COMMONWEALTH of VIRGINIA

Karen Remley, MD, MBA, FAAP
State Health Commissioner

Department of Health
P O BOX 2448
RICHMOND, VA 23218

TTY 7-1-1 OR
1-800-828-1120

DATE: April 30, 2009

TO: District Health Directors
District Environmental Health Managers
Authorized Onsite Soil Evaluators
Professional Engineers
Manufacturers of Proprietary Technology

GMP #147

FROM: Karen Remley, M.D., M.B.A., F.A.A.P.
State Health Commissioner

THROUGH: Jim Burns, M.D., M.B.A.
Deputy Commissioner of Public Health

Robert W. Hicks, Director
Office of Environmental Health Services

SUBJECT: Interim Policy to Implement Section 448 of the *Sewage Handling and Disposal Regulations*.

Key Parts	Pages
Interim guidance	2
Scope	3
Background and Discussion	4 - 6
Decision to Grant Variance	6
Procedural Outline and Overview	7
Table 1: Loading Rates by Variance	8
Table 2: List of Variances	9
Table 3: Separation to Watertable	11
Technology Listing Procedures	14 - 16
Permitting Procedures	16 – 17
Evaluation Procedures	17 - 18
Commissioner's Variance to Homeowner	19
Manufacturer Agreement	20 - 23
List of Technology and Data Collected	24
Appendix I: Description of Statistical Analysis	25 - 30

Interim Guidance

This interim policy is effective until the Board of Health (BOH) adopts regulations for alternative onsite sewage systems. The BOH is required to adopt emergency regulations within 280 days (see HB2551 and SB1468 of the 2009 General Assembly session: http://leg1.state.va.us/lis.htm). The emergency regulations will establish performance requirements, horizontal setbacks, and operation and maintenance (O&M) requirements for alternative systems. Promulgation of the regulation will make this policy obsolete.

Pursuant to HB1788 and SB1276 of the 2009 General Assembly session (http://leg1.state.va.us/lis.htm), manufacturers of alternative onsite sewage systems will be required on July 1, 2009 to provide O&M instructions for their technologies. This legislation states that until the BOH adopts final regulations pursuant to Chapters 892 and 924 of the Acts of Assembly of 2007, owners must operate their alternative onsite sewage systems in accordance with those O&M instructions, any guidance by the BOH, or any local standard, whichever may be more stringent. The legislative requirement is separate from the expectations contained in this interim guidance to implement Section 448 of the *Sewage Handling and Disposal Regulations* (*Regulations*).

The procedures outlined herein require manufacturers to submit an O&M manual as a pre-requisite for listing their proprietary treatment device. Designers and VDH are then expected to notify and inform owners of any operation and maintenance expected or required for their installed alternative onsite sewage system. The O&M manual submitted as a pre-requisite for listing may not be the same instruction manual provided to the owner because this interim policy only lists treatment technologies and not dispersal mechanisms. The O&M instructions for listing may change once implementation of the expected legislation takes place.

HB1788 and SB1276 also require that property owners record in the land records of the clerk of the circuit court their alternative onsite sewage system permits serving residential structures and identify applicable maintenance regulations for each component of the system, which shall be transferred with the title to the property upon the sale or transfer of the land.

This interim policy does not establish future regulatory requirements and will not limit the BOH's regulatory actions. VDH will follow the regulatory process required to implement the legislation and that effort will not be based on this interim policy. Keep in mind that some manufacturers may not complete the evaluation of their product before this interim policy expires. Manufacturers should be aware of this potential outcome. Stakeholders are asked to participate in the regulatory process to help guide the development of comprehensive regulations.

VDH recognizes that routine maintenance is essential for proper operation of any alternative onsite sewage system and that failure to maintain a system could result in increased public health risks. VDH strongly encourages that owners of alternative onsite sewage systems assure O&M is provided in accordance with the manufacturer recommendations as well as any additional expectation of the system designer.

Scope

Section 448 of the *Regulations* states that VDH must initially implement a policy to grant general approval to technology or processes after a provisionally approved technology demonstrates satisfactory performance. Three manufacturers of proprietary products satisfactorily demonstrated performance and this interim policy implements Section 448 of the *Regulations*. This policy replaces Guidance Memoranda, and Policy (GMP) #112.A, #114.A, and #118.A, #144, and #145.

This interim policy applies to facilities generating residential strength wastewater[1] with a peak design flow less than 1,000 gallons per day (GPD). Owners of such facilities may receive construction permits by following the procedures outlined herein. Certification letters may be issued in accordance with the loading rates and other allowances granted to the generally approved technologies. Should a conflict exist between the manufacturer or designer's criteria and this interim policy or applicable regulation, then the BOH regulation or policy shall apply.

The interim policy's allowances, variances, and considerations are wholly voluntary. If a stakeholder elects to use this interim policy, then the policy requirements must be adhered. This interim policy is exclusive from Title 32.1-163.6 of the *Code of Virginia* (*Code*).[2] Designs offered to VDH through Title 32.1-163.6 of the *Code* are evaluated by the criteria set forth in the *Code*.

This interim policy does not address whether any design constitutes the practice of engineering. Title 54.1- 400 et. seq. of the *Code* defines the practice of engineering and its exemptions. The Department of Professional and Occupational Regulation (DPOR) and its associated board has regulatory oversight of the practice of engineering and its exemptions.

---

[1] "Residential wastewater" means sewage (i) generated by residential or accessory uses, not containing storm water or industrial influent, and having no other toxic, or hazardous constituents not routinely found in residential wastewater flows, or (ii) as certified by a professional engineer. See Title 54.1-400 of the *Code of Virginia*.

[2] See GMP #146 or its successor policy for how VDH implements Title 32.1-163.6 of the *Code of Virginia*. Under Title 32.1-163.6, VDH must accept designs for treatment works from professional engineers when those designs comprise standard engineering practice and demonstrate the degree of skill and care ordinarily expected from those professionals. The professional engineer's design must comply with the performance standards established by the BOH and meet those horizontal setbacks necessary to protect public health and the environment. Any owner may work with a professional engineer to design systems in accordance with Title 32.1-163.6 of the *Code of Virginia*.

Background and Discussion

VDH recognizes that sewage systems dispersing secondary or better effluent (SE) or advanced treatment[3] can have higher loading rates, shallower offsets to soil limiting features, and different pumping and dispersal mechanisms than presently prescribed in the *Regulations*. Technical literature[4] and results from prior testing[5] validate these concepts. Additionally, Title 32.1-163.6 of the *Code* became effective on July 1, 2008 and further recognizes that non-complying designs are possible and practical.

The *Regulations* currently recognize some benefits when dispersing SE (e.g., shallow-placed systems, 12 inches of separation to certain soil limiting features). To install a sewage system with higher loading rates, additional reductions in vertical separation, or different dispersal methods (i.e., pads), owners have three options: they may request and receive a variance; they can obtain a permit through the experimental or provisional testing protocol of the *Regulations*, or they may seek a permit in accordance with Title 32.1-163.6 of the *Code*.

VDH has historically evaluated technology considered experimental or provisional by connecting treatment with dispersal and then measuring fecal counts after effluent dispersed through the soil. The pass/fail criteria did not require "end-of-pipe" testing. Nevertheless, three manufacturers (Bord na Móna, Orenco, and Premiere Tech) collected influent and "end-of-pipe" data as part of their evaluations. These units performed successfully with higher loading rates and reduced separation to soil limiting features. Looking at their data retrospectively, one can develop the defacto end-of-pipe treatment that is associated with satisfactory performance for certain higher loading rates, pad designs, and reduced offsets. Based on the three demonstrations and evaluations, there is no need to continue evaluating whether similar or better treatment should have the same considerations.

---

[3]The *Regulations*, at Section 120, defines SE as effluent treated to reduce five-day biochemical oxygen demand (BOD_5) to 30 mg/l or less, total suspended solids (TSS) to 30 mg/l or less, and fats, oils, and grease (FOG) to less than 5 mg/l. The Environmental Protection Agency (EPA) defines advanced treatment as "a level of wastewater treatment more stringent than secondary treatment; requires an 85-percent reduction in conventional pollutant concentration or a significant reduction in non-conventional pollutants, sometimes referred to as tertiary treatment." http://www.epa.gov/OCEPAterms/aterms.html.

