STATE BOARD OF HEALTH

Title of Regulation: **12 VAC 5-610-10 et seq. Sewage Handling and Disposal Regulations (amending 12 VAC 5-610-120, 12 VAC 5-610-170, 12 VAC 5-610-250, 12 VAC 5-610-260, 12 VAC 5-610-370, 12 VAC 5-610-470, 12 VAC 5-610-700, 12 VAC 5-610-810, 12 VAC 5-610-820, 12 VAC 5-610-950, 12 VAC 5-610-1080, and 12 VAC 5-610-1140; adding 12 VAC 5-610-441 through 12 VAC 5-610-449 and 12 VAC 5-610-815; repealing 12 VAC 5-610-110, 12 VAC 5-610-150, 12 VAC 5-610-830, 12 VAC 5-610-840, and 12 VAC 5-610-1150).**

Statutory Authority: §§ 32.1-12 and 32.1-164 of the Code of Virginia.

Public Hearing Dates:

May 20, 1996 - 7 p.m. (Leesburg)

May 20, 1996 - 7 p.m. (Rocky Mount)

May 21, 1996 - 7 p.m. (Fredericksburg)

May 21, 1996 - 7 p.m. (Eastern Shore)

May 22, 1996 - 7 p.m. (Newport News)

May 22, 1996 - 7 p.m. (Woodstock)

May 23, 1996 - 7 p.m. (Virginia Beach)

May 23, 1996 - 7 p.m. (Verona)

May 28, 1996 - 7 p.m. (Henrico County)

May 29, 1996 - 7 p.m. (Farmville)

May 29, 1996 - 7 p.m. (Blacksburg)

May 30, 1996 - 7 p.m. (Abingdon)

Public comments may be submitted until May 31, 1996.

(See Calendar of Events section

for additional information)

Basis: The authority for the Sewage Handling and Disposal Regulations is found in § 32.1-164 of the Code of Virginia. The Code specifically authorizes the Board of Health to adopt regulations governing the location and construction of septic systems, and other onsite sewage systems, so that public health is protected and ground and surface water contamination is prevented.

Purpose: The proposed revisions remove restrictions in the current regulations, provide equal or better environmental protection, and provide for better flexibility in adopting to changing technology. The revisions will generally provide the citizens of Virginia with both more development options and more environmentally sound development options. The proposed changes were initiated primarily from recommendations made by the Task Force on Septic Tank Regulations which was charged with examining the adequacy of the regulations relative to ground water contamination. The task force was comprised of individuals representing the development community, environmental interests, private sector soil scientists, industry, academia and affected regulatory agencies. In July of 1991 the task force issued a report suggesting 11 changes to improve the onsite program.

Subsequently, the USEPA issued regulatory guidelines for the siting and operation of onsite systems under Section 6217 of the Coastal Zone Management Act. The USEPA requires "...states with coastal zone management programs to develop coastal nonpoint pollution programs to control sources of nonpoint pollution which degrade coastal waster quality or face the loss of federal grant funds." The increased separation

distance to water table and rock, septic tank maintenance, and mass drainfield requirements are necessary to comply with the EPA recommendations.

Substance: The proposed revisions include:

1. Increasing the separation distance to a water table below a drainfield from 2 to 20 inches to 18 or 24 inches.

2. Increasing the separation distance to bedrock below a drainfield from 12 inches to 18 inches.

3. Wording to encourage the use of new and innovative onsite wastewater technologies by granting provisional approval to promising new systems.

4. Increasing ground water protection standards for large onsite systems (mass drainfields).

5. Reducing the installation depth for conventional systems from 18 inches to 6 to 12 inches.

6. Adding provisions that will make it easier for homeowners to know when to pump their septic tank.

7. Making administrative changes designed to revise cumbersome portions of the regulations and make it easier for the public to comply with the regulations (i.e., reduced "red tape").

Issues: There are two primary advantages of the proposed regulation changes to the public and the Commonwealth. First, ground water contamination due to septic systems will be reduced. This will provide protection against waterborne illnesses and minimize the need for localities and the Commonwealth to provide for public water and

sewerage facilities. Second, this increase in ground water protection will occur while simultaneously allowing an increase in the number of approvable sites. In addition to providing individual citizens with new building options the Commonwealth and localities will benefit from the expanding tax base. This two-fold advantage is possible because of careful regulatory revisions which incorporate recent scientific research findings.

There are no disadvantages to the agency or Commonwealth of implementing the proposed amendments to the regulation. The primary short-term economic disadvantage to the public of the proposed amendments is that mass drainfield requirements impose new restrictions on large scale onsite development. These increased restrictions include the installation of ground water monitoring wells, ground water sampling requirements, and a 100% repair area to replace the system when it fails. Long term advantages include having the ability to repair the system onsite rather than having to provide sanitary sewer facilities, and identifying ground water contamination before the levels exceed public health standards and jeopardize nearby residents. The proposed revisions also formalize existing requirements to evaluate the impact of nitrogen loading and ground water mounding which have been implemented under general authority provisions of the current regulations. These requirements are included in the least intrusive manner that appears to comply with USEPA guidance on mass drainfields. The department believes the long-term advantages outweigh the short-term disadvantages.

Estimated Impact: The department typically processes over 32,000 applications per year for onsite wastewater systems. The department's denial rate varies but generally runs between eight and 10%. The proposed changes have been carefully developed to

eliminate, or at least minimize, any adverse impact on the development community while simultaneously increasing environmental and public health protection. Statewide, the department's eight to 10% denial rate is expected to decline slightly. A slight increase in the denial rate may occur in some localized areas having coarse sandy soils, with the primary impact being on the Eastern Shore. For example, based on previous year's work, the department expects an increase of about 12 permit denials in Accomack County, out of approximately 440 applications processed annually. A possible solution has been identified and a committee of public and private sector individuals has been established to evaluate the appropriate use of sand-on-sand fills.

