Economic Impact Analysis

VR 355-34-02 - Sewage Handling and Disposal Regulations
October 30, 1995

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

[1] This section relies heavily on Stolt and Reneau (1991).
[2] Cruan, G.F. (1985).

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.

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 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

[3] See B. B. Ross et al. (1991).
[4] *See* Cruan, G.F. (1985).

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 days	1	3	5
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.

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.

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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.

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 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.

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

[8] A figure suggested by DOH.

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.

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 $1,125000 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 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

[9] This can probably be credited to "jawboning" by DOH field staff although some 100% reserve requirements are required under the Chesepeake Bay Agreement.

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 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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