Per person		5
Camps—Resort Day and Night (With limited plumbing), per camp site (privies)		50
Luxury Camps (with flush toilets), per camp site		100

3. *Construction—Ready Made Concrete Septic Tanks*—Precast concrete septic tanks may be used if they comply with design and capacity requirements. The side walls and bottom of such tanks shall be at least 2½ inches in thickness. The top shall have a minimum thickness of 3½ inches. Such tanks shall have reinforcing of at least 6"x6" mesh, No. 12, welded wire fabric. Minimum compressive strength of concrete shall be 3,000 pounds per square inch. Aggregate used in the concrete shall not be larger than No. 9 stone (Virginia Highway designation ¾ inch size). Concrete shall be vibrated or well rodded to minimize honeycombing and to assure reasonable water tightness.

4. *Construction—Poured in Place Septic Tanks*—For poured in place septic tanks up to 4 feet in width, the reinforcing for the cover

slab shall consist of welded wire mesh reinforcing with 4 inch x 4 inch spacing made of No. 4 gauge wire. For tanks wider than 4 feet, the cover slab shall be reinforced with ½ inch rods spaced 6 inches center to center both ways. Single piece poured in place tanks shall have a bottom at least 6 inches in thickness. The walls of all poured in place tanks up to and including 1,000 gallons capacity shall be at least 6 inches in thickness and the tops of such tanks shall be at least 4 inches in thickness. Poured tanks with capacities greater than 1,000 gallons but less than 1,500 gallons in capacity shall have walls at least 7 inches in thickness. Poured tanks with capacities 1,500 gallons or greater shall have walls at least 8 inches in thickness. All poured tanks with capacities in excess of 1,000 gallons shall have tops at least 5 inches in thickness.

5. *Metal Septic Tanks*—Single compartment Residential Bituminous Coated Metal Septic Tanks may be approved provided they meet the standard design and comply with United States Department of Commerce Commercial Standard 177-51.

The hole to receive the tank shall be large enough to permit the proper placement of the tank and backfill. Where rock or other undesirable obstruction are encountered, the bottom of the hole must be excavated an additional 6 inches and backfilled with sand, crushed stone or gravel to the proper grade.

6. *Inlet and Outlet Fittings*—The inlet invert shall be one inch or more above the outlet invert in any septic tank. Inlet and outlet fittings shall be of cast iron or other material of equal quality or in ready made tanks may be cast with tank and shall be at least 2½ inches thick. Cast iron joints shall be either leaded or welded. The following shall be required for fittings in any septic tank:

Diameter (inside) shall be 4″ or greater.

The inlet tee should extend 6″-8″ below flow line.

The outlet tee should extend into about 35% of the liquid depth.

SEPTIC TANK LOCATION

TABLE III

LOCATION OF SEPTIC TANK

Minimum Horizontal Distance In Feet	*Wells by Classification*			*Shell-Fish Waters*	*Impounded Waters*	*Streams*	*Property Lines*	*Basements*
	*I**	*II**	*III‡*					
5							X	
10								X
20								
35	X							
50		X	X	X	X	X		
100								

* Public Water Supply Standards—Division of Engineering, Bureau of Sanitary Engineering, Virginia State Health Department.

‡ It shall be presumed that a Class III well will be installed unless sufficient evidence and assurance is proffered.

SECTION B. Sewer Line

1. *Construction*—The sewer line from the house to the septic tank must have tight joints so there will be no leakage. The building drain must be extended to a point 3 feet outside the building where it is joined to the sewer from the house to the septic tank. If the well is located within 35 feet of this point, the cast-iron pipe or other material of equal quality must be extended more than 35 feet from the well before it joins the building drain or sewer. Pipe used for the building sewer shall be 3 inches or greater in diameter as determined by fixture unit value in State Plumbing Code, and constructed of cast iron, vitrified clay, concrete, cement asbestos, bituminous fiber, or other materials of equal quality. Where two different types of sewer pipes are connected, a proper type of conversion adapter shall be used. The elevation of the house sewer shall be such as to permit the installation of the septic tank system at optimum depth. Clean outs shall be installed when turns of 45 degrees or greater are necessary and where straight runs are in excess of 90 feet. When the sewer line cannot be laid straight from the house to the tank, it shall be laid in a straight line as far as possible and then a one-eighth or one-sixteenth bend used. The next section shall be laid straight as far as conditions permit and another bend put in. The point where bends are made should be marked in some way so that the line can be found easily. If it is neces-

sary to have a bend of more than 45 degrees, a manhole shall be installed.

2. *Grade*—For a 3 or 4-inch sewer line, the grade shall be not less than 12½ inches per 100 feet or 1¼ inches for each 10 feet in length. The grade for a 6-inch sewer line shall be 7½ inches per 100 feet or ¾ inch for each 10 feet of length.

1. *Location*—See Table IV, below, "Location of Drainfield."

TABLE IV

LOCATION OF DRAINFIELD

Minimum Horizontal Distance In Feet	*Wells by Classification*			*Shell-Fish Waters*†	*Impounded Waters*†	*Streams*†	*Property Lines*	*Base-ments*
	*I**	*II**	*III*‡					
5							X	
10								
20								X
35	X							
50		X		X	X	X		
100			X					

* Public Water Supply Standards—Division of Engineering, Bureau of Sanitary Engineering, Virginia State Health Department.

† If the water table rises within 2 feet of the surface of the ground, a standard drainfield shall not be located nearer than 100 feet of shellfish waters, impounded waters or a stream.

‡ It shall be presumed that a Class III well will be installed unless sufficient evidence and assurance is proffered.

2. *Units*—The units of the subsurface drainfield shall consist of a distribution box and subsurface drainfield distribution systems to carry the liquid from the distribution box to the field.

3. *Distribution Box*—The distribution box may be constructed of either concrete, brick, or masonry block, with one inlet pipe and as many outlet pipes as desired. The outlet pipe should be 4" or more above the bottom of the box. The inlet pipe shall be placed at least one inch higher than the outlet pipe. Where excessive velocities are anticipated, the flow shall be reduced by the use of a baffle, tee or ell. The distribution box must be installed on a solid foundation, either natural or artificial. When equal distribution of effluent is desirable to all outlets, it shall be determined by water testing.