[4] "Impact of Effluent Quality and Soil Depth on Renovation of Domestic Wastewater", C.S. Duncan, R.B. Reneau, and C. Hagedorn. Proceedings of the Seventh International Symposium on Individual and Small Community Sewage Systems. December 1994.
"Wastewater Renovation as a Function of Soil Depth and Effluent Quality", R.B. Reneau, Proceedings of the Seventh International Symposium on Individual and Small Community Sewage Systems. December 1994.
Bord na Móna, Virginia Demonstration Project Report, December 1999 and Puraflo Data, December 7, 1999.
"Verifying Performance of a Proprietary Technology for Onsite Treatment and Dispersal of Residential Wastewater-Virginia's Experience". D.J. Alexander and A.R. Jantrania. Proceedings of the Ninth National Symposium on Individual and Small Community Sewage Systems. March 11-14, 2001.
"Hydraulic Wastewater Loading Rates to Soil", E. J. Tyler, Professor of Soil Science, University of Wisconsin-Madison. Proceedings of the Seventh International Symposium on Individual and Small Community Sewage Systems. December 1994.

[5] See prior GMPs #69, #79, #93, #112.A, #114.A, and #118.A for more information.

VDH observed that end-of-pipe treatment from the three manufacturers was effective for the designs allowed through the experimental and provisional evaluations. VDH concluded that similar or better treatment should have the same considerations. In other words, VDH does not need to continue evaluating whether similar treatment can have the loading rates and designs previously established as acceptable through experimental and provisional demonstrations.

Determining whether a treatment unit has produced similar or better treatment to the units previously evaluated is not a straight forward statistical exercise. Nevertheless, some generalizations can be made based on a September 2005 research paper by the New England Interstate Water Pollution Control Commission (NEIWPCC). The NEIWPCC led a consortium of agencies to research a statistical and sound scientific relationship between test center data and actual field data of installed alternative onsite sewage systems. The consortium provided a method to evaluate the quality and quantity of data submitted for regulatory decisions. The NEIWPCC report can be found at www.ndwrcdp.org. In the NEIWPCC report, the authors wrote that understanding statistical relationships can (1) enhance field-testing protocols, (2) reduce unnecessary and costly testing, (3) help predict field performance levels, and (4) enable uniform acceptance of new technology.

The evaluation procedures noted within this interim policy are guided by the work from the NEIWPCC research. The research found that measures of median would be less affected by outlier data than the mean, especially when a small data set is gathered. Data between residences would be more valuable than data collected from within residences. Log measurements and geometric means would be more valuable for fecal coliform data.[6]

The conclusions that can be reached from the three field evaluations of the proprietary alternative systems are limited. The evaluations measured performance of the treatment units for a defined period of time and did not predict how performance will change over time. The evaluations were not laboratory controlled and did not necessarily predict the robustness of the treatment units. The evaluations did not evaluate operation and maintenance needs or differences. The life expectancy of the various media, the design life for each, or the life cycle costs for each were not explored as part of the evaluations. At its core, the evaluations demonstrated that the higher loading rates did not cause failures to occur within the time frame

[6] On Page 32 of the NEIWPCC study, the authors wrote that the Central Limit Theorem of statistics states that if a large number of samples (*k*) are collected, then the average will follow a Normal distribution and no transformation of the data is necessary if one tests for mean difference or constructs Confidence Interval estimates of the mean. If *k* is small, then the site means may not be "Normally" distributed and a transformation may be necessary. The transformation may be necessary if there are "outlier" site means or "outlier" observations within sites. On Page 34, the authors note that BOD_5 and TSS results did not seem to be affected by seasonal weather changes and that the median was the best measure to eliminate the effects of outliers for their particular study. On Page 36, the authors noted the variability of data was greater between residences than from within any single residence and that a log 10 transformation of the data was best to use given the variability of their data. On Page 38, the authors wrote that the field test data variability was sufficiently dissimilar (higher) than test center data variability. Test center data could not be used to predict field test data. From Pages 38 through 39, the authors suggested a minimum 12-month sampling period for BOD_5 and TSS evaluations. Sampling more residence sites and fewer samples at a site would be more efficient in reducing the variance of the overall mean than sampling more at fewer residence sites. In other words, standard error of the mean is reduced as more residence sites are sampled, regardless of whether the data is transformed or not.

of the evaluations.[7] Given the limitations of the evaluations, VDH understands the importance of other testing (e.g., ANSI/NSF Standard 40, or the U.S. EPA Environmental Technology Verification (ETV) Program's Water Quality Protection Center).

Decision to Grant Variances by the Commissioner of Health

VDH has seen an increase in the requests for variances as stakeholders seek to avoid unwanted labels and different evaluation procedures than prescribed in the *Regulations* and *Alternative Discharging Sewage Treatment Regulations for Individual Single Family Dwellings* (*Alternative Discharging Regulations*). A variance is a conditional waiver of a regulation that is granted to a specific owner for a specific situation and period of time. The Commissioner of Health may grant a variance when the economic hardship imposed outweighs the benefits of following the regulations and when the health risks are reasonable (see Section 190 of the *Regulations* and Section 170 of the *Alternative Discharging Regulations*).

Based on stakeholder input, the Commissioner of Health understands that the experimental and provisional evaluation procedures may be cost prohibitive using a soil based evaluation. Similarly, the evaluation labels (i.e., "experimental" or "provisional") may stigmatize technology and designs, making their use more costly. Instead of using staff resources to continue evaluating requests for product approvals on a case-by-case basis, the Commissioner of Health has elected to provide a process through variance to implement Section 448 of the *Regulations*.

The Commissioner of Health determined that the variances outlined herein are warranted when a property owner requests them. Case-by-case evaluation is not necessary. The variances only apply to technologies and treatment units being evaluated to show similar or better end-of-pipe treatment to the three manufacturers who previously completed an evaluation. Variances are not necessary for units that have already completed an evaluation in accordance with the experimental or provisional requirements of the *Regulations*. In other words, if a technology is listed as having general approval, then the owner does not need to request a variance.

Treatment units verifying equivalent or better treatment are not experimentally or provisionally approved. The treatment unit, as a pre-requisite for listing, will have already received general approval as a secondary treatment device. The dispersal mechanisms not recognized by the *Regulations*, but which are allowed through this interim policy, are approved pursuant to the variances or as a result of satisfactory data submission (e.g., quarterly data from a third party on 20 field installations for one year). The data submission does not need to be from systems installed in Virginia.

[7] Section 350 of the *Regulations* defines failure.

Procedural Outline for Units that are Generally Approved

Listing Procedure

Manufacturer submits O&M manual, which is listed on VDH's website.

Permitting Procedure

Owner submits application with supporting work from a designer.

↓

The local health department (LHD) reviews the application and determines whether the design conforms to the loading rates and design parameters listed in GMP #147.

↓

If the application is in accordance with GMP #147, then the LHD issues the permit or certification letter. If it is not, then the LHD denies the request and provides due process.

↓

The LHD and DOSWS maintains a database of the systems permitted. There is no limit on the number of system installations.

Evaluation Procedure

To be determined through the regulatory and legislative process.

Procedural Outline for Units Verifying Treatment

Listing Procedure

Device recognized as producing secondary or better effluent

↓

Manufacturer has engineer submit treatment certification

↓

Manufacturer submits O&M manual for device and signs agreement to evaluate treatment units

↓

DOSWS approves O&M manual, appropriately lists device under policy, and adds treatment data to website.

↓

Manufacturer submits quarterly data as required. DOSWS monitors and keeps website up-to-date.

↓

DOSWS may remove the treatment device listing with cause. Manufacturer may challenge adverse decision.

Permitting Procedure

Owner submits application and variance with supporting work from the designer.

↓

The local health department (LHD) reviews the application and determines whether the application and variance is in accordance with GMP #147.

↓

If the application and variance is in accordance with GMP #147, then the LHD issues the permit in accordance with GMP #147. If it is not, then the LHD denies the request and provides due process.

↓

The LHD and DOSWS maintain a database of systems permitted pursuant to GMP #147. The LHD will notify DOSWS when it issues a construction permit for a specific treatment unit pursuant to GMP #147. Limit of 30 systems with the variances per calendar year.