Approximately 99.9% of all sites which can presently be developed will remain so. Moreover, some sites which cannot be developed under current implementation of the present regulations will be opened for development. The net result should be an increase in the number of sites that the department can permit. Additionally, new provisions are incorporated which encourage innovative technology that will promote this trend over time.

Some of the proposed changes will reduce negative environmental impacts but none of the revisions will eliminate the impact of onsite systems on the environment. Some changes will increase the cost of developing some, but not all, property. None of the costs are expected to be exorbitant and every attempt has been made to minimize impact on residential development. Some of the rule changes will open up heretofore undevelopable land; however, not to a great extent. The proposed changes are modest and realistic and overall are believed to have a net positive impact for the public at large. A discussion of the rationale and impact of each proposed revision to the

regulations follows.

1. Increased Stand-Off to Water Table

Cause for Change

The first and primary recommendation of the Task Force on Septic Tank Regulations specifies:

> "Virginia should increase its vertical separation distance requirements to a minimum of 24 inches of separation between the bottom of septic trenches and the seasonal high water table in Group I soils and a minimum of 18 inches of separation between the bottom of septic trenches and the seasonal high water table in Group II and III soils."

USEPA requirements under section 6217 of the Coastal Zone Management Act include several references to maintaining an adequate, but undefined, separation distance between septic field trench bottoms and a water table. Management strategies 1, 2, 3 and 4 for new systems, and strategy 1 for existing systems apply.

Impact

This regulation revision increases the stand-off distance between a water table and a drainfield trench. The present regulation uses a sliding scale from 2 inches of separation in sandy soils to 20 inches in clayey soils. In sandy soils (Texture Group I) the proposed stand-off will be 24 inches. In loamy, silty and clayey soils (Texture Groups II, III and IV) the stand-off distance will be 18 inches.

This change will have the greatest effect on approximately one-third of the systems installed east of I-95. Some sites with very sandy soils (Texture Group I) will require a

shallower installation depth or pretreatment (ex. sandfilter). In some cases, both may be required.

When comparing the existing regulation to the proposed regulation, there will be a few additional denials in Texture Group I, sandy soils. A review of applications received in the areas of greatest impact reveal that about 2.0% of the 400 permits issued (eight permits) in Accomack County and about 8.0% of the 60 permits (four permits) issued in Chincoteague would be denied under the proposed regulation but would be issued under the existing regulation. The survey data used to develop these estimates appear as the Appendix at the conclusion of this impact statement.

The department is evaluating research in progress at VPI&SU on the use of fill material to treat and dispose of effluent. Additionally, a committee of both public and private sector representatives has been formed to evaluate ways to use "sand-on sand" fill to eliminate any additional denials due to the regulation changes. It is hoped (and expected) that its recommendations could be incorporated into the proposed regulations as part of the public comment process.

Texture Group II soils (loamy textured soils) will require significantly fewer system design changes than noted above for Texture Group I soils. These soils already require 3 to 12 inches of stand-off between a trench bottom and a water table. This effectively means the water table must be 21 inches to 30 inches from the ground surface to obtain a permit (18 inches minimum installation depth plus 3 inches to 12 inches stand off). The proposed changes will allow systems to be installed in soils with water tables occurring at 18 inches from the ground surface when pretreatment is utilized. The majority of systems will be installed either shallower or with no design changes. Only

sites where the water table occurred between 18 inches and 23 inches would require pretreatment. Overall, some additional permits would be issued with the proposed change and no additional permits would be denied.

There would be a net gain in permits issued in Texture Group III and IV soils (silty and clayey soils) and no increase in permit denials. Stand-off distances are currently 12 to 20 inches and the proposed stand-off would become 18 inches as measured from the drainfield trench bottom. By reducing the installation depth from 18 inches to 6 inches and by allowing the separation distance to be reduced to 12 inches with pretreatment, significant numbers of new sites may become future development sites.

2. Provisional System Regulations

Cause for Change

The fourth recommendation of the Task Force on Septic Tank Regulations specifies:

> "Virginia should do everything it can to expedite consideration of promising new technologies and encourage responsible use of alternative onsite treatment technologies by continuing to do research and monitoring of existing and new technologies, by providing training and certification for proper installation of these technologies, and by establishing regulatory incentives for the use of proven technologies."

The official policy of the department is to encourage the development and use of innovative technology. The current regulations have been restrictive in the use and evaluation of new technology. This proposed change grants provisional status to promising new systems which is intended to improve the acceptance of new technology

without unduly jeopardizing public health or the environment.

Impact

This new regulation is designed to create a mechanism to encourage the development, demonstration, and use of new onsite system technology. It will rely heavily on the private sector to fund and demonstrate new and developing technologies and will use third party review to provide an impartial evaluation.

Several companies have expressed interest in pursuing this option should it become available. Citizens will benefit by having more options in terms of possible types of sewage systems for which they can get permits. Over time, the department hopes that these alternative systems will expand the envelope of useable soils and sites and that environmentally safe development will be able to occur on property currently being denied.

If adopted, Virginia's regulations would be among the most favorable in the Eastern United States for manufacturers proposing new and innovative technology. It is hoped that a healthy, cooperative public-private relationship would ensue and that this would spur the development of environmentally sound wastewater technologies and economic development within the Commonwealth.

The cost to evaluate the technical merits of these alternative systems is estimated to be $25,000 per year per system and a minimum five-year evaluation is being proposed. Since the industry funding the research would stand to benefit from satisfactory findings, it seems appropriate that industry bears the cost. Preliminary discussions with industry indicate that funding an evaluation program at this level is not unreasonable. This

would provide a mechanism for proprietary systems to be evaluated.