4. *Feeder Lines*—The feeder lines shall consist of water tight lines connecting the outlet from the distribution box to its respective subsurface drainfield.

5. *Drainfield*—The open joint subsurface drain field usually consists of a series of shallow lateral trenches 18 to 36 inches in width and excavated to a depth offering the highest potential absorptive conditions. The slopes of the line shall be not less than 2 inches nor more than 4 inches per 100 feet unless otherwise stated. The size of the individual aggregate media used in trenches shall be not less than ½ inch nor than than 2½ inches. Aggregate material to a depth of 6 inches shall be placed in a trench with top of stone flush with the top of the grade board or grade stake. The open joints should be covered with tar paper strip; or other suitable material. After laying, aggregate material shall be placed around the tile to hold it in place, covering it to a depth of 2 inches. Paper or straw should be placed over the aggregate to prevent soil penetration. There shall be at least 6 inches of aggregate under the tile, providing a total of 13 inches of aggregate under, beside, and on top of tile. When the trenches are filled, the earth should be well rounded above the surface of the ground to allow for settling. Subsurface drain tile lines shall be spaced at least three times the width of the trench. Length of subsurface drain tile lines should not exceed 100 feet and should be 75 feet or less where feasible.

6. *Drainfield Materials and Construction*

(a) Concrete tile shall be Extra-Quality and meet current ASTM standards for non-reinforced concrete. The tile should be 4 inches in size and should not exceed 1 foot in length.

(b) Clay tile shall be Extra-Quality and meet current ASTM standards for clay tile. The tile should be 4 inches in size and should not exceed 1 foot in length.

(c) Perforated Corrugated Plastic Drainage Tubing shall meet current ASTM standards and comply with all applicable sections of Commercial Standard 228-61. At not greater than 10′ intervals the pipe shall be plainly marked, embossed or engraved thereby showing the manufacturer's name or hallmark and that the product meets a bearing load of 1,000 lb. per foot. In addition, a painted or other clearly marked line or spot shall be marked at not greater than 10′ intervals to denote the top of the pipe.

The tubing shall have 3 holes, ¾ inch in diameter evenly spaced and placed within 130°, the center hole being directly opposite the top marking. Spacing of each set of 3 holes shall be at 4 inch intervals along the tube. If there is any break in the continuity of the tubing, an appropriate connection shall be used to join the tubing.

(d) Bituminous Fiber Drainage Pipe shall meet current ASTM standards for bituminous fiber drainage pipe. At not greater than 10′ intervals the pipe shall be plainly marked, embossed or engraved

thereby showing the manufacturer's name or hallmark and that the product meets a bearing load of 1,000 lb. per foot. In addition, a painted or other clearly marked line or spot shall be marked at not greater than 10′ intervals to denote the top of the pipe.

The tubing shall have 3 holes, ¼ inch in diameter evenly spaced and placed within 130°, the center hole being directly opposite the top marking. Spacing of each set of 3 holes shall be at 4 inch intervals along the tube. If there is any break in the continuity of the tubing, an appropriate connection shall be used to join the tubing.

7. *Soil Evaluation*—Soil evaluation for a drainfield system shall follow a systematic approach including consideration of physiographic province, position of landscape, degree of slope and soil profile (thickness of horizon, color, texture). Such evaluation shall indicate whether or not the soil has problems relative to the position in the landscape, seasonal water table, shallow depths, rate of absorption, or a combination of any of the above. If absorption rate problems are suspected and there is no indication of a water table, percolation tests should be made but their result shall not be presumptive, prima facie or conclusive evidence as to the suitability for effluent absorption. Such percolation tests may be considered and analyzed as one of many criteria in determining soil suitability for absorption of effluent.

8. When percolation tests are performed, they will be made according to the following:

(a) Percolation tests may be used as one of the means of determining the suitability of the soil for subsurface tile fields and to determine the amount of absorption area needed. When percolation tests are made, such tests shall be made at points and elevations selected as typical of the area in which the disposal field will be located.

(b) Tests shall be made in holes which have been kept saturated with water at least 4 hours.

(c) Percolation rates shall be figured on the basis of the test data obtained after the soil has had the opportunity to become saturated and to swell at least 24 hours.

(d) Enough tests should be made in separate holes to assure that the tests are accurate.

(e) Type of test hole: Dig or bore a hole with horizontal dimensions of 4 to 12 inches and vertical sides to the depth of the proposed absorption trench.

(f) Preparation of test hole: Carefully scratch the bottom and sides of the hole with a knife blade or sharp pointed instrument, in order to remove any smeared soil surfaces and to provide a natural soil

interface into which water may percolate. Remove all loose material from the hole. Add 2 inches of coarse sand or fine gravel to protect the bottom from scouring and sediment.

(g) Saturation and swelling of the soil: It is important to distinguish between saturation and swelling. Saturation means that the void spaces between soil particles are full of water. Swelling is caused by intrusion of water into the individual soil particle.

(h) In the conduct of the saturation, carefully fill the hole with clear water to a minimum depth of 12 inches over the gravel. In most soils, it is necessary to refill the hole by supplying a surplus reservoir of water, possibly by means of an automatic siphon, to keep water in the hole for at least four hours and preferably overnight. Determine the percolation rate 24 hours after water is first added to the hole. This procedure is to insure that the soil is given ample opportunity to swell and to approach the condition it will be in during the wettest season of the year. Thus, the test will give comparable results in the same soil, whether made in a dry or in a wet season. In sandy soils containing little or no clay, the swelling procedure is not essential and the test may be made as described under item i, after the water from one filling of the hole has completely seeped away.

(i) Percolation rate measurement. With the exception of sandy soils, percolation rate measurements shall be made on the day following the procedure described under item h above. If water remains in the test hole after the overnight swelling period, adjust the depth to approximately 6 inches over the gravel. From a fixed reference point, measure the drop in water level over a 30-minute period. This drop is to be used to calculate the percolation rate. If no water remains in the hole after the overnight swelling period, add clear water to bring the depth of water in the hole to approximately 6 inches over the gravel. From a fixed reference point, measure the drop in water level at approximately 30 minute intervals for four hours, refilling 6 inches over the gravel as necessary. The drop that occurs during the final 30-minute period is used to calculate the percolation rate. The drops during prior periods provide information for possible modification of the procedure to suit local circumstances. In sandy soils or other soils in which the first 6 inches of water seep away in less than 30 minutes after the overnight swelling period, the time interval between measurements shall be taken as 10 minutes and the test run for one hour. The drop that occurs during the final 10 minutes is used to calculate the percolation rate.