Evaluation Procedure

DOSWS maintains three evaluation lists and associated data: (1) "Testing Complete and Passed," (2) "Did not pass or did not complete testing," and (3) "Evaluation Ongoing."

↓

Manufacturer submits quarterly data to DOSWS on 20 treatment units in accordance with the evaluation agreement.

↓

DOSWS reports the data via their website and LHD and DOSWS monitor compliance with the evaluation protocol.

↓

If the manufacturer meets or exceeds the pass/fail criteria, then DOSWS will show the unit as having successfully completed evaluation.

↓

If the manufacturer does not meet, then its status is changed. The LHD will notify owners who use the treatment device that the unit is no longer allowed with the variance they received.

(7)

Variances permitted by the interim policy

A. A sustainable sewage system has an adequate hydraulic loading and organic loading, and has perpetual operation and maintenance. This section specifies the maximum hydraulic loading rate to grant the variances permitted through this interim policy. Designers are expected to follow the manufacturer's guidelines when they are available unless it exceeds the loading rates herein. Loading rates should reflect landscape position, soil structure, texture and permeability, and the experience of the site evaluator or designer.

Table 1:
Hydraulic Loading Rates

Percolation Rate (Minutes/Inch)	Gallons Per Day Per Square Foot of Horizontal Surface			
	Pads	Trenches		
		1.5	2.0	3.0
20 or less	1.66	2.78	2.5	2.22
25	1.33	2.22	2.00	1.78
30	1.11	1.85	1.66	1.48
35	0.95	1.59	1.43	1.27
40	0.83	1.39	1.25	1.11
45	0.74	1.23	1.11	0.99
50	0.67	1.11	1.00	0.89
55	0.61	1.01	0.91	0.81
60	0.55	0.93	0.83	0.74
65	0.51	0.85	0.77	0.68
70	0.48	0.80	0.72	0.64
75	0.44	0.74	0.67	0.59
80	0.42	0.69	0.63	0.56
85	0.39	0.65	0.59	0.52
90	0.37	0.62	0.56	0.49
95	0.35	0.58	0.53	0.47
100	0.33	0.56	0.50	0.44
105	0.32	0.53	0.48	0.42
110	0.30	0.51	0.45	0.40
115	0.29	0.48	0.43	0.39
120	0.28	0.46	0.42	0.37

Table 2 lists the variances that apply to designs and evaluation of dispersal systems. Additional explanations to some of the variances are also provided. All designs must comply with the *Regulations* unless waived in Tables 1 and 2. Where variances apply, then the designs must follow the requirements and recommendations of the designer and manufacturer.

Table 2: Applicable Variances	
Regulation	**Discussion**
12 VAC 5-610-930.E.1	Limits slope of trenches. See additional explanations in Paragraph C of this section.
12 VAC 5-610-950 E.2	Limits absorption trenches to widths between 18 to 36 inches. See additional explanations in Paragraph B of this section.
12 VAC 5-610-596 C.1	Limits the installation of trenches shallower than 12 inches to Texture Group I and II soils. Variance allows pads and trenches at grade with conditions. See additional explanations in Paragraph D of this section.
Table 5.4 and 12 VAC 5-610-950 D	Establishes the required loading rates for onsite sewage systems. See additional explanations in Paragraph E of this section.
12 VAC 5-610-880, including sections A.1, B.1, B.6, and B.7	Establishes pump station, pump frequencies, doses, etc. See additional explanations in Paragraph F of this section.
Table 4.3 of the *Regulations*	The separation between the infiltrative surface to various limiting features is waived in accordance with Table 3 and Paragraph J.
12 VAC 5-610-250 C 12 VAC 5-640-370	These sections are waived. Compliance with the *Code of Virginia*, Title 54.1-400 et. seq. of the *Code of Virginia* is expected, which establishes the practice of engineering and its exemptions. See Paragraph G of this section.
12 VAC 5-610-441, 442, 443, and 444	These sections and its subsections are waived unless specifically required by the interim policy or the manufacturer's agreement. This section has historically considered treatment and dispersal together. Since this interim policy and variance(s) separates treatment and dispersal, no specific label can be applied. The treatment unit is generally approved to produce secondary or better effluent. The dispersal mechanisms allowed by variance do not receive a label.
12 VAC 5-640-350	This section, which describes three labels for treatment units (experimental, preliminary, and general), is waived. Treatment units listed under this interim policy can be considered generally approved to produce secondary or better effluent.
Table 3.4 of the *Alternative Discharging Regulations*	Requires monthly and quarterly testing for experimental systems, semi-annual and quarterly testing for systems with preliminary approval, and annual and semi-annual testing for systems with general approval. This table does not apply and is waived. Treatment units listed under this interim policy will be evaluated as described herein.
12 VAC 5-640-450 3	Specifies 10-10 BOD_5, TSS treatment for certain dry ditch discharges. Under the *Alternative Discharging Regulations*, this interim policy recognizes that the unit is designed to produce 10-10 effluent. See GMP #27. http://www.vdh.virginia.gov/EnvironmentalHealth/Onsite/GMP/GMPdocs/Gmp027.pdf

B. Trench width. 12 VAC 5-610-950 E.2, limits absorption trenches to widths between 18 inches and 36 inches. This section is waived to allow the use of absorption pads. A pad is an absorption area wider than three feet but not longer than 100 feet. Absorption pads may be used under the following conditions:

1. A system may contain one or more pads.

2. The combined area of all pads in a system may not exceed 1,200 square feet.

3. Pads and trenches may not be used together in a single system.

4. Pads shall be limited to sites with slopes of 10 percent or less.

5. The pad design must incorporate a means to approximate uniform dispersal.

C. Minimum Cross Section Dimensions 12 VAC 5-610-950.E.1 is waived. This section establishes how sidewall depth is measured and requires increases in the installation depth of trenches as the slope of the site increases. By waiving Section 950.E.1 absorption systems designed under this policy may be installed at grade even on steeper slopes. No distinction is made between pads and trenches. Section 12 VAC 5-610-950.F, which increases the lateral separation distance between trenches as the slope of the site increases, is not waived.

Designers are encouraged to use a conservative approach when designing shallow placed systems on sloping sites to prevent effluent from breaking out at the contact between the original soil surface and the fill interface. Drip Dispersal may be appropriate technology for difficult sites.

D. Minimum Installation Depth. 12 VAC 5-610-596 C.1, which limits the installation of trenches shallower than 12 inches to Texture Group I and II soils, is waived for slopes up to 15 percent. For slopes up to 15 percent, there are not any soil texture group limitations for shallow placed systems. The infiltrative surface (i.e., the bottom of the pad or trench) shall be installed at grade or deeper on naturally occurring undisturbed soil. No fill material shall occur beneath the infiltrative surface. On sloping sites the installation depth shall be measured on the downhill side of the trench or pad.

E. Loading Rates. Table 5.4 of the *Regulations* and 12 VAC 5-610-950 D, which establish loading rates for subsurface soil absorption systems, are waived. Systems designed pursuant to this policy shall use Table 2 contained herein to determine the maximum acceptable loading rates. Designers are authorized and encouraged to use more conservative loading rates.

F. Pump System Designs.

1. Pumps Integral to Treatment Systems. Pumps integral to the treatment system are pumps that move sewage or effluent from the house or pretreatment system to the treatment system and/or pumps that move effluent within the treatment system. The *Regulations* do not

specifically address pumps used for purposes other than conveying effluent to a dispersal system. Section 880 is waived in its entirety for pumps, pump chambers, and appurtenances integral to treatment systems.

2. Conveyance Pumps. The pump requirements contained in 12 VAC 5-610-880 subsections A.1, B.1, B.6, and B.7 are waived. Pump systems designed in accordance with these sections of the *Regulations* are not appropriate for systems dispersing treated effluent to a reduced size absorption area. Therefore, the use of the pump design criteria in subsections B.1, B.6 and B.7 in the *Regulations* is expressly prohibited except when the sizing criteria in Table 5.4 of the *Regulations* are used. The requirement in subsection A.1 for a velocity of two feet per second to achieve scouring, while not necessarily needed for treated wastewater, may be used at the discretion of the designer.

G. Plans and Specifications. Formal plans and specifications required in Section 250.C is waived for designs that are exempt from the practice of engineering.

