Insurance as a Means of Regulating Individual Sewage Disposal Systems in Rhode Island

(The Argument for Market-Based Controls)

by
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Abstract

Homeowners in the State of Rhode Island, and across the country, rely heavily on individual sewage disposal systems (ISDSs) for the treatment and disposal of domestic wastewater. In 1968 the State of Rhode Island began regulating these systems to minimize human health, environmental and economic risks associated with poor performance of ISDSs. Regulation of the design, construction, siting and installation of these systems has progressed as a greater understanding of septic systems processes has been acquired. However, regulation falls short with respect to providing homeowners with incentives to take necessary maintenance measures and repair or replace antiquated systems. In 1987 enabling legislation was passed allowing municipalities to implement Wastewater Management Districts. The Department of Environmental Management hopes to push the implementation of WWMDs in Rhode Island communities as a means of regulating homeowner maintenance. There are several limitations to a regulatory approach of this sort. A conceptual framework for an alternative regulatory approach, an insurance requirement, is presented. A comparative analysis was completed to illustrate the advantages and disadvantages of each strategy. The criteria for evaluation includes the effectiveness, efficiency, ideological concerns, and political feasibility of each approach. In terms of effectiveness, WWMDs have proven their ability to insure adequate homeowner maintenance, while little "real world" experience with market-based approaches like an insurance requirement is available. An economic analysis shows the potential of incentive-based regulatory approaches to achieve regulatory goals in a cost-effective manner. Ideologically, each strategy presents merits. Command and control techniques such as WWMDs explicitly state the goals and objectives of regulation, while incentive-based pricing has the potential to align our economic system with an ecologically sound "land ethic." With respect to political feasibility, WWMDs while unpopular at the local level, stand a good chance of being implemented across the state. Alternative regulatory approaches are being increasingly studied and experimented with, but the likelihood of implementing an insurance requirement is slim. Upon completion of this analysis a hybrid regulatory approach was designed in an attempt to incorporate the advantages of each option into a single regulatory approach. It is recommended that DEM continue encouraging communities to implement WWMDs with an incentive-based pricing schedule similar to that which an insurance requirement would provide.

Introduction

During the 1960s a plethora of government actions were taken in response to the great many concerns our increasingly affluent society had produced. There was a call for action and the federal government responded by creating regulatory agencies and budgetary programs. It was a commonly held belief that any social or economic problem could be dealt with through these programs. A backlash of resentment against these regulatory agencies and the means they employ to achieve their objectives has been generated (Schultze, 1977). Critics of this system point to the inefficiencies that arise under our current regulatory regime (Beckerman, 1990).

The last decade has brought the issue of what devise is best suited to deal with societal concerns to the forefront of the political debate. The possibility of transferring a portion of regulatory responsibility to the private sector is one popular alternative to traditional command and control regulatory mechanisms. In 1988, the Environmental Protection Agency (EPA) implemented legislation which requires underground storage facilities to prove that they are financially capable of funding cleanups in case a release occurs from one of these tanks (GAO, 1988). One means of establishing "financial responsibility" is purchasing an insurance policy. This work attempts to apply a framework similar to that of financial responsibility, namely an insurance requirement, to the problem of individual sewage disposal system (ISDS) failure in Rhode Island.

The first section of this paper provides some insight into the extent of the problems presented by poorly performing septic systems in Rhode Island (I. Scope of the Problem). Next, the factors contributing to ISDS failure are outlined (II. Septic System

Function). Thirdly, the objectives in addressing ISDS function are presented (III. Goals). The fourth section is devoted to examining the current ISDS regulation and alternative regulatory approaches for dealing with poor ISDS performance in the State of Rhode Island (IV. Regulatory Options). Rhode Island uses best available technology standards to regulate the design, construction, siting and installation of ISDSs. An informational distribution approach is used throughout the State to encourage homeowner maintenance and investment in the repair or replacement of failing systems. This approach has proven ineffective as evidenced by the ISDS failure rate. To address this regulatory quandary, the