9. *Minimum absorption area requirements for private residences*—The following "Minimum Area Requirements" (Table V) shall apply, based on percolation rate measurements. These recommendations provide for the use of garbage grinder and automatic sequence washing machine units.

TABLE V

MINIMUM ABSORPTION AREA
REQUIREMENTS FOR PRIVATE RESIDENTS

Percolation rate (Time required for water to fall 1 inch, in minutes	*Required absorption area, per 100 gallons day of water used in ft.²*
1 or less	52
2	63
3	74
4	85
5	93
10	122
15	140
30	184
45	222
60	244

Note 1—Over 60 minute rate will require special design which meets the approval of the Regional Sanitarian and/or the Director of the Bureau.

Note 2—In every case, sufficient area shall be provided for at least 400 sq. ft. unless otherwise indicated by soil evaluation.

Note 3—Absorption area for standard trenches is to be figured as trench-bottom area.

Note 4—Drainfield design should be based on peak loading and not on long time averages.

Note 5—Peak loading creates other stresses, including the immediate need for discharge space.

Other Considerations: Absorption will be adversely affected if the ground is dug while wet.

PART IV—STABILIZATION POND

The following standards shall apply for the installation, alteration, repair or extension of any waste stabilization pond in the Commonwealth of Virginia.

ARTICLE 1. DESIGN AND CONSTRUCTION

SECTION A. Design

1. Original construction shall provide at least one (1) surface acre, measured at the four ft. depth water level, per 200 persons served at 0.2 lbs. 5 day 20° C-B. O.D. per capita per day, including the population equivalent of any industrial wastes to be discharged to the sewer system under the following conditions:

(a) Depending on the site location and requirements of the receiving stream, the 200 persons per acre per day figure may be appropriately reduced to provide the storage period referred to above.

(b) Minimum detention shall be 50 days at 100 gallons per person per day at depth of four feet or less.

(c) Chlorination and perhaps also means for removing algae shall be provided where demanded by the receiving stream.

(d) The outlet structure shall be placed on the horizontal pond floor adjacent to the inner toe of dike embankment. A permanent type walkway from top of dike to top of outlet structure for access shall be provided for all stabilization ponds.

2. Stabilization Ponds for Schools

(a) For high schools with showers the equivalent full-time population shall be considered to be in the ratio of 100/16 or 6.25 pupils equal one full-time resident.

(b) For elementary schools without shower facilities the ratio shall be 100/10 = 10 pupils equal one full-time resident.

3. Dual cells will be mandatory for all new plants which discharge into critical waters such as those used for public water supplies, shellfish or primary contact recreation. The pond cells should be of nearly equal size and designed to operate in either series or parallel.

4. Where ponds of one or more cells follow some type of conventional primary treatment device, the requirements in A-1 may be reduced to compensate for the B. O. D. reduction in the pretreatment unit(s) but the surface area should be not less than 75% of A-1.

5. The shape of all cells shall be such as to produce a uniform perimeter, with no islands, peninsulas or coves permitted.

6. Sufficient area shall be provided at all installations to allow room for expansion due to normal growth.

SECTION B. Location

1. Criteria used in setting the distance of conventional sewage treatment plants from the nearest habitation or residence will apply in case of raw sewage stabilization ponds.

2. If practical, ponds shall be located so that prevailing winds will be in the direction of non-inhabited areas. Preference should be given sites which will permit an unobstructed wind sweep across the ponds, especially in the direction of local prevailing winds.

3. Natural run-off from the drainage areas around or above shall be excluded from the pond by adequate drainage ditches or by-passes.

4. Proximity of ponds to water supplies and other facilities subject to contamination shall be critically evaluated to avoid creation of health hazards or other undesirable conditions.

SECTION C. Embankments and Dikes

1. Compacted embankments of impervious materials shall be con-

structed, unless the entire pond and dikes are water proofed or sealed. See Section D-4.

2. From the standpoint of maintenance and structural stability the following slopes and widths of embankments are recommended:

(a) Minimum embankment top width should be not less than 8 feet for ponds of 1 acre or larger.

(b) Maximum embankment slopes should not be steeper than:

Inner—3 horizontal to 1 vertical
Outer—3 horizontal to 1 vertical

(c) Minimum embankment slopes should not be flatter than:

Inner—4 horizontal to 1 vertical
Outer—not applicable, except that significant volume of surface water shall not enter the ponds

(d) Minimum free board should be 3 feet

3. Normal minimum liquid depth shall be 3 feet.

4. Normal maximum liquid depth shall not be more than 5 feet.

5. Embankments and excavated areas shall be dressed with top soil, raked, fertilized and seeded, except below the water line. Newly seeded areas shall be protected by straw or other suitable cover until a good stand of grass cover has been obtained. Alfalfa should not be included in seed mixtures since the long roots of this plant are apt to impair the water holding efficiency of the dikes. Additional protection for embankments such as riprap may be necessary as soil conditions and pond size warrant.

Section D. Pond Bottom

1. The pond bottom shall be as level and as smooth as practicable at all points. Shallow or feathering fringe areas usually result in locally unsatisfactory conditions.

2. The bottom shall be cleared of vegetation and debris. Organic material thus removed shall not be used in embankment construction.

3. Soil formations must be relatively tight to avoid undue liquid losses through percolation or seepage. Soil boring to determine soil characteristics shall be made a part of preliminary surveys to select pond sites.

4. The ability to maintain a satisfactory water level in the lagoons is one of the most important aspects of design; one for which the owner must be primarily responsible. Some use has been made of bentonite, asphalt coatings, clay blanket, plastic linings and other seal-

ing materials. Sealing by these methods can best be considered as a special problem for individual installations, with the owner basically responsible for adequate sealing to permit maintenance of satisfactory water levels.