No corresponding method exists to evaluate nonproprietary systems. It is believed that some nonproprietary systems may be developed that are equal in effectiveness to proprietary systems and may be less expensive to install. Since the program does not yet exist, funding for it has not been provided. No resources within the Division of Onsite Sewage and Water Services have been identified that can be diverted to cover this new program without serious impact on services delivered to the public. Future options available to review nonproprietary systems would include providing general fund support, seeking private funding through grants, and placing a "surcharge" on the review of proprietary systems to cover nonproprietary systems.

3. Mass Drainfield Requirements

Cause for Change

The ninth recommendation of the Task Force on Septic Tank Regulations specifies:

> "Virginia should consider requiring the use of alternative technologies which provide treatment of nitrogen where there are clusters of drainfields and high loading rates in a limited geographic area and nitrate contamination is a concern."

Management strategy 5 for new systems and strategy 3 for existing systems of the USEPA's nonpoint source guidance document also address the need to remove nitrate from wastewater to reduce ground water contamination.

The USEPA document does not differentiate between mass drainfields and smaller systems. VDH's knowledge of and experience with nitrogen reduction strategies is that

they can be expensive on small scale applications and that smaller systems (i.e., those under 1,200 gallons per day or GPD) have a questionable impact on the nitrogen delivered to sensitive surface waters. Consequently, VDH drafted regulations that excluded systems that discharged less than 1,200 GPD on an acre of land. Except where drainfields are clustered, or wastewater flows combined, residential development will not be affected.

Impact

Mass drainfields typically serve multi-family dwellings such as resort condominiums and commercial establishments, such as restaurants over 24 seats and shopping centers. In the event of system failure, these establishments need to be able to repair their sewage system quickly and with a high degree of certainty that the repair will work. The public health risk associated with a failing mass drainfield is significantly greater than with a failing single family system. The wastewater flows are substantially greater, as are the number of individuals potentially exposed and the variety of pathogenic organisms which may be present.

The Sewage Handling and Disposal Regulations were originally written to address residential wastewater flows and strengths. Mass drainfields, because of their higher flow and variable strengths, pose different risks and technical problems than residential wastewater. This regulation is proposed to provide long term groundwater protection against nitrate and bacterial contamination.

The department has been operating since 1987 under a mass drainfield policy which requires a water mounding analysis and an evaluation of the concentration of nitrates leaving the site. Authority for the policy comes from 12 VAC 5-610-250 B and 12 VAC

5-610-290 A. These sections of the regulation formalize the requirements of the policy and add several additional requirements.

Two new provisions are proposed that may result in permit denials. These are a 100% reserve area requirement and limiting nitrate contamination to 10 mg/l or less. Currently all systems (residential, commercial and mass drainfields) must have a 50% reserve area only when the percolation rate exceeds 45 minutes per inch. At faster percolation rates no reserve area is required for any system regardless of size.

The development of property on mass drainfields will face two additional requirements that will increase development costs. These are: providing a 100% repair area and installing at least four monitoring wells. Additionally, the users (or owners) of the system will face the ongoing cost of semi-annual monitoring of fecal coliforms, nitrates and chlorides. Sampling costs will vary but should be between $50 and $100 per sample point every six months.

4. Redefinition of Rock and Stand-off to Rock

Cause for Change

The third recommendation of the Task Force on Septic Regulations specifies:

> "Virginia should examine the adequacy of current separation distance requirements to rock and consider whether these requirements also need to be increased."

Management strategy 2 of the USEPA's nonpoint source pollution management program addresses maintaining an undefined but adequate stand-off distance to rock.

Impact

The stand-off distance to rock is being increased from 12 inches to 18 inches. The proposed regulation requires a 24-inch separation distance to rock in Texture Group I soils. Texture Group I soils make up less than 1.0% of the soils in Virginia and essentially all occur in the Tidewater area where rock is not an issue.

The current regulations provide for a minimum of 30 inches from the ground surface to rock. This is based on a 12-inch separation distance from the trench bottom and a minimum trench installation distance of 18 inches. The proposed regulations will require a minimum of 24 inches from the ground surface to rock because the minimum installation depth is reduced from 18 inches to 6 inches while the separation distance is increased from 12 inches to 18 inches. Both the existing and proposed regulations require identical increases in the minimum installation as slope increases. In short, more sites should become permitable under the proposed regulations because of the decreased installation depth.

The impact to the public seeking permits should be positive; some undevelopable sites should become useable. Further, the Virginia Cooperative Extension has reported up to 49% bacterial contamination rates in some Northwestern counties in Virginia (Evaluating Household Water Quality in Warren County, Virginia. B.B. Ross, et. al. 1991). Some of this contamination can be attributed to improperly sited septic fields. The primary mode of contamination of groundwater by a drainfield, in the Northwestern portion of the state, is through rock fractures. This proposed regulation will reduce that potential significantly.

5. Reduced Installation Depth

Cause for Change

The Task Force on Septic Tank Regulations recommended reducing the installation of systems from 18 inches to 12 inches as a way of allowing permits to be issued on some currently unsuitable land while providing better wastewater treatment. The recommendation specified:

> "Virginia should reduce the installation depth requirement to 12 inches for low pressure distribution systems for more effective drainfield use."

Research conducted by VPI&SU on Piedmont soils indicated that installation depths could be reduced to make better use of the capacity of soils to renovate effluent.

Impact

This change by itself will result in an increase in permits issued. When taken in conjunction with the increase in stand-off distance to water table and rock the net result will be an overall increase in permits issued. The details of the changes were discussed in 1, Increased Stand-Off to Water Table.

Onsite systems that are installed shallower will benefit from being placed in the most biologically active soil zone. This should provide additional effluent renovation and better ground water quality protection. In some cases this additional stand-off distance may be utilized at the discretion of the department to optimize treatment even though deeper installations may be possible.

6. Septic Tank Maintenance

Cause for Change

The Task Force on Septic Regulations recommended the following:

> "Virginia should require the necessary maintenance and oversight of all onsite

systems to ensure that they continue to function well over time. This should include requirements for maintenance agreements for alternative systems serving clusters of two or more houses, to establish clear legal responsibility for the long-term operation and maintenance of these onsite waste disposal systems."