H. The depth of gravel in Section 930.E is not waived. All trenches and pads, which use aggregate, shall be designed using six inches of gravel (or other approved aggregate) under gravity percolation lines and two inches over the line. For LPD (low pressure distribution) systems 8.5 inches of aggregate is required under the pipe and two inches over the pipe.

I. Separation Distance to Impervious Strata for Shallow Placed Systems. An impervious stratum is a soil feature that has a measured or estimated percolation rate in excess of 120 minutes per inch and may include bedrock, pans, restrictions, or shrink-swell soil. The separation distance to these features for shallow placed systems is shown in Table 4.3 of the *Regulations*, with the exception of the separation distance to watertable. The separation distance to an impervious strata may be reduced from 18 inches to a distance not less than 12 inches below the trench bottom when a professional engineer certifies in writing that he has evaluated the hydraulic capacity of the site to disperse wastewater and in his professional opinion, water mounding will not encroach on the separation distance required in Table 3.

J. Separation Distance to Watertable. The separation distance between the infiltrative surface of a soil absorption system and a watertable as shown in Table 4.3 of the *Regulations* is waived. Use Table 3 of this policy.

Table 3
Separation Distance between Infiltrative Surface of Soil Absorption System and Watertable

Percolation Rate	Separation Distance
1-25	6 inches
26-37	8 inches
38-49	10 inches
50-120	12 inches

K. The Minimum Standoff Distance to Watertable, or Other Limiting Factor, is Achieved Under the Entire Absorption Area. The absorption area may consist of any dispersal method approved by the department or authorized by the variance. The absorption area determined may be achieved by either an absorption pad or absorption trenches, provided:

- The absorption area, (either pads or trenches) is installed on contour. When a pad system is designed, the longest dimension of the pad shall be along the contour. Contour means that the longitudinal axis of the pad follows the contour of the site within 4 inches (+/-2 inches). Every effort *should* be made to minimize the linear loading rate, particularly when using a pad design.

- When a pad is utilized, the bottom pad area shall be installed level while maintaining at least the minimum required separation distances to all soil limiting factors.

- No portion of the pad bottom area may be installed in fill material.

- The system shall be designed to provide equal flow, within 10 percent, throughout all portions of the absorption area. Distribution of effluent by gravity or pressure dosing (before or after the treatment system) is acceptable.

- When designing a drip dispersal system, the designer may use the loading rate shown for either the two or the three foot wide trenches shown in Table 1. To determine the area needed, divide the daily peak wastewater flow in gallons by the loading rate (GPD/ft^2) selected from Table 1. Multiply this result by three to determine minimum footprint area in square feet. The drip dispersal design guidance in GMP #107 applies to the design of the drip field. Where slopes and/or restrictive horizons are a consideration, the Absorption Area Increase Table in GMP #107 must be followed.

- When a pad is proposed for use within 20 feet up slope or down slope from another proposed or actual absorption system, the designer must certify that the upslope system will not adversely impact the down slope system and produce the calculations used to make the certification.

- The absorption area cannot be smaller than the maximum loading rates established in Table 1. A larger area may be specified by the designer. The minimum absorption area shall be 320 square feet and no additional area reduction shall be permitted for the use of water saving fixtures.

- All absorption trenches shall use parallel distribution (i.e., either a distribution box or pressure distribution). Distribution to the absorption area may be accomplished by gravity flow to an underlying pad or a distribution box, or under positive pressure to a manifold. In any case, effluent shall be applied proportionally to the absorption area herein.

- The infiltrative surface that comprises the absorption area may be installed at grade. On sloping sites, this shall be measured on the downhill side of the installation (i.e., no fill material may be placed below the absorption system).

- Cover material shall be provided from the top edge of the absorption system horizontally in all directions to existing grade and shall cover the top and side of the absorption area, which may be exposed during construction. The designer shall include sufficient cover in the system design to prevent freezing. In no case shall the depth of cover be less than four inches (note: in some areas of the state this may be insufficient to provide frost protection). The finished slope of the cover material shall not exceed 1:4 (rise:run) and a slope of 1:6 or shallower is preferred. Soil cover material shall be conducive to successful vegetative growth.

TECHNOLOGY LISTING PROCEDURES

1. The manufacturer submits a written request to the Division of Onsite Sewage and Water Services (DOSWS) asking that their unit be listed under this interim policy. The request must include the information described within this section. To be listed, the following must occur:

    a. The proprietary treatment device or treatment device must receive VDH recognition as being able to provide secondary or better effluent (SE). This measure may be completed by producing a certification from a nationally recognized testing facility (e.g., ETV, NSF), or by submitting sufficient third party performance data.

    b. A professional engineer licensed to practice in Virginia must certify in writing that in his professional opinion the treatment unit can be expected to produce effluent at the end-of-pipe that will likely meet the treatment expectations identified in within this policy (e.g., the treatment process will be equivalent or better than the units previously evaluated and as described in Appendix I):

    The professional engineer must also certify in writing that he has reviewed the manufacturer's O&M manual; and in his professional opinion, the manufacturer's maintenance schedule appears to accurately reflect the servicing and maintenance needs of the proprietary product. If the treatment unit includes continuous disinfection as part of treatment process, then the engineer must note that detail in his analysis.

    c. The manufacturer must submit an O&M manual to the DOSWS. DOSWS will review the O&M manual; and if acceptable, approve it. The O&M manual is for listing the technology only.[8] The O&M manual must contain the following minimum elements:

        1. A list of any control functions for the treatment unit and how to use them.
        2. A recommended schedule for periodic monitoring and inspection of the treatment unit and the actions recommended at each inspection interval.
        3. The expected use and the design limits for the treatment unit.
        4. Other information as deemed necessary or appropriate.[9]

[8] Depending on the specific and individualized design after systems are constructed or proposed for installation, the local health department may receive additional or different O&M instructions.

[9] Pursuant to HB1788 and SB1276 of the 2009 General Assembly session, manufacturers of alternative onsite sewage systems may be required to provide additional O&M instructions for their technologies beginning on July 1, 2009. Any future O&M requirement developed to implement HB1788 and SB1276 must be adhered.

d. The Commissioner of Health and the manufacturer (or system designer, as appropriate) must sign an agreement (the "Agreement") to evaluate the treatment unit's efficacy. Upon execution of the Agreement, the treatment unit will be listed as "Evaluation Ongoing." The variances to owners as permitted through this interim policy may be used accordingly.

   When the manufacturer submits adequate BOD_5, TSS, and fecal coliform data in accordance with the Agreement, then the unit is listed as generally approved and no additional evaluation is required. Furthermore, if a manufacturer includes adequate and continuous disinfection as part of the overall treatment system, then measurement of the fecal coliform goal is waived.

   The manufacturer or designer may submit third party data for field tested units of single family residences. The specific evaluation procedure and data submission outlined in the Agreement is waived to the extent that the manufacturer submits third party end-of-pipe data for BOD_5, TSS, and fecal coliform or E.Coli data (e.g., 20 installed residential units, sampled at least quarterly for 12 months). In other words, if the data has already been collected as required by the Agreement, then the manufacturer does not need to enter into the Agreement to develop another complete set of data. If a manufacturer submits data on five residential units, then the manufacturer would only need to evaluate 15 units under the Agreement. The manufacturer is required to submit the complete and entire data set from the third party. In other words, the manufacturer cannot preferentially select 20 field tested units from a larger sample to show that at least 20 installed treatment units met the treatment expectations of this interim policy.

e. The Manufacturer (or system designer, as appropriate) must comply with the conditions found in the Agreement. DOSWS may change the status of the treatment unit to "Testing Complete" or to "Did not pass evaluation/Did not complete testing" with cause and/or non-compliance with the Agreement.

f. Upon installation of each alternative onsite sewage system, the manufacturer and/or system designer must provide the owner with written and verbal instructions on the proper operation and maintenance of the installed system. The manufacturer and designer must provide owners with updates, revisions, and other changes as necessary.

   Manufacturers must submit O&M changes to the DOSWS and designers must submit O&M changes to the local health department holding jurisdiction for the system installation. Nothing prevents a manufacturer or designer from developing instructional materials for public use and prior approval of DOSWS is not required. Any instructional material or literature must not infer or indicate that VDH endorses, promotes, approves, or suggests use of the proprietary product.