SECTION E. Influent Lines

1. The influent line into single celled ponds shall be essentially center discharging and influent lines into the primary section of multiple-celled ponds shall be essentially center discharging, but this does not apply to those cells following the primary cell in series operation.

2. Either upward or horizontal discharging influent lines may be used where the sewage is pumped to the pond. Horizontal inlets shall be used for gravity flow. When upward discharging lines are used, the discharge end of the pipe should be located approximately one foot above the bottom of the pond. If sewage is discharged to pond through force main an anti-siphoning device shall be provided on force main at a point immediately outside the dike.

3. The end of the discharge line shall rest on a suitable concrete apron with a minimum size of four feet square. Larger aprons and influent piping supports are suggested in cases where the soil is unstable.

4. Manholes or clean-outs are required where inlet pipe passes through the embankment. Normally this should be a drop manhole with invert of influent sewer placed at or above the 5 ft. water level of the pond.

5. Influent lines shall be placed on or under the bottom. The use of exposed dikes carrying influent lines to the center of the pond will be prohibited, as such structures will impede circulation. Inlet lines on pond bottom shall be anchored to concrete pads placed flush with the pond bottom..

SECTION F. - Interconnecting Piping and Overflows

1. Cast-iron pipe of ample size is recommended for interconnecting piping and overflows.

2. The final overflow structure shall provide means for varying the water level from 3 ft. depth to 5 ft. depth in increments of 0.5 ft. or less with points of withdrawal of effluent spaced so that the effluent can be withdrawn from depths of 0.75 ft. to 2.0 ft. below pond water surface irrespective of the depth of water in the pond. At depths greater than 2 ft. below surface, the pond water will often be devoid of oxygen.

3. Overflow lines shall discharge onto concrete slabs. These lines should be vented if siphoning may be developed.

4. The pond or ponds shall be provided with means for completely draining each unit independent of other units.

5. Cast-iron pipe is recommended for pond effluent and/or drain line.

SECTION G. Chlorination Equipment and Contact Tank

1. Chlorination equipment when required shall be of the solution feed type for feeding liquid chlorine from cylinders. Duplicate chlorinators are required each to feed at least 35 mg/l based on the design flow. Chlorinators shall be housed in a separate heated chlorinator room provided with mechanical exhaust fan. Scales of adequate capacity for weighing cylinders of chlorine shall be provided for each installation. A chlorine testing set for testing residual chlorine and direct reading of residuals up to 2.0 mg/l or more shall be provided.

2. The chlorine contact tank shall be either a self-cleansing type or it shall be provided with means of removing solids that may accumulate. The contact tank shall provide a detention period of not less than 30 minutes based on design flow.

SECTION H. Miscellaneous

1. Each stabilization pond shall be provided with a primary metering device located on pond effluent for flow measurement. At small installations where recording and totalizing instruments are not provided, the primary metering device shall be equipped with a brass or stainless steel staff gauge graduated in tenths and hundredths of a foot mounted on side wall of approach chamber of float well with the zero set for zero flow through the metering device.

A metering device is also desirable on pond influent. Any measuring device placed on the influent to the pond should be a Parshall flume or other equipment suitable for measuring raw sewage flow.

2. The pond area shall be adequately enclosed with a suitable fence to keep out small animals and children. The fence shall be at least six (6) ft. high with not less than two strands of overhanging barbed wire spaced at 0.5 ft. vertical intervals above the six ft. fence. For ponds of one acre or more, at least one gate eight ft. wide, clear opening, shall be provided to allow entrance of power mowing equipment, trucks hauling chlorine cylinders or service vehicles. Additional gates may be provided as desired, all of which shall be provided with means of locking.

3. Appropriate signs shall be provided to designate the nature of the facility. The size of the sign and lettering used shall be such that it can be easily read by a person with normal vision for a distance of 50 or more feet.

4. An all-weather road shall be provided for nearest existing all-weather road to the stabilization pond for access for maintenance, moving in mowing equipment, for transporting chlorine cylinders, and for inspection and observation.

PART V—OTHER SEWAGE TREATMENT PLANTS FOR SCHOOLS AND OTHER PUBLIC BUILDINGS

ARTICLE 1 IMHOFF TANKS

In the design of the Imhoff tank, the following capacities have been provided settling compartment—2½ hours retention based on the flow from day schools taking place in 8 hours. The capacity of the sludge digestion compartment is based on 6 cubic feet per capita for the full-time resident population, calculated from a point starting 18 inches below the slots.

ARTICLE 2. SLUDGE DRYING BEDS

Sludge drying beds must be surrounded by a concrete, brick or cinder block wall which extends about 12 inches above the sand and is at a higher level than the adjoining ground surface.

The underdrainage system consists of drain or farm tile laid with open joints.

The sand for the bed shall be clean, coarse and free of silt and fine particles. The graded gravel or stone shall be clean, hard, durable stone such as crushed stone or clean gravel. Crushed limestone is not suitable for the top layer of fine gravel.

Basis of design for sludge drying beds shall be 1½ square feet per capita, based on full-time resident population for open beds. If glass green house covers are used, the area may be reduced to 1 square foot per capita.

The bottom of the sludge drying bed shall be sloped to 4" underdrains. The underdrains shall be surrounded with No. 4 stone with at least 3" of No. 4 stone above the underdrains. The middle layer of stone shall consist of at least 3" of No. 9 stone. The upper layer of stone supporting the sand shall consist of at least 12" stone. At least 12" of sand shall be provided.

ARTICLE 3. DOSING TANKS

It is essential that all parts of the sand or trickling filter receive as nearly as possible the same quantity of sewage. This is accomplished by installing a dosing tank provided with siphon which discharges the sewage to the filter at intermittent intervals. One siphon shall be re-

quired for each sand or trickling filter onto which sewage is discharged by a rotary distributor.

Table No. I gives the effective volume of the dosing tank for discharging the sewage to rotary distributor on sand filter. This volume shall be sufficient to provide a dosage of ⅛ to ¼ inch of sewage over the entire sand bed being dosed at each discharge of the siphon. Table No. II gives the effective volume of the dosing tanks for discharging the sewage to rotary distributor on trickling filter. For a trickling filter, the sewage shall be applied in small doses at frequent intervals.