The USEPA made similar recommendations in recommendation 1 for existing systems.

A VDH appointed, citizen advisory committee considered these recommendations and concluded that the existing regulations adequately protected the public where were clustered systems existed with multiple owners. For single family homes, it recommended not to mandate maintenance but rather to modify the design of new septic tanks to make it convenient for a homeowner to determine if maintenance is necessary. The change involves adding a piece of plastic pipe to the top of the septic tank to access the tank so that the sludge depth may be checked without uncovering the tank. The change is analogous to using a dipstick on an automobile to check the oil. In short, the department decided a minor design change to new septic tanks was the least onerous way to encourage homeowners to maintain their system.

Impact

This requirement is not a basis for issuing or denying a construction permit. Hence, there will be no permitting impact.

It is estimated that the cost of a septic tank will increase by less than $50. The cost of materials for the inspection port (PVC pipe and fitting) is less than $25. The remainder of the expense is for labor and profit. This increased cost will be offset by increased

drainfield longevity on systems that are properly maintained. Complete residential septic systems cost between $1,800 and $3,500 or more depending on the size and location of the system. Well over half of this cost is for the drainfield, and proper maintenance will extend the life expectancy of the drainfield.

7. Administrative Changes

Cause for Change

These changes were initiated by VDH to reduce paperwork, bureaucracy and better serve the public.

Impact

These changes are exclusively red tape reduction efforts and should increase the speed of processing an application.

Department of Planning and Budget's Economic Impact Analysis:

The Department of Health has proposed amendments to its sewage handling and disposal regulations that significantly alter the requirements for on-site waste disposal systems (OSWDS) and that change the certification process for new disposal technologies. The primary function of the changes is to increase the protection against contamination of the ground water by domestic wastes. Some of the provisions are designed to reduce the cost of achieving the increased protection.

The proposals can be grouped into 3 main parts. First, they change the restrictions on the vertical displacement of drainfields from the underlying rock, the water table, and the surface. Second, they increase the requirements for large (mass) drainfields, requiring a 100 percent reserve area, a minimum level of monitoring and a minimum level of

dilution of the plume at the property line. Finally, the regulations provide for a small change in septic tank design that will make it easier for homeowners to determine when their septic tanks need pumping.

Introduction

For most rural (and many suburban) households, OSWDS are the only economically feasible method for disposing of domestic wastes.[1] More than half of Virginia localities have 60 percent or more of households served by OSWDS. According to the Department of Health (DOH), use is increasing each year by from 30,000 to 40,000 units. Increased use of OSWDS increases the potential for pollution of ground water. Very little is known about the amount of illness that is due to ground water contamination from OSWDS, although one study indicates that 40 percent of the outbreaks of waterborne disease in the U.S. may be attributed to OSWDS.[2]

The current Virginia standards for construction of OSWDS are probably the most lenient in the country. This has led to some areas of the state having high rates of contamination of ground water and hence drinking water. In some areas of the state, as many as 49 percent of the drinking water wells are contaminated. [3] Again, it is not known what part of this problem is due to OSWDS failure. The main problems are due to contamination of ground water by human pathogenic viruses and bacteria and by nitrates.

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[1] This section relies heavily on Stolt and Reneau (1991).

[2] Cruan, G.F. (1985).

[3] See B. B. Ross et al. (1991).

Moderate elevations in the concentration of nitrates in drinking water can cause serious illness, even death, in infants ("blue baby" syndrome). Otherwise, they do not themselves pose a significant health hazard. Water-borne pathogens, on the other hand, can sicken even healthy adults. The rate of illness due to water-borne pathogens is about 30,000 per year nationally.[4] It is not known how many of these are due to OSWDS failure; some are caused by animal wastes and some are caused by the breakdown of municipal sewage systems. For healthy adults, the illness associated with water-borne pathogens is generally not life-threatening. The symptoms are generally confined to intestinal distress.

For one subset of the population, exposure to water-borne pathogens has much more serious consequences. For anyone whose immune system is suppressed, these pathogens that imply discomfort and lost productivity for a normal adult, may be deadly. Immuno-suppressive groups in the population include the very young, the very old, those suffering from immuno-suppressive illness such as HIV, and anyone on drugs that reduce the effectiveness of the immune system. These include cancer patients on chemotherapy and anyone taking steroid-based anti-inflammatory drugs; for example, asthma patients using cortisone-based inhalers. The size of the immuno-suppressive population is rising, hence, so is the population susceptible to water-borne pathogens.

These characteristics of the immuno-suppressive group also define a group with a disproportionate representation in the lower income brackets. Thus, we would expect the incidence of water-borne illness to be quite regressive. Aside from any ethical implications, this result is important because lower income generally implies less

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[4] *See* Cruan, G.F. (1985).

education. The members of this group may have a lower awareness of the need for and availability of precautionary measures. If we were to attempt to measure the value of avoiding water-borne illness by observing defensive expenditures, say on bottled water, we might underestimate the value if a significant fraction of the population is unaware of the hazard they face or the possible preventive measures available.

Estimating the benefits of the regulations

Because so little is known about how much illness is caused by OSWDS effluent, it is not possible to give a reasonable point estimate of the health benefits of reducing contamination. The best that can be done is to provide a range of possible values that might occur under different sets of assumptions. In Table 1, we provide health benefits calculations under three possible scenarios: low, middle and high health impacts. We must emphasize that we cannot describe the middle estimate as a best guess. There is so little data that the actual outcome in any year could be anywhere in this range or could even fall outside. Under the circumstances, we should consider whether a greater effort to gather information would be worthwhile. The range of possible health effects is enormous mostly due to uncertainties about the number and values of lives lost in Virginia in a given year due to OSWDS effluent.