PERMITTING PROCEDURES FOR UNITS WITHOUT GENERAL APPROVAL

2. Following listing of the treatment unit, the owner must submit an application for a construction permit or certification letter with supporting work from a qualified designer.

3. The owner must include the following variance request (with the appropriate information inserted):

   I, __(insert name)__, am owner of __(insert property identification)__. I request the Commissioner of Health, Virginia Department of Health (VDH) to grant a variance or variances in accordance with Guidance Memoranda, and Policy (GMP) #147. I have read GMP #147, the agreement between the manufacturer and the Commissioner of Health, and understand the allowances and limitations therein. I am asking VDH to approve the plans prepared by my designer.

   I understand that VDH intends to propose regulations that will require operation and maintenance of alternative systems and I should seek a qualified professional to routinely inspect my alternative sewage system. I understand that I may be subject to such regulations for operation and maintenance once they become effective. I also understand that VDH may periodically inspect my alternative system during normal business hours to assure that it performs in accordance with the expectations of GMP #147 and the agreement with the Commissioner of Health.

   I understand that VDH does not warrant the performance of my alternative system and does not provide any guarantee that the system will perform as expected. I recognize and understand that VDH may ask me to take certain actions to keep the variance(s) effective should the treatment device's listing be changed to "did not pass evaluation or did not complete testing,".

   Signed: _____

4. Upon receiving an application for a construction permit with the request for variance(s) from the owner, the local health department must review and process the application as it would normally do. The local health department must verify that the treatment unit is listed under this interim policy and is submitting data in accordance with the Agreement. The local health department must check the VDH's website to determine how many units have been permitted and installed. Upon determining that the treatment unit has a satisfactory listing under this interim policy, then staff will evaluate whether the dispersal mechanisms are in accordance with the interim policy.

   The manufacturer is allowed to install a maximum of thirty (30) units per calendar year with the variances herein. If more than 30 units are accidentally permitted within one calendar year, then the local health department must contact the manufacturer and DOSWS. The variances only apply to the first 30 systems for a construction permit and the Commissioner will act on variance requests as prescribed in the *Regulations* or *Alternative Discharging Regulations.*

5. If the design for the construction permit is in accordance with the applicable regulations and this interim policy, then a construction permit is issued and the Commissioner's letter of variance is attached to the permit. The owner must receive a copy of the construction permit and variance.

6. Upon receiving an application for a certification letter with a product listed under this interim policy, the local health department must review and process it as routinely done for any application for certification letter. If the footprint is in accordance with the applicable regulations, except for the variances and/or waivers as authorized by this interim policy for construction permits, then a certification letter can be issued for a loading rate as established herein since some manufacturers have general approval. Certification letters prepared under this policy must cite the treatment contained herein, the installation depth, the area defined for use, and the flow rate.

7. The local health department and DOSWS will maintain a database of system installations (i.e., there will be one district database and one state database). EH Managers will periodically review their database with the DOSWS database that is published on the VDH website. Should a conflict exist, the EH Manager or DOSWS will promptly notify the other. DOSWS and the local health departments will work together to assure that the manufacturer installs no more than 30 treatment units per year with the variances herein.

EVALUATION PROCEDURES FOR UNITS WITHOUT GENERAL APPROVAL

8. The manufacturer must perform in accordance with the Agreement and test, evaluate, and report influent and effluent data as required in the Agreement.

9. During evaluation and testing of the treatment unit's efficacy, DOSWS will periodically and routinely update VDH's website to show results of testing and evaluation for each system listed under this interim policy. DOSWS will note whether the Manufacturer files reports in accordance with the Agreement.

10. When testing and evaluation is completed in accordance with the agreement, the manufacturer will present all data collected, in its entirety, to DOSWS in electronic format with a summary report describing whether the manufacturer believes its data met the performance expectations in the Agreement. Following submission, DOSWS will perform a statistical analysis of the data (see Appendix I). DOWS will render a case decision and one of two events will occur:

    1. The treatment unit will be removed from the "Evaluation Ongoing" list to the "Did not pass or did not complete testing" list or to the "Testing completed and passed" (i.e., generally approved) list.

2. Additional testing, at the sole discretion of DOSWS, might be approved to continue evaluation of the treatment device. A new evaluation agreement is necessary.

When the interim policy expires upon promulgation of emergency and/or final regulations, then stakeholders will be bound to those regulations. Some manufacturers may not have completed their verification of treatment before emergency or final regulations take effect. Keep in mind that regardless of how treatment technologies are listed in this interim policy, the emergency and final regulations may have different listing, reporting, and servicing requirements for all alternative onsite sewage systems.

COMMONWEALTH of VIRGINIA
Department of Health
KAREN REMLEY, MD, MBA, FAAP
STATE HEALTH COMMISSIONER
P O BOX 2448
RICHMOND, VA 23218
TTY 7-1-1 OR
1-800-828-1120

VARIANCE

Dear _____:

RE: _____

On _____, 20__, you requested a variance or variances to the *Sewage Handling and Disposal Regulations* and/or the *Alternative Discharging Sewage Treatment Regulations for Single Family Dwelling* in accordance with Guidance Memoranda and Policy #147 (GMP #147).

Virginia Department of Health (VDH) staff reviewed your request and the design plans from _____. Based on staff's review and your designer's certification and representations, your request was found to be within the expectations and requirements permitted by GMP #147. Hence, your request for a variance is approved in accordance with GMP #147. The variance is effective 15 calendar days from the date that a construction permit is issued.

The variance is granted to the holder of the construction permit to which it is attached. The variance is not transferable to another sewage system or property, is not transferable to another owner, and, will expire when the *Regulations* are amended or repealed and replaced with new regulations; or when GMP #147 is rescinded. The variance will also expire should VDH determine that the treatment device is not performing satisfactorily or did not pass or complete its evaluation as detailed in GMP #147. The variance will also expire if the construction permit to which it is attached expires, and will be revoked if the permit to which it is attached is revoked.

You must follow all requirements of the new regulations, future policy, or VDH directives if they apply to your situation should this variance expire or be revoked.

Sincerely,

Karen Remley, M.D., M.B.A., F.A.A.P.
State Health Commissioner

COMMONWEALTH of VIRGINIA
Department of Health
KAREN REMLEY, MD, MBA, FAAP
STATE HEALTH COMMISSIONER
P O BOX 2448
RICHMOND, VA 23218
TTY 7-1-1 OR
1-800-828-1120

Manufacturer Agreement

Memorandum of Understanding and Agreement

This Agreement, made this ____ day of _____, 20___, is by and between the Commissioner of Health and _____, the "Manufacturer." The Commissioner delegates implementation and acceptance of this Agreement to the Division of Onsite Sewage and Water Services (DOSWS).

The Manufacturer agrees to test and evaluate the efficacy of _____, the "Treatment Device" in accordance with the evaluation protocol set forth below. The Treatment Units will be jointly selected and agreed upon by the Manufacturer and DOSWS. The Manufacturer further agrees to:

1. Test and complete an evaluation (as described in this Agreement) of a minimum 20 Treatment Units within three years of the date that this Agreement is executed. The Manufacturer must conclude the evaluation on or before _____.

    i. Each of the 20 Treatment Units selected for evaluation must be designed and used for a single-family residential dwelling less than 1,000 GPD, used as expected for a permanently occupied home for 12-months.

    ii. No evaluation or testing will be accepted for seasonal occupancy or seasonal rental use.

    iii. The Manufacturer will contact DOSWS as soon as practical when a viable Treatment Unit for evaluation is installed. Upon notice by the Manufacturer, DOSWS will confirm whether the Treatment Unit will be selected.

    iv. The Manufacturer will maintain an electronic database of Treatment Units selected for evaluation and report the database, along with associated influent and effluent results quarterly. The Manufacturer will retain copies of the Chain of Custody forms for sample collection, transport, and measurements and provide them to DOSWS within five days upon request.

v. Hire and use a third party, as described in this section and accepted by DOSWS, to collect a minimum of four consecutive quarterly influent and effluent samples for 12 months on each of the 20 Treatment Units. All procedures to collect, transport, and measure samples, with proper chain of custody, must be conducted under the supervision of a faculty member in an appropriate program of an accredited college or university, a licensed professional engineer experienced in the field of sanitary engineering, or by a testing firm acceptable to DOSWS.

vi. Bacterial counts shall be made using Standard Methods 9223, 9221 E, or 9222 D with sufficient dilution to report values up to approximately 200,000 organism/100mL. If adequate and continuous disinfection is provided, then measurement of bacterial counts is not required. If the installation complies with the vertical offset requirements for the dispersal of secondary effluent to the seasonal watertable or other soil wetness feature as specified in the *Regulations*, then disinfection is not required.