TABLE I

SAND FILTER WITH ROTARY DISTIRBUTOR

Number of Persons			Siphon and Dosing Tank	
Day Students		*Full Time Residents*	*Eff. Vol. Dos. Tank*	*Inlet Pipe*
Without Showers	*With Showers*			
50	30	5	68	4"
75	45	7	102	4"
120	80	12	169	4"
175	110	17	242	4"
250	155	25	300	4"
370	235	37	350	4"
500	310	50	450	6"
620	390	62	500	6"
750	470	75	550	6"
1000	625	100	725	8"
1500	940	150	1060	8"
3000	1250	200	1360	8"

Note: Effective volume is the volume of liquid in gallons contained in the dosing tank between high and low water level.

The dimensions and other details except effective working volume, of the dosing tank and siphon for operating rotary distributors must be furnished by the manufacturer of the rotary distributor. Names of firms furnishing siphons and rotary distributors will be furnished on request by the State Department of Health. (The use of distributor arms with mercury seals will not be permitted).

TABLE II

TRICKLING FILTER WITH ROTARY DISTRIBUTOR

Number of Persons			Siphon and Dosing Tank	
Day Students		*Full Time Residents*	*Eff. Vol. Dos Tank*	*Inlet Pipe*
Without Showers	*With Showers*			
50	30	10	68	4"
75	45	15	68	4"
120	80	25	68	4"
175	110	35	90	4"
250	155	50	90	4"
370	235	75	90	4"
500	310	100	150	6"
620	390	125	150	6"
750	470	150	150	6"
1000	625	200	180	8"
1500	940	300	180	8"
2000	1250	400	180	8"

Note: Effective volume is the volume of liquid in gallons contained in the dosing tank between high and low water level.

For sand filters with intermittent flooding, a sufficient amount of sewage shall be applied onto the bed at each dosage to cover the sand to a depth of approximately two inches. The rate of dosing is controlled by the automatic dosing siphons so as to obtain this depth of flooding in a short period in order that the sewage will spread over the entire bed, thereby providing uniform loading on the filter. If pumps are used in place of the automatic siphons, the pump capacity shall be equal to the average discharge rate of the siphon shown in the tables.

Dimensions and other details of dosing tanks and siphons for intermittent flooding of open sand filter beds are shown in Table III, page 26.

TABLE III

DOSING TANK AND SIPHONS FOR SAND FILTER USING INTERMITTENT FLOODING

Number of Persons			Dosing Tank and Siphons						
Day Students		Full Time Residents	No. Siphons	Siphon Size	Inside Dimensions		Inlet Pipe	Outlet Pipe	Min. Water Depth
Without Showers	With Showers				Length and Width	Max. Water Depth			
50	30	5	2	3"	4'-0"	13"	4"	4"	3"
75	45	7	2	3"	5'-0"	13"	4"	4"	3"
120	80	12	2	4"	5'-9"	17"	4"	6"	3"
175	110	17	2	4"	6'-9"	17"	4"	6"	3"
250	155	25	2	5"	7'-0"	23"	4"	8"	3"
370	235	37	2	5"	7'-0"	23"	4"	8"	3"
500	310	50	2	5"	8'-0"	23"	6"	8"	3"
620	390	62	2	6"	7'-9"	30"	6"	10"	4"
750	470	75	2	6"	8'-6"	30"	6"	10"	4"
1000	625	100	2	6"	9'-9"	30"	8"	10"	4"
1500	940	150	2	6"	12'-0"	30"	8"	10"	4"
2000	1250	200	2	6"	14'-0"	30"	8"	10"	4"

Note: 1. Reinforce cover slabs with wire mesh.
Note: 2. Cover slabs should be approximately 3'-3"x1'-0"2½" to facilitate removal.
Note: 3. When ordering siphons specify that automatic alternation is required.

Dosing tanks for subsurface sand filters are similar in design to those for open filters with intermittent flooding except for the working capacity or effective volume of the dosing tank. For subsurface sand filters, the effective volume of the dosing tank must be equal to the total holding capacity of the tile distribution lines in each unit of the filter in order to fill the lines at each discharge, this insuring equal distribution over the filters. See Table IV, page 27.

The capacity of dosing tanks for subsurface percolation fields shall be directly proportional to the total holding capacity of the tile drainage lines. Since the tile lines may not always be completely emptied between dosing by soil percolation, it is not advisable to attempt to completely fill the tile lines at each dosage. Therefore, in order to apply sufficient sewage effluent to obtain good distribution throughout the tile lines of the entire field and at the same time not flood the field, a dosing tank capacity equal to six-tenths (0.6) of the total holding capacity of the tile drainage lines shall be used. See Table V, page 27.

TABLE IV

Dosing Tank and Siphons for Subsurface Sand Filters

Number of Persons			Dosing Tank and Siphons						
Day Students		Full Time Residents	No. Siphons	Siphon Size	Inside Dimensions		Inlet Pipe	Outlet Pipe	Min. Water Depth
Without Showers	With Showers				Length and Width	Max. Water Depth			
50	30	5	0				4"		
75	45	7	0				4"		
120	80	12	1	3"	4'-7"	13"	4"	4"	3"
175	110	17	1	3"	6'-0"	13"	4"	4"	3"
250	155	25	1	4"	6'-1"	17"	4"	6"	3"
370	235	37	2	3"	6'-0"	13"	4"	4"	3"
500	310	50	2	4"	6'-0"	17"	6"	6"	3"
620	390	62	2	5"	5'-8"	23"	6"	8"	3"
750	470	75	2	5"	6'-2"	23"	6"	8"	3"
1000	625	100	2	5"	7'-2"	23"	8"	8"	3"
1500	940	150	2	6"	7'-10"	30"	8"	10"	4"
2000	1250	200	2	6"	9'-10"	30"	8"	10"	4"

Note: 1. Reinforce cover slabs with wire mesh

Note: 2. Cover slabs should be approximately 3'-3"x1'-0"x2" to facilitate removal.

Note: 3. When ordering siphons specify that automatic alternation is required.