Table 1: Health Costs

	Scenarios		
	Low	Medium	High
Symptom	1	3	5

days			
Value of day ill	$50	$100	$150
National incidence	30,000	30,000	30,000
Virginia's share	1%	2%	3%
% due to OSWDS	10%	25%	40%
Deaths (in Va.)	0	2	4
Value of a death	$1,000,000	$3,000,000	$5,000,000
	Valuation		
Illness	$1,500	$45,000	$270,000
Deaths	$0	$6,000,000	$20,000,000
Total health costs	$1,500	$6,045,000	$20,270,000

The figures presented in Table 1 are the total value of health effects from all OSWDS

installations. As such, they greatly overstate the impact of these regulations in the short run since these regulations only affect new or replacement installations. However, there is some feeling among the experts in this area that newer installations are being placed on increasingly marginal sites, and these installations may be expected to have a higher failure rate unless the standards for drainfields are updated.

There are other consequences of water contamination by human pathogens. A significant proportion of the closures of Virginia shellfish beds is due to the presence of coliform contamination. Nationally, one quarter of all shellfish beds are closed due to coliform contamination. Again, it is not known what part of this contamination is due to OSWDS, however, as the incidence of OSWDS contamination increase, it is reasonable to assume that the proportion of closures due to OSWDS will also increase. The closure of shellfish beds has significant economic impact and often these impacts are quite localized, so the associated hardships are very unevenly distributed.

In addition, to these benefits of regulating OSWDS, there is an impact on land values. In rural areas, an OSWDS may be essential for a piece of property to have any value for residential development. However, the same is true of clean ground water as the source of potable water for the household. Thus, a drainfield that poses a significant threat of ground water contamination reduces the value of both the property on which it is situated and any neighboring properties that may be contaminated. So, on land that is very marginal for drainfield effectiveness, a regulation prohibiting the construction of ineffective drainfields should not reduce property values.

One possible response to a failure of rural or suburban residential drainfields is to extend municipal sewer and water service. This is a very expensive capital investment.

Any changes in drainfield design that delays or reduces the need for extending municipal services into less densely populated areas can be expected to save on investment in infrastructure. The size of this effect is unknown but is known to be positive and could be large. Certainly the size of these savings would be expected to increase over time.

Given that the homeowner using an ineffective drainfield is likely to suffer first from the contamination of ground water, it is important to ask why ineffective drainfields are built in the first place. A home buyer clearly has incentive to make sure that the septic drainfield on the property purchased is not going to contaminate the drinking water supply for that property. And yet academic, government, environmental group, and construction industry representatives all agree that residences do often have drainfields that pose a hazard to the drinking water serving that same residence. There appears to be some sort of market failure here but little research has been done on why homeowners under-invest in sewage treatment. This is important because, if we knew more about how households make these choices, regulations could be better targeted to reduce ground water contamination at the lowest cost.

There is one more subtle impact of regulations for improved drainfields. Virginia has been subject to some very negative publicity related to its level of protection of ground water. The image of Virginia as a clean and healthy place to live is of great value in attracting business to the state. This is especially true of businesses employing a more highly skilled work force. These are particularly attractive businesses for the state. Improving Virginia's ranking on ground water protection will probably contribute to its economic development.

There are a number of reasons why ground water contamination should not be treated as a matter of simple nuisance between adjoining landowners. First, proving the source of contamination is a very expensive process, and in many cases is not even be possible. Second, a single landowner can have serious impact on many other nearby pieces of property as well as on the quality of surface waters. This would reduce the probability that negotiation or common law remedies could result in an efficient outcome. Third, the effects are invisible and can be serious. Thus, the consumption of the water before the contamination is discovered can lead to serious injury, even death. There are a number of documented cases of serious injury due to ground water contamination in Virginia.

Issue 1: The vertical positioning of drainfields

The current requirements in Virginia for the distance between septic drainfields and the water table are probably the most lenient in the country, allowing as little as 2 inches separation. Increasing the separation between the drainfield and the underlying water table and bedrock will greatly reduce the potential for ground water contamination due to OSWDS. The vertical separation distance is being increased to 18 inches[5], a level that is widely considered to be the minimum effective amount of soil column needed to protect ground water.[6] Of Virginia's neighboring states, Maryland requires 48 inches, Delaware requires 36 inches, and North Carolina requires 18 inches. The 1990 recommended national standard for private sewage disposal is 36 inches.

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[5] And in more marginal soils, 24 inches.

[6] A separation of 12 inches may be allowed if pre-treatment of the effluent is provided.

Current scientific research appears to confirm that a properly constructed drainfield with 18 inches of separation can perform effectively for about 25 years. It is important to point out, however, that this standard leaves little room for error. Any error in the evaluation of the site or construction of the drainfield could compromise its effectiveness. Since the effectiveness of a drainfield is difficult to evaluate after the fact, it is very important that either the field be properly constructed or that the system be robust to human error. It may be that the 18 inch separation is the best choice but there is simply no way to know without more information on how the systems built and used by private individuals actually perform. It is not clear from the proposed regulation what strategy the Department of Health has for developing the information needed to make an informed choice about this matter.

The costs of this proposal have been kept to a minimum by relying on recent research showing that drainfields may be placed closer to the surface than previously thought without significantly compromising the safety or performance of the system. The minimum depth of the drainfield has been reduced to as little as 6 inches in appropriate soils. The reduction of this distance means that there will actually be an increase in the number of permitable sites even after the increased separation distance is implemented. Thus, for counties west of I-95, there will be both an increase in ground water protection and an increase in the number of sites eligible to use OSWDS.

The reduced depth of the drainfield does make the drainfield more susceptible to possible damage, say by vehicles passing over the field. However, the homeowner has great incentive to avoid this damage since the consequences would be cost of repairing the field. It is not expected that the decreased depth will lead to a significant increase in

drainfield failure.