2. The Manufacturer will provide a copy of the contract with the third party, which must clearly describe the duties to be performed by both the third party and the Manufacturer. The Manufacturer and third party will provide a Quality Assurance and Quality Control (QA/QC) plan in the contract. The QA/QC plan will include information on the collection, transport and handling of samples and must be satisfactory to DOSWS.

   The contract must specify when sample measurements will be sent to DOSWS and that all persons used to collect, transport, or test samples will be properly trained to perform the corresponding tasks. The contract must be provided at the time this Agreement is completed and must be acceptable to DOSWS.

   i. The third party agreed to is/are _____.

   ii. If requested by DOSWS, the Manufacturer agrees that the third party will provide at least 72 hours notice before collecting samples and allow for joint collection with DOSWS, or its designee upon request.

   iii. The Manufacturer agrees to place and assure that at least two inspection and sampling ports are available to allow the third party to adequately sample for influent and effluent. Each inspection and sampling port must be located to accurately characterize the influent and effluent generated.

   iv. The Manufacturer agrees to test and report influent and effluent results as described above for the following constituents (unless specifically waived by DOSWS): BOD_5, TSS, Fecal Coliforms in cfu/100 ml or E.Coli (when disinfection is not provided), Dissolved Oxygen, Temperature, and pH.

Sometimes influent data that reflects the wastewater characteristics produced by the residential dwelling is not practical to collect. In such case, the Manufacturer will report influent from the recirculation tank.

If the influent does reflect the average or normal values for residential wastewater, then DOSWS may require additional testing or eliminate that specific residence from consideration as part of the evaluation.

3. Hire and use a lab certified and accepted by DOSWS to perform BOD_5, TSS, and fecal coliform measurements using the *Standard Methods for the Examination of Water and Wastewater* for influent and effluent, including any requirements set forth by the U.S. Environmental Protection Agency (USEPA). Composite or grab samples for TSS and BOD_5 may be used. Grab samples for fecal coliforms is required. The third party will directly report the results to DOSWS no later than the 15th day following completion of testing for any sample.

   i. The certified lab is/are _____.

4. Maintain an electronic database or spreadsheet of all system installations, with or without variances, and report the database to the Director, DOSWS by the 15th day of March, June, September, and December of each year the evaluation continues. The spreadsheet report will include the following information:

   i. Sample results for influent and effluent.

   ii. Interim observations about the Treatment Unit's performance with respect to the pass/fail criteria.

   iii. Describe the dispersal design and offsets to soil limiting features for each system sampled.

5. Install no more than 30 Treatment Units per calendar year with the variances provided by this interim policy, for a maximum of 90 Treatment Units with the associated variances over the three year evaluation period. An unlimited number of Treatment Units is allowed without the associated variance(s).

6. The pass/fail criteria for effluent will be as follows:

	Log Transformed Upper 99% Confidence Interval Converted Back to Native Units
BOD_5 (mg/l)	Less than or equal to 10 mg/l
TSS (mg/l)	Less than or equal to 10 mg/l
Fecal coliforms (cfu/100ml) or E.Coli	Less than or equal to 2,000 cfu/100ml

In return for the above considerations, DOSWS agrees to maintain a list of Treatment Units installed in Virginia and their sampling results. DOSWS will have three categories under which a Treatment Unit may be listed. The categories are as follows: "Completed testing and passed," "Did not pass/Did not complete testing," and "Evaluation Ongoing." The database and categories will be posted on the Virginia Department of Health's website.

This Agreement is binding upon both parties until new regulations to amend or replace the *Sewage Handling and Disposal Regulations*, 12 VAC 5-610, occurs, or is otherwise made unnecessary. Upon conclusion of the testing and evaluation in accordance with this Agreement, DOSWS will render a case decision regarding whether the Treatment Unit has met the influent and effluent performance expectations.

If the case decision affirms that the Treatment Unit met the pass/fail criteria, then the Manufacturer is no longer required to continue the evaluation. Alternatively, if DOSWS finds the Treatment Unit did not meet the performance standards, then the Manufacturer will have 30 days to challenge the decision before the Manufacturer and Treatment Device are removed from being listed under GMP #147. Without listing, owners of Treatment Units will not have access to the variances permitted by GMP #147. If the Manufacturer cannot continue or decides not to continue the evaluation, the Manufacturer will provide DOSWS with 30 days written notice. DOSWS, in its sole discretion, will decide whether to remove sampling results for the Treatment Unit from its website.

This Agreement may be updated, amended, modified, or replaced upon 30 days written notice of either party or with the consent of both parties. The DOSWS may update, amend, modify, or replace the Agreement on behalf of the Commissioner.

Read, Understood, and Agreed to:

_____ _____

Karen Remley, M.D., M.B.A., F.A.A.P.
State Health Commissioner

Manufacturer

Technology Listings and Data

Testing completed (generally approved)			
Brand Name	Manufacturer	Data Links (Design Manuals) (O&M) (Cut-sheets)	Website Link

Evaluation ongoing for general approval					
Brand Name	Manufacturer	Data Link (Design Manuals) (O&M) (Cut-sheets)	Installation and Permitting Database	Agreement	Testing Begin & End Dates

Did not pass evaluation or did not complete testing for general approval					
Brand Name	Manufacturer	Data Link	Installation and Permitting Database	Agreement	Testing Begin & End Dates

Appendix I

Analysis of Alternative Wastewater Systems Data
Collected in Virginia through Experimental and Provisional Evaluation

Virginia Department of Health

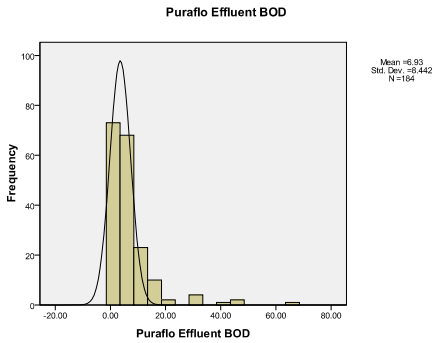
Data collected from three proprietary systems (Bord Na Mona's Puraflo, Orenco System's AdvanTex, and Premier Tech's Ecoflo) used to establish reduced footprint installations under GMP #69 were analyzed to establish interim "end-of-pipe" standards for additional reduced footprint treatment devices without requiring soil monitoring data.

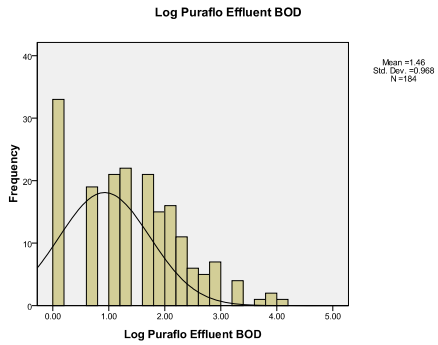
There are several challenges in using these data. For various reasons, the laboratory testing methods used for the three systems were not exactly the same. Bord Na Mona (Puraflo) measured fecal coliforms and BOD_5, Orenco (AdvanTex) measured E.Coli and cBOD, and Premiere Tech measured fecal coliforms and cBOD. There was no standard upper limit for bacterial measurements, with the maximum reported values for effluent being 2,000,000, 36,000, and 920,000, and for influent being 200,000,000, not reported, and 3,500,000 respectively.