TABLE V

Dosing Tank and Siphons for Various Size Tile Percolation Fields

Number Feet Tile	Number Siphons	Siphon Size	Inside Dimensions				
			Length and Width	Max. Water Depth	Inlet Pipe	Outlet Pipe	Min. Water Depth
800	1	4"	5'-4"	17"	4"	6"	3"
1000	1	4"	5'-0"	17"	4"	6"	3"
1200	1	5"	5'-9"	23"	4"	8"	3"
1400	2	5"	4'-4"	23"	4"	8"	3"
1600	2	5"	4'-8"	23"	4"	8"	3"
1800	2	5"	4'-11"	23"	4"	8"	3"
2000	2	5"	5'-4"	23"	4"	8"	3"
2400	2	6"	5'-0"	30"	4"	10"	4"
2800	2	6"	5'-5"	30"	4"	10"	4"
3200	2	6"	5'-9"	30"	6"	10"	4"
3600	2	6"	6'-1"	30"	6"	10"	4"
4000	2	6"	6'-5"	30"	6"	10"	4"
4400	2	6"	6'-9"	30"	6"	10"	4"
4800	2	6"	7'-1"	30"	6"	10"	4"

Note: Effective volume of dosing tank based on 0.6 volume of drain tile used.

ARTICLE 4 SAND FILTERS

Section A. General Construction

Sand filter beds shall consist of level areas of sand beneath which there are graded layers of gravel around and over the underdrains. The sewage is discharged onto the beds through rotary distributors or through pipes on to splash plates or, in case of covered filters, through lines of drain tile laid with open joints with the tile lines placed in a 12-inch layer of No. 5 gravel. For open sand filters, the beds shall be surrounded by a concrete, brick, or cinder block wall extending above the sand and at least one foot above ground level to prevent washing in of clay or loam which might clog the sand bed or to prevent encroachment of vegetation or flooding. For covered sand filters, the surrounding wall is not necessary except in case where it is necessary to prevent caving of the earth walls while the sand and gravel are being placed.

The underdrainage system shall consist of drain or farm tile laid with open joints.

Section B. Materials

The sand for the filter bed shall be clean, coarse sand, free from clay, loam, or organic matter, and fine particles. The sand shall have an effective size of 0.30 mm. to 0.50 mm and a uniformity coefficient of not more than 4.0. No more than two per cent shall be finer than 0.177 mm. (80 mesh sieve) and not more than one per cent shall be finer than 0.149 mm. Not more than two per cent shall be larger than 4.76 mm. (4 mesh sieve). The sand beds shall be not less than 30 inches deep.

The gravel for sand filters shall conform to "Virginia Department of Highways Material Specification (April 1, 1954) Section 206 Coarse Aggregate." (See Appendix No. 1)

The gravel must be carefully placed in well-leveled layers, with the coarse or No. 4 gravel at the bottom around and over the underdrains, with at least 3" of No. 4 gravel above underdrain. Care must be taken to avoid movement or injury to the underdrains. The middle layer shall consist of the medium size or No. 9 gravel, at least 3" deep. The fine or No. 12 gravel at least 3" deep is the top layer for supporting the sand above. Crushed limestone is not suitable for the top layer of fine gravel.

Since the efficiency of the filter depends to a large extent on the filter medium (sand and gravel), care shall be taken to obtain sand and gravel of a known quality and size. Before obtaining the sand and

APPENDIX NUMBER I

Aggregates for Sand Filters and Tile Percolation Fields

Total Percent Passing

	Square Sieves—Sizes in Inches								Sieve Numbers			
No.	3½	2½	2	1½	1	¾	½	⅜	4	8	16	100
4		100	95-100		35- 70		10- 30		0- 5			
4-F				100	85-100	60- 85	25- 50		0-10			As 40-50% of No. 4
5			100	95-100	15- 50	0- 15						
6				100	95-100	40- 75		0- 15	0- 5			
7-C				100	95-100	40- 75	0- 15					As 50-60% of No. 7
9					100	95-100		30- 65	5-25	0- 5		
12							100	95-100	10-40	0-10		

gravel, a sample of approximately one pint each of the sand and gravel must be submitted to the State Department of Health or a qualified commercial testing laboratory for observation, sieve analyses and comment as to its suitability.

All sand shall be hand placed in the filters by use of shovels and wheelbarrows. Dumping from trucks onto the filter beds will not be permitted. Board runways shall be provided when wheelbarrows are used.

Section C. Construction of Sand Filters with Rotary Distributors

A rotary distributor will effect the most even application of the sewage over the bed, thereby increasing the efficiency of the filter bed, making it possible to use a higher dosage rate, or for equal sewage flows to safely reduce the area of sand bed required.

A supply pipe from the dosing tank feeds the sewage to a vertical pipe at the center pier of the filter from which it enters the distributor. The rotary distributor shall consist of two or more horizontal pipes or arms, extending the diameter of the filter and rotating about a central hollow shaft. The sewage shall flow through these distributors from which it is spread over the filter through ports designed to give even distribution over the entire surface of the bed. The horizontal arms are placed a few inches above the sand bed and the discharge of sewage through the ports rotates the distributor.

Since the distributor is driven by the flow of the sewage through the ports, it will be necessary to provide a closely limited hydraulic head on the distributor. Mercury seals in the distributor are not permitted.

The dosing tank and siphon serve to provide this head to maintain it within required limits. Therefore, it will be necessary for the manufacturer of the rotary distributor to furnish the dimensions and other details, except effective volume of the dosing tank, and including the difference in elevation of high and low water level and that of the arms of the distributor. Also, the manufacter shall furnish the details of the center pier for the rotary distributor base. The siphon and rotary distributor shall be purchased from the same manufacturer to be certain that these requirements will be met.

There are several companies that furnish siphons and rotary distributors. The names of such companies will be furnished on request by the State Health Department.

The design of the area of the filter beds equipped with rotary distributors shall be based upon a rate of application of 150,000 gallons of sewage per acre per day, which is approximately 3.5 gallons per square foot per day or one-third more than the safe dosage where rotary distributors are not used. The amount of sewage applied to the sand filter with rotary distributor at each discharge of the siphon shall be equal to a depth of $\frac{3}{8}$" to $\frac{1}{4}$" over the entire sand bed area being dosed.