Thus, for the western part of the state, these regulations both reduce the costs associated with permit denial (and possibly of field construction) and increase ground water protection. The effect is clearly a net economic gain for the region.

For the coastal plain, where the water table is very high, the increased separation distance will result in the denial of some permits, at least in the short-run. There simply may not be enough separation available to achieve the 12 inches allowed with pre-treatment. For the counties east of I-95, denials could increase by as much as 25 sites a year. Again, it is unclear whether this denial actually has any impact on property values on average. There will be individual cases where the potential damage from contaminating the ground water is not great because the local drinking water is taken from deep wells not affected by drainfields. However, the opinion of experts in the field is that the potential for contaminated ground water will offset any immediate financial gain from an ineffective drainfield installation.

The Department of Health has indicated that the increase in permit denials is very probably a short-term impact because new drainfield designs and pre-treatment technologies will allow the sites rejected due to insufficient separation distance to be permitted in the near future. Consultations with independent experts confirmed this potential. The newer designs will be more expensive; one builder experienced an incremental cost of $10,000 for the newer design that allowed him to install a field that had previously been denied.[7] This was higher than what he expects these new systems

[7] Robert Leipertz, Construction 2000, personal conversation, October 24, 1995.

will cost in the future. According to DOH, a more reasonable figure would be $4,000 - $5,000. As many as 1,100 additional sites could require such a system under the new regulations,[8] the maximum direct increased expenditures resulting from this regulation would be $4,400,000 to $5,500,000. Not all of this expenditure is social cost. The portion of these payments that is profit to the firms building the systems is a transfer of income not a cost to society. Naturally, any costs will be offset by reduced costs associated with ground water contamination and by the increase in permitable sites west of I-95.

For those sites where the regulations will require an additional expenditure, property values could actually increase by more than the added cost of the more expensive treatment system. This would happen if the value of increased protection of the property's drinking water supply were worth more than the cost of protecting it. In other cases, the benefits will not all accrue to the property owner with the increased costs but to neighboring pieces of property as well.

There is general agreement among the experts and interested parties who gave their opinions for this analysis that, in aggregate, the value of the new requirements on the 1,100 sites east of I-95 exceeds the costs. Many of these benefits will accrue to the property on which the more advanced treatment is built. However, a significant (but unknown) portion of the benefit will accrue to neighboring property owners and to any others downstream who might have been harmed by the treatment failures in the older systems.

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[8] A figure suggested by DOH.

On balance, these regulations, combined with the new technologies that are expected to become available in the next few years, appear to have a significant positive net economic impact. However, because of the weakness of the data, this conclusion must be based on the informed opinion of experts and of people with considerable practical experience in the industry rather than on scientific studies. On the basis of current information, we cannot determine whether an even greater separation requirement or some other technical requirements would be worthwhile. Given the great uncertainties, additional information may have considerable value for the people of Virginia.

One problem that is not considered in the regulations is what happens at the end of the 25 year life of drainfields. Most housing stock is expected to last much longer than 25 years. Some locations have 100% reserve area requirements which extend the potential deadline for another 25 years. Again, because of the dearth of good data on rates of contamination at the end of a drainfield's life, there is no way, at this time, of calculating the net benefits of requiring a longer design life for drainfields. It is important to keep in mind that most drainfields at the end of their useful life can be repaired at a cost. Suppose that it would cost $3,500 to repair an old drainfield at the end of its life. At 5 percent interest, that is worth only $1,034 today. Thus, any incremental cost greater than this to double the life of a drainfield would not be worth the expense. At the higher interest rates routinely attributed to individual consumers, this effect would be even more dramatic. An 8 percent discount rate would justify an incremental expenditure of no more than $515.

Issue 2: An observation port for new septic tanks

The regulations proposed by the Department of Health require that all new septic tanks

be fitted with a piece of PVC pipe that allows the homeowner or a contractor to readily determine whether the septic tank needs to be pumped out. The failure to pump out a septic tank when it is needed can cause drainfield failure and leaks at the surface. Many homeowners fail to pump out septic tanks frequently enough even though it could prevent costly repairs to the drainfield. As a result, some counties in Virginia require regular preventative cleaning of septic tanks. This is a very costly approach, since it means that homeowners who make low demands on their tanks will nonetheless be required to clean them frequently.

The observation port, at a cost of about $50-150 per tank would make it much easier for the homeowner to measure the sludge level in the tank. Since the homeowner has the most to gain by the proper maintenance of the septic tank, this should encourage more appropriate septic tank maintenance. Inspection of the state of the septic tank would be easier for potential home buyers. This inspection port may also allow counties that have considered regular prophylactic tank cleaning to opt for periodic inspection by licensed agents instead. Thus, tanks would only be cleaned as needed. Such a program may be considerably cheaper than requiring regular cleaning regardless of need.

It should be noted that an increase in requirements for regular cleaning of septic tanks would very quickly use up the current capacity for septage disposal. The increased capacity would certainly be forthcoming but would probably be more expensive. Thus, the increased pumping requirements would probably lead to an increase in the cost of septage disposal.

The effectiveness of the required observation port is unknown because we do not know

why many homeowners fail to clean their septic tanks in a timely fashion. Such information would be very useful in designing programs to prevent drainfield failure. However, experts questioned on this issue seem to believe that easier inspection may lead to significant improvements in septic management.

At about 30,000 new septic systems a year, the annual cost of the observation ports will be approximately $1,500,000 to $4,000,000. Since some portion of this amount will be profit for the contractor, the social cost will be this price paid minus contractor profit. At a 25% markup for the installation of the port, the economic cost of the ports will range from $1,125,000 to $3,000,000. The balance will be a transfer among the various parties to the transaction.

Good data on drainfield failure due to overloaded septic tanks is not available. However it would only take from 600 to 1,500 repairs avoided for $2,000 each to justify the expenditure. Any other savings due to fewer unnecessary cleanings and lower septage management costs would be added to these benefits. It appears, then, that the money spent installing observation ports is probably a good investment.