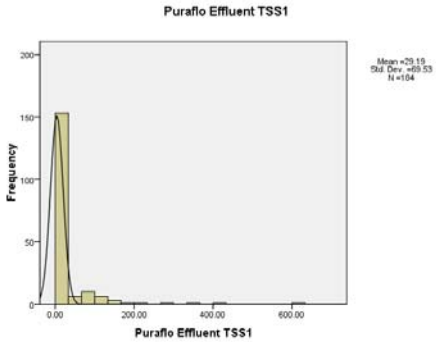
Data cleanup included the following: all "greater than" values were incremented by one (i.e. >2,000 converted to 2,001), all "TNTC" values were set to the highest value in that set (i.e. manufacturer-specific influent or effluent, 2,000,000 for Puraflo effluent), all text values were removed, and all zeros were converted to 0.9 when the lowest value reported was 1.0 and to 1.0 when the lowest reported value was 2.0.

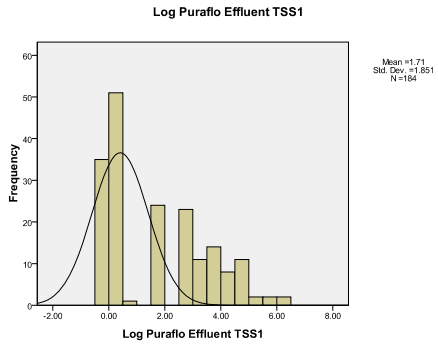
As expected, all data sets demonstrated non-normal distributions and were log transformed for analysis. Thus the central tendency is the geometric mean, though it was generally calculated as the mean of the log transformed data, which is mathematically identical. Data clean-up was in Excel and analyses in SPSS V 17.0.

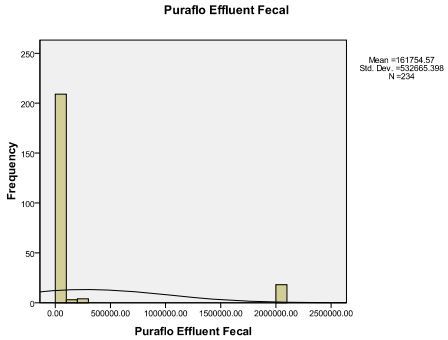
The following graphs demonstrate the original data distributions and the log transformed distributions:

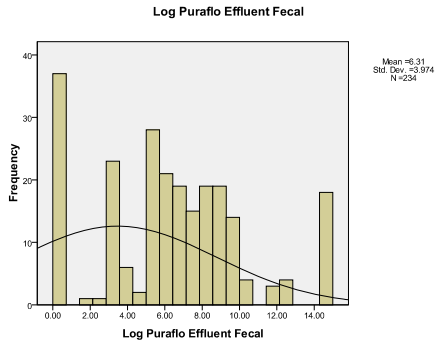

Puraflo Effluent BOD
Mean =6.93
Std. Dev. =8.442
N =184
Frequency
Puraflo Effluent BOD

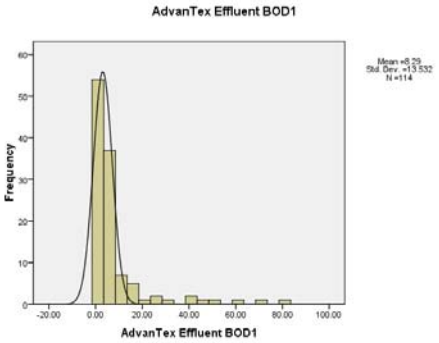

Log Puraflo Effluent BOD
Mean =1.46
Std. Dev. =0.968
N =184
Frequency
Log Puraflo Effluent BOD

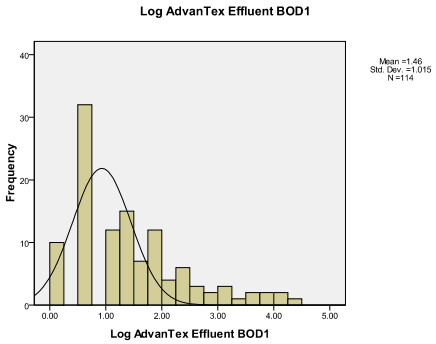

Puraflo Effluent TSS1
Mean =29.19
Std. Dev. =69.53
N =184
Frequency
Puraflo Effluent TSS1

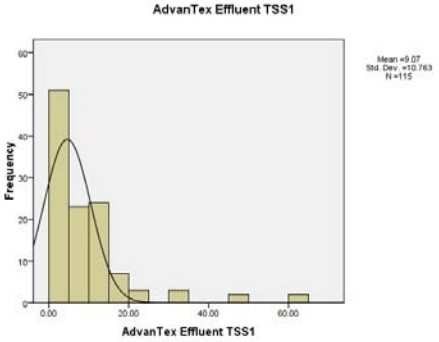

Log Puraflo Effluent TSS1
Mean =1.71
Std. Dev. =1.851
N =184
Frequency
Log Puraflo Effluent TSS1

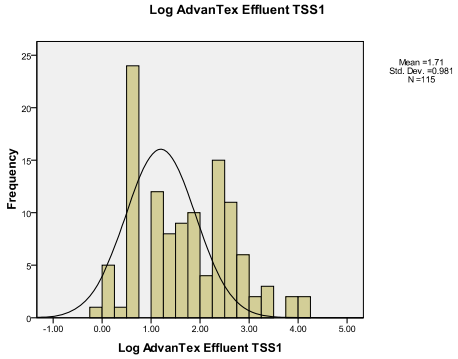

Puraflo Effluent Fecal
Mean =161754.57
Std. Dev. =532665.398
N =234
Frequency
Puraflo Effluent Fecal

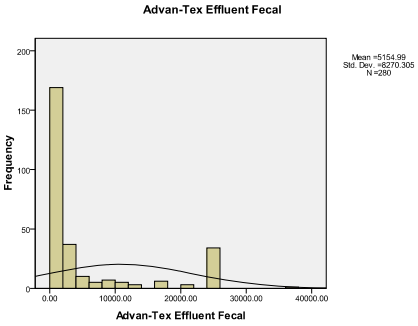

Log Puraflo Effluent Fecal
Mean =6.31
Std. Dev. =3.974
N =234
Frequency
Log Puraflo Effluent Fecal

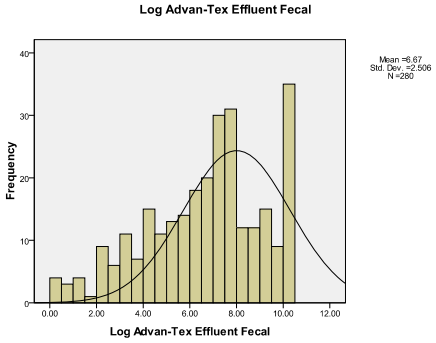

AdvanTex Effluent BOD1
Mean =8.29
Std. Dev. =13.532
N =114
Frequency
AdvanTex Effluent BOD1

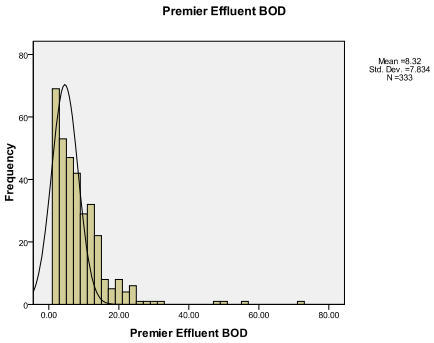

Log AdvanTex Effluent BOD1
Mean =1.46
Std. Dev. =1.015
N =114
Frequency
Log AdvanTex Effluent BOD1

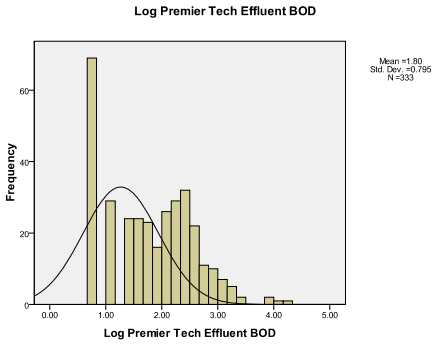

AdvanTex Effluent TSS1
Mean =9.07
Std. Dev. =10.763
N =115
Frequency
AdvanTex Effluent TSS1

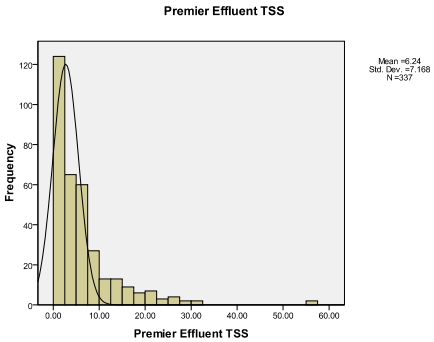

Log AdvanTex Effluent TSS1
Mean =1.71
Std. Dev. =0.981
N =115
Frequency
Log AdvanTex Effluent TSS1