Section D. Construction of Sand Filters with Intermittent Flooding

Sand filters designed for intermittent flooding shall be divided into at least two beds for small filters and three beds for the larger filters. Distribution boxes must be provided for diverting the sewage onto the filter bed or beds desired, as it is often necessary to cut one filter bed out of operation for rest periods.

In the design, the area of the filter beds shall be based upon a rate of application of 100,000 gallons of sewage per acre per day or 2.3 gallons per square foot per day.

On filters employing intermittent flooding, a sufficient amount of sewage shall be run onto the bed at each discharge of the siphon to cover the sand to a depth of two inches.

Section E. Subsurface Sand Filters with Distributing Tile Lines

On account of their inaccessibility and liability of clogging of subsurface sand filters, the rate of dosage allowable shall be 50,000 gallons per acre per day or 1.15 gallons per square foot per day.

The sewage shall be applied to the filter through lines of drain tile laid with open joints with the tile placed in a 12-inch layer of No. 4 stone.

In all cases possible, the top of the filter shall be finished with a 12-inch layer of stone without any earth cover over the stone.

In cases where it is not feasible or desirable to finish the top of the subsurface filter with the stone, then on top of the gravel shall be placed a 3-inch layer of straw, and then the filter shall be covered with a layer of top soil not less than 4 inches nor more than 8 inches deep.

The sand and gravel beneath the top layer of stone and the underdrains shall be the same as for open sand filters, using intermittent flooding.

All sand shall be hand placed in the filters by use of shovels and wheelbarrows. Dumping from trucks onto the filter beds will not be permitted. Board runways shall be provided when wheelbarrows are used.

Distribution boxes must be provided for diverting the sewage onto the filter beds through individual lines or headers with each header connecting to not more than four lines. The far ends of the distributing lines shall be tied together through bell and spigot tile and should be vented to atmosphere. As with surface filters, stop gates or shear gates shall be provided in the distribution box to permit either filter unit or header to be placed out of service.

Vehicles and heavy machinery will not be permitted on the bed when placing the cover of gravel, or gravel, straw and earth, since the tile distribution and drain lines may be crushed or moved out of alignment.

Section F. Trickling Filters with Rotary Distributors

The standard rate trickling filters shall be of crushed stone, about 6 feet deep, with individual pieces ranging in size from 2 inches to 4 inches in diameter.

Sewage shall be applied to the surface of the stone in the form of a spray as uniformly as possible so that it trickles down to the underdrainage system, where it is collected and conveyed to the final settling tank. The filter stone and the underdrainage system must be such as to avoid clogging and permit free circulation of air through the bed. Vent wells shall be provided to aid in circulation.

The side walls of the filter shall be of concrete, brick or cinder block. A solid water-tight wall, suitably designed to prevent clay and

loam from washing into the filter and encroachment of vegetation shall be provided.

A concrete floor shall be necessary in trickling filters and this shall be sloped to a central drain to convey the effluent from the filter.

The trickling filter underdrainage system shall consist of vitrified clay underdrain blocks laid directly on and covering the entire floor. The blocks shall comply with all requirements of the specifications of the ASTM and of the Trickling Filter Floor Institute. Cover blocks for the center drainage channel shall have at least three inches of bearing at either end.

The stone for the filter beds shall consist of hard, durable pieces of crushed limestone, traprock or granite screened to the size limits required and shall be free from thin, flat or long pieces. It must be washed and screened and free from sand, clay, loam and organic impurities. All stone shall be hand placed in the filter and dumping from trucks onto filter will not be permitted.

The sewage shall be applied to the trickling filter by a rotary distributor operated by a dosing siphon or pump. The manufacturer of the rotary distributor and dosing device shall furnish dimensions and other details except effective volume of the dosing tank, including difference in elevation required and also dimensions and other details of the center pier for supporting the rotary distributor. Mercury seals in the distributor are not permitted.

Trickling filters are not acceptable for secondary treatment of the effluent from septic tanks. The design of the trickling filter shall be based on a loading of 275 pounds of B.O.D. per acre foot per day or 3.14 square feet of surface area per 100 gallons.

ARTICLE 5. CHLORINATION FACILITIES

SECTION A. Final Settling of Chlorine Contact Tanks

The effluent from trickling filters shall be treated in a final tank as it will contain a considerable amount of suspended material washed from the filter stone.

The final settling tank shall be a plain settling tank, rectangular in shape. The hopper shall be provided at the inlet end to aid in removal of accumulated solids. The settled sludge can be squeegeed or scraped into the hopper and pumped to the inlet of the primary treatment device. A small portable pump equipped with sufficient suction and discharge hose may be provided in lieu of a fixed pump moving the sludge from the final tank. A circular tank with center or periferal discharge with satisfactory sludge removal equipment is acceptable.

When chlorination of the effluent from the trickling filter plant is necessary, the final tank will also serve as a chlorine tank for providing the necessary detention period for reaction of the chlorine.

The required detention period in final settling tanks following trickling filters in 1½ hours. If this final tank is to be used for flows from school populations, which flows take place in an eight hour period, the dimensions of the tank shall be increased accordingly so as to provide the 1½ hour detention period.

Final settling tanks are not necessary for the removal of solids from the effluent from sand filters as such effluents are usually clear and free of settleable solids. In case it is necessary to disinfect the plant effluent before it is discharged into a stream, the final tank can be used as a chlorine contact tank for providing the necessary detention period for reaction of the chlorine. The detention should be a minimum of 30 minutes based on average flow over the time the plant is in service or for 20 minutes detention based on siphon discharge rate or pumping discharge rate if applicable. Duplicate chlorinators are required.

Section B. Chlorinator House

A chlorinator house shall never be less than 8 feet by 8 feet inside dimensions. The building shall be of brick, cinder block or concrete block construction. A ventilator shall be provided near the ceiling on one side and near the floor on the opposite side. The floor shall be of concrete and sloped to a drain. No windows shall be provided in this small building. Heating equipment for maintaining a temperature of 50° F. or above at all times shall be provided.

A water line to supply clean water free from suspended or floating solids and under a pressure of at least 15 to 20 pounds shall be run to the building for operating the chlorinator. Use of an approved potable supply which will also serve for washing up and other uses is preferred, and a sink or lavatory shall be provided in the building.