That said, one is inclined to ask why, if it is such a good idea, haven't homeowners demanded such a port as a matter of course? Again, knowing why would be useful information for formulating policy.

Issue 3: Mass drainfield requirements

This part of the regulation requires, among other things, that all mass drainfields have a 100% repair area. Since this is already being done even before the regulation[9], the

[9] This can probably be credited to "jawboning" by DOH field staff although some 100% reserve requirements are

codification of this requirement has little impact one way or the other.

Second, the mass drainfield provisions include a requirement that four monitoring wells be drilled and semi-annual samples taken. The sampling wells will cost between $600 and $4,000 (or more) each depending on whether rock is encountered. Thus each new mass drainfield will incur an up-front cost of from $2,400 to $16,000 to drill the wells and an annual monitoring cost of from $400 to $800. With approximately 20 mass drainfields permitted each year, the annual additional capital expenditures for the wells is between $48,000 and $320,000. The total annual increment to operating expenses will be $8,000 to $16,000. Since mass drainfields are more prone to failure than are residential fields and since the consequences are invariably greater due to the higher flow rates, it is expected that these additional costs will produce net gains in terms of reduced ground water contamination over the expected life of the field.

Mass drainfields will be subject to one additional (and possibly costly) requirement; the effluent must be sufficiently diluted to ensure that the ground water does not have a nitrate concentration greater than 10 mg/l at the property boundary. This regulation is designed to protect downstream property owners against contamination of well-water. Ten mg/l of nitrate is the federal standard for drinking water. Even at this level, when there are very young children in the household, some parents (assuming they are aware of the nitrate concentration) will want to purchase water with lower nitrate levels for their children.

The dilution requirement may require that a significant amount of land be available between the drainfield and the property boundary. Part of this requirement may be

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required under the Chesepeake Bay Agreement.

satisfied by the reserve area, but there are circumstances where the land area needed for dilution will require land in addition to the reserve area. The potential expense of this provision is greatly mitigated by the ability of a landowner to obtain an easement on neighboring land for use as part of the dilution area. This allows the party interested in installing a mass drainfield to avoid the expense of identifying a dilution area if it would be cheaper to buy the property right from a neighbor.

There is one problem with this provision. The permit for the mass drainfield requires the landowner to keep the 100% reserve area and the dilution area together as part of the property served by the drainfield. However, there is no requirement that this restriction be recorded as an appurtenance to the land. Thus it would be possible for the drainfield owner to subdivide the land and sell off the dilution area and even the reserve area with little prospect that the permit requirement would be detected or enforced. The Department of Health reports only one known instance of a violation of this type. Yet, as land values rise, the incentive to violate the terms of the permit will increase.

The requirement that the permit restrictions be recorded as a restriction on the alienability of the property would cost no more than $100 at the time of the permit and would act as a very effective enforcement mechanism to prevent permit violations. It would help increase transferability of land by reducing the amount of expensive pre-purchase inquiries that would be required in absence of recording the permit restrictions.

Conclusions

These regulations have been designed in a way that greatly increases ground water protection in many parts of the state but with only very modest increases in costs. In

fact some of the provisions may actually lead to lower costs, although there is not sufficient data to draw a firm conclusion on this. The range of possible values for the health effects of ground water contamination is uncomfortably wide. Most observers, including those from industry, environmental groups, academia and government, seem to feel that the figure is unlikely to be at the low end of the range given. However, there is a very great need for more data on the effects of OSWDS on water quality and disease. Until this data is available, we can have little confidence that we have chosen the proper amount of ground water protection.

Also, given that some of these regulations protect consumers from the effects of their own choices, we should ask why these provisions are needed at all. Again, most observers agree that consumers often turn a blind eye toward the problems of managing their wastewater stream even if it means high costs in the future. It would be very useful to have additional information about how households make septage management decisions so that regulations can address the cause of the problem rather than its symptom. This may allow for a lower cost way of solving the problem.

Finally, the mass drainfield provisions could be improved by requiring that any permit restrictions on the transferability of property be recorded so that all future buyers would automatically be made aware of the restrictions. This would make the policy self-enforcing and would greatly reduce the temptation landowners would otherwise have to violate their permit restrictions. This requirement would be very inexpensive at a total state-wide cost of around $2,000 per year.

Sources

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Agency's Response to Department of Planning and Budget's Economic Impact Analysis:

The Department of Health (VDH) substantially agrees with the Department of Planning and Budget's (DPB) economic impact analysis. The analysis notes that there is general agreement among experts and interested parties that, in aggregate, the benefits of the regulations will exceed the costs. This finding is reflective of the process for the development of these regulations; VDH has proceeded slowly and deliberately, with input being sought from individuals with economic, environmental, scientific and public health interests in the proposed changes. VDH has responded below to the three issues discussed in the DPB analysis.

DPB notes that the rate of illness due to waterborne pathogens is about 30,000 nationally, based on a 1985 reference. Since 1985, Cryptosporidium has become increasingly common and is a significant additional agent of waterborne disease. The American Water Works Association noted the increasing importance of Cryptosporidium in 1995 when it reported the following data: in 1981 there were 7 reported cases of Cryptosporidium worldwide; in 1985 there were 47 cases in Brown Station, Texas; in 1987 there were 13,000 cases in Carrollten, Georgia; in 1992 there were 15,000 cases in Jackson County, Oregon; and in 1993 there were 403,000 cases in Milwaukee, Wisconsin, including 104 deaths. As housing density increases, the potential risk for waterborne disease outbreaks increases. The proposed regulations are intended to

minimize this risk by providing additional wastewater treatment without significantly restricting development. In fact, in most of the Commonwealth, risk can be significantly reduced while allowing sites to be developed that currently cannot be developed.