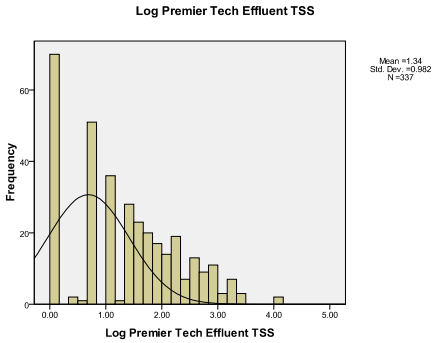

Advan-Tex Effluent Fecal
Mean =5154.99
Std. Dev. =6270.305
N =280
Frequency
Advan-Tex Effluent Fecal

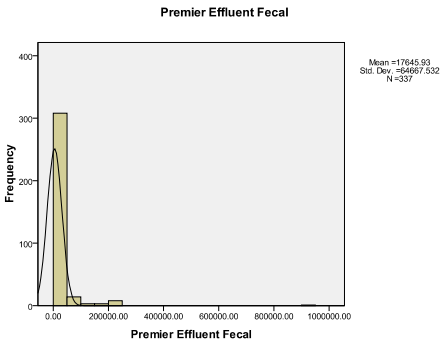

Log Advan-Tex Effluent Fecal
Mean =6.67
Std. Dev. =2.506
N =280
Frequency
Log Advan-Tex Effluent Fecal

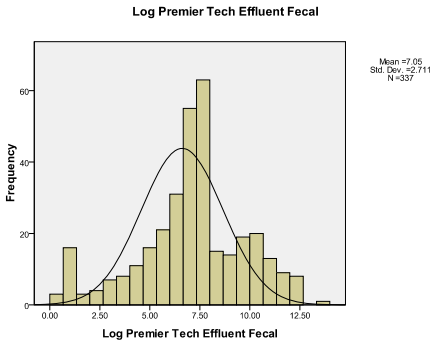

Premier Effluent BOD
Mean =8.32
Std. Dev. =7.634
N =333
Frequency
Premier Effluent BOD


Log Premier Tech Effluent BOD
Mean =1.80
Std. Dev. =0.795
N =333
Frequency
Log Premier Tech Effluent BOD


Premier Effluent TSS
Mean =6.24
Std. Dev. =7.168
N =337
Frequency
Premier Effluent TSS


Log Premier Tech Effluent TSS
Mean =1.34
Std. Dev. =0.982
N =337
Frequency
Log Premier Tech Effluent TSS


Premier Effluent Fecal
Mean =17645.93
Std. Dev. =54667.532
N =337
Frequency
Premier Effluent Fecal


Log Premier Tech Effluent Fecal
Mean =7.05
Std. Dev. =2.711
N =337
Frequency
Log Premier Tech Effluent Fecal

An inspection of the graphs and the following descriptive statistics show that log transformations improves all distributions. The statistics confirm that the log transformation improves the distribution, but does not make them completely normal. Note: Kurtosis is a measure of how peaked a distribution is, with three indicating a normal distribution, and skewness is a measure of how asymmetrical the distribution is with zero indicating a normal distribution.

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Puraflo Effluent BOD	184	1.00	64.00	6.9293	.62236	8.44205	3.560	.179	16.637	.356
Puraflo Effluent TSS	184	.90	600.00	29.1858	5.12583	69.53008	5.034	.179	31.866	.356
Puraflo Effluent Fecal	234	1.00	2000000.00	161754.5684	34821.42639	5.32665E5	3.178	.159	8.212	.317
Advan-Tex Effluent BOD	114	.00	79.00	8.2018	1.27217	13.58303	3.305	.226	11.613	.449
Advan-Tex Effluent TSS	115	.00	60.00	9.0609	1.00427	10.76955	2.829	.226	9.476	.447
Advan-Tex Effluent Fecal	280	1.00	36000.00	5154.9915	494.24528	8270.30542	1.705	.146	1.444	.290
Premier Effluent BOD	333	2.00	71.00	8.3213	.42931	7.83424	3.423	.134	19.050	.266
Premier Effluent TSS	337	1.00	56.00	6.2359	.39049	7.16842	2.996	.133	13.668	.265
Premier Effluent Fecal	337	1.00	920000.00	17645.9288	3522.66492	64667.53174	9.217	.133	115.365	.265

Log Transformed data

	n	Minimum	Maximum	Mean	Std. Error of Mean	Std. Deviation	Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
Log Puraflo Effluent Fecal	234	.00	14.51	6.3119	.25976	3.97354	.157	.159	-.306	.317
Log Puraflo Effluent BOD	184	.00	4.16	1.4613	.07134	.96773	.141	.179	-.417	.356
Log Puraflo Effluent TSS1	184	-.11	6.40	1.7090	.13646	1.85110	.498	.179	-1.061	.356
Log AdvanTex Effluent BOD	114	.00	4.37	1.4621	.09508	1.01522	.934	.226	.556	.449
Log AdvanTex Effluent TSS	115	-.11	4.09	1.7123	.09151	.98131	.266	.226	-.584	.447
Log Advan-Tex Effluent Fecal	280	.00	10.49	6.6735	.14976	2.50597	-.557	.146	-.299	.290
Log Premier Tech Effluent BOD	333	.69	4.26	1.7994	.04356	.79493	.155	.134	-.662	.266
Log Premier Tech Effluent TSS	337	.00	4.03	1.3428	.05350	.98217	.238	.133	-.783	.265
Log Premier Tech Effluent Fecal	337	.00	13.73	7.0523	.14769	2.71114	-.425	.133	.371	.265

Results for the transformed data showing means and upper confidence intervals converted back to the original scale:

		Log transformed			**Converted**
	n	Mean	Std. Dev	Std. Error Mean	**Mean**
Puraflo BOD	184	1.46	0.97	0.07	**4.31**
Puraflo TSS	184	1.71	1.85	0.14	**5.52**
Puraflo Fecal	234	6.31	3.97	0.26	**551.07**
AdvanTex BOD	114	1.46	1.02	0.10	**4.32**
AdvanTex TSS	115	1.71	0.98	0.09	**5.54**
AdvanText E.Coli	280	6.67	2.51	0.15	**791.19**
Premier Tech BOD	333	1.80	0.79	0.04	**6.05**
Premier Tech TSS	337	1.34	0.98	0.05	**3.83**
Premier Tech Fecal	337	7.05	2.71	0.15	**1155.52**

	Log **99**% Confidence		**Converted**
	Lower	Upper	**Upper**
Puraflo BOD	1.28	1.65	**5.19**
Puraflo TSS	1.35	2.06	**7.88**
Puraflo Fecal	5.64	6.99	**1081.91**
AdvanTex BOD	1.21	1.71	**5.53**
AdvanTex TSS	1.47	1.95	**7.04**
AdvanTex E.Coli	6.29	7.06	**1166.72**
Premier Tech BOD	1.69	1.91	**6.77**
Premier Tech TSS	1.20	1.48	**4.40**
Premier Tech Fecal	6.67	7.43	**1694.07**

Based on these results, VDH has determined that a reasonable interim "end-of-pipe" standard of effluent leaving a treatment unit and qualifying for a reduced footprint for dispersion shall be geometric means of ≤10mg BOD/L, ≤10mg TSS/L, and ≤2,000 fecal coliforms or E. coli CFUs/100mL.

Sample size for new system testing:

Sample size calculations were performed on the transformed bacterial data. Because of the large standard deviations, standard sample size calculations result in recommended sample sizes in the range of the originally submitted data, i.e., 100-600[10]. Requiring this amount of testing was determined to be unreasonable and the Agency will accept minimum sample sizes of 80. Applicants should be allowed to provide additional data when they feel it is appropriate, though additional test results must be combined with the original testing results.

[10] Daniel WE. Determination of sample size for estimating means (6.7.3). In: *Biostatisitcs: A Foundation for Analysis in the Health Sciences.* Hoboken, NJ: John Wiley; 1999:180-181