A terra cotta or concrete pipe with no bends larger than 45° shall extend through the floor and continue to the sewer line, or point of application of chlorine to serve as a conduit for the chlorine hose.

Section C. Chlorinators

Either liquid chlorine, calcium hypochlorite or Na hypochloride may be used in the disinfection of sewage and there are several manufacturers of equipment for feeding either liquid chlorine or hypochlorite.

Chlorine gas taken from cylinders or liquid chlorine may be ap-

plied to sewage by chlorinators either as a gas or dissolved in water. However, the solution feed chlorinator for feeding chlorine dissolved in water is much more satisfactory.

ARTICLE 6. FINAL DISCHARGE OF THE PLANT EFFLUENT

The plant effluent from the final unit of the treatment plant shall be piped to the stream where it will be discharged into the water so as to prevent pooling at the outlet. A concrete head wall may be necessary at the stream bank to support the outlet sewer and shall always be provided where there may be erosion around this pipe.

ARTICLE 7. SEWAGE PUMPS

With few exceptions sewage pumps shall be installed in duplicate with either pump having adequate capacity to handle maximum flow. They shall be adequately housed to protect the pump motors from bad weather and protection shall be given to prevent freezing in any portion of the unit.

No cross-connection between a potable water supply line and sewage pump for priming or sealing packing glands will be permitted.

Pump sumps shall be of adequate size to avoid too frequent operating cycles of the pumps. The sump shall also be designed to prevent excessive settling and accumulation of solids.

For some installations where lift is required between primary settling and final treatment units, the pump sump and pumps can be designed as to eliminate the need for a separate dosing tank. At any installation where double pumps are substituted for alternating siphons, dual pipe lines and automatic alternating equipment will be required. Where this is done, special consideration must be given to capacity and design of the pump sump, pump discharge capacity and, particularly where delivery is to a rotary or other distributor of this type, the discharge head characteristics of the pump used must be considered. On most units of the latter some form of flow level control box would be used. Distributor manufacturer's recommendation must be accurately followed for each installation.

ARTICLE 8. SUBSURFACE DRAIN FIELDS

When subsurface tile fields are used to serve schools and other large public buildings some means of dosing the field will be necessary.

A single siphon with one distribution box may be used for dosing a single field that has a total length of drainage tile up to 1200 linear feet. A single siphon together with a weir diversion box and two distribution boxes, or twin alternating siphons and two distribution boxes,

may be used for dosing two separate fields having a total length of drainage tile up to 2400 linear feet. All installations having more than 2400 linear feet of drainage tile shall have twin alternating siphons, two weir diversion boxes, four distribution boxes and four separate tile drainage fields.

The maximum total length of tile in the four tile fields must not exceed 4800 linear feet. Any installation that will require more than 4800 linear feet of tile drainage lines will be considered a special case and the owner's engineer will submit detailed plans and specifications to the State Department of Health for approval. Also, the owner or his engineer will submit in writing a proper justification for the larger installations and a satisfactory explanation as to why some other method of secondary treatment would not be more feasible and/or practical for any installation requiring a total length of tile drainage lines in excess of 4800 linear feet.

ARTICLE 9. CONCRETE

All concrete shall be made from carefully selected, proportioned and mixed material and placed in accordance with current recommendation of the Portland Cement Association. Each cubic yard of concrete shall contain a minimum volume of six gallons. In all cases, however, the amount of water per sack of cement shall be the minimum amount necessary to produce a plastic workable mixture which can be spaded or vibrated into place in the forms. In no case shall the slump be less than two inches or more than six inches.

No concrete shall be placed when the atmospheric temperature is below 35 degrees Fahrenheit. When the air temperature is between 35° F. and 40° F. adequate means shall be employed to heat the water (water shall not be heated to a temperature exceeding 150° F.) and/or aggregate so that the concrete after placement in the form shall have a temperature of not less than 75° F. nor more than 100° F. The heating apparatus shall be such that the materials shall be heated uniformly and preclude the possibility of the occurrence of hot spots which will burn the materials. When the air temperature is below or likely to go below 50° F. all concrete placed during this period shall be protected with sufficient housing or covering of an approved type in such manner that the air surrounding the fresh concrete will be maintained at a minimum temperature of 60° F. for a period of seven days following pouring.

No materials containing frost, lumps or crusts of hardened material shall be used.

Reinforcing steel shall be new billet steel A.S.T.M. 15-54T or Rail steel, A.S.T.M. 16-54T deformed round or square bars and shall be

free from dirt, rust, paint, or grease. In order to secure even, smooth finish concrete, construction form must be substantial and unyielding, and erected so that the concrete will conform to the required dimensions and be so constructed as to prevent leakage. Structural concrete work shall not be undertaken except under the immediate supervision of a person thoroughly experienced in this type of construction.

In design of the concrete it is assumed that all units will be substantially below ground level and backfilled around upon removal of the forms and that concrete will not be subjected to ground water pressure before the units are filled. Should it be necessary to construct the units above ground level, or partly above ground level, steel shall be added as required. Also, if any unit such as the Imhoff tank is constructed partly below ground water level the necessary steel shall be provided.

PART VI—GENERAL REQUIREMENTS FOR SEWAGE DISPOSAL SYSTEMS

ARTICLE 1

A. Nothing contained in Parts II through V shall be construed as debarring any sewerage system which has been demonstrated as of at least equal efficiency and is approved by the Health Commissioner.

B. Plans and specifications for all sewage treatment facilities must be submitted to the Health Commissioner by the owner or sponsor for review and approval prior to the beginning of construction. All treatment facilities must be constructed in accordance with the approved plans and specifications.

C. All sewage disposal systems shall be located, constructed, or operated and maintained in a manner so that they:

1. Do not contaminate any drinking water supply.

2. Do not pollute or contaminate the water of any bathing beach, shellfish breeding ground, or stream used for a public or domestic drinking water supply purposes or for recreational purposes.

3. Are not a health hazard by being accessible to children.

4. Will not violate any Commonwealth of Virginia Laws, Rules or Regulations governing water pollution or sewage disposal.

5. Will not create a nuisance.