Issue 1: The Vertical Positioning of Drainfields

DPB notes the benefits of the regulations west of I-95 in terms of increased ability of VDH to issue permits. VDH concurs and notes that there are other intangible benefits resulting from better protection against groundwater contamination. One of the benefits may be a growing tax base as a result of less restrictive development constraints. These benefits extend to other geographic areas of the state. VDH, however, believes the benefits of being able to issue permits on many unpermitable lots also extends east of I-95. Only texture Group I soils have a negative impact and that impact has been evaluated and found to be minor. Texture Group III and IV soils are found east of I-95 and these areas will receive immediate benefits from the proposed regulation changes.

More important in the long term, the regulations propose to make using innovative technology easier. VDH has taken a proactive approach to bring in new technology, including drip disposal, spray irrigation, Bord na Mona and discharging systems for homeowners. The current structure of the regulations has hindered onsite innovation and VDH is making significant changes to the regulations in terms of innovative systems. It is expected that all areas of the state will benefit significantly beginning with the adoption of these regulations. It would appear very reasonable to assume that most of the developments in wastewater pretreatment will benefit the eastern part of the Commonwealth far more than any other area. This is because the eastern part of the state has high watertables (i.e., natural treatment is low) and soil disposal is not difficult

to achieve.

DPB notes that VDH's proposal to reduce drainfield installation depth from 18 inches to six inches would make the drainfield more susceptible to possible damage. As proposed, a drainfield using the reduced installation depth would be required to place additional cover over the field as required by 12 VAC 5-610-950 C which states:

"All systems shall be provided with at least 12 inches of cover to prevent frost penetration and provide physical protection to the absorption trench..."

This 12 inches of cover is nominally equivalent to the cover in a system installed at 18 inches in the current regulations. Hence, the regulations as proposed should not make the drainfield more susceptible to possible damage.

DPB notes that the average drainfield life expectancy is 25 years and that housing stock is expected to last much longer. It is further noted that it is not clear in the regulations what strategy VDH has for developing the information needed to make an informed choice about whether an 18-inch stand-off is adequate. VDH is not aware of any research that correlates greater separation distance with increasing system longevity. A greater separation distance would provide additional ground water protection security. The most practical way to provide a life expectancy greater than 25 years is to provide a reserve area to replace the drainfield. Proposing either a stand-off distance greater than 18 inches or requiring a 100% repair area would cause significant increase in permit denials. Consequently, VDH chose a stand-off distance that is widely recognized to be a vast improvement over the current two-inch stand-off distance.

There is a significant body of scientific information showing that a stand-off distance of

12 inches or less is unequivocally inadequate to protect public health. Further, research conducted over the past 20 years has consistently shown two to four feet of separation distance is safe. In Virginia, VPI & SU has shown that 18 inches of stand-off can provide safe, adequate and proper wastewater treatment. DPB notes the studies by Ross (B.B. Ross, et. al. 1991) showing up to 49% well contamination rates in Virginia. While there are certainly a variety of sources for this contamination, it would not be unreasonable to assume a portion of it comes from septic systems meeting only the minimum requirements of the current regulations.

Relative to data collection, VDH has a program under development that will allow the collection of information on drainfield longevity necessary to determine a cost-effective life expectancy. The hardware and software components are planned to be completed in early 1997. At that time data collection can begin.

The DPB economic analysis considers the cost of replacing a system but does not address the more serious issue of assuring that there is an adequate area available that will support a sewage system. If after 25 years the septic system fails and no repair area was provided for initially, it may not be possible to adequately repair the system. It is not realistic to assume that a suitable $3,500 repair will automatically be available when a system fails. As land prices increase, and lots become smaller, the likelihood of finding a suitable repair area diminishes. In those instances where a site cannot be found to treat and dispose of effluent in a safe and esthetically acceptable manner, the property value and "salability" of the property will be substantially diminished. This reduction in value would almost certainly exceed the estimated $3,500 cost to provide a replacement site at the time of construction. Homeowners living is such a dwelling have

to dramatically reduce their water use habits and, in some cases, accommodate sewage surfacing in their yard.

While the issue of repairs is very important, VDH is not proposing to alter the current repair area requirements in the regulations. When the data is available to make an informed decision, the department will decide whether to proceed with further regulations governing repair area requirements.

Issue 2: An Observation Port for New Septic Tanks

DPB notes that if homeowners pump out their septic tanks, as recommended by VDH (i.e., when tanks are one-third full of sludge), septage disposal capacity will be temporarily exceeded and then the cost of septage disposal will increase. This problem has been studied by VPI & SU for the areas east of I-95 (covered by the Chesapeake Bay Act). Its findings were that adequate and accessible septage disposal capacity is available.

For areas west of I-95, VDH agrees with DPB that septage disposal capacity most probably is not adequate, if everyone maintained their system properly. This was part of the basis for VDH proposing an inspection port rather than mandating routine pump out, as initially proposed by the Secretaries Task Force Studying Septic Regulations. VDH does not expect everyone will inspect and pump their tank out; however, individuals will have a feasible way to readily inspect their tank and decide if they wish to have their tank pumped. This proposed inspection port is analogous to an oil dip stick in one's personal vehicle; it provides the opportunity to monitor the level and condition of the oil but it does not assure that maintenance will occur.

As for cost, there is at least one safe, low cost septage disposal method that could be

made available in Virginia. Lime stabilization of septage is a proven (and EPA recognized and approved) low-tech solution that does not require expensive infrastructure such as a secondary wastewater treatment plant or lagoons to make available. It is well suited to rural areas where agricultural land is available for land disposal. At the present time, lime stabilization is prohibited by the Code of Virginia. Should the prohibition on lime stabilization be rescinded, VDH believes adequate septage disposal capacity should be available statewide.

Issue 3: Mass Drainfield Requirements

VDH agrees with the analysis as presented. Further, the observation that property restrictions related to mass drainfields could be recorded with the deed is an excellent point and will be considered as part of the comment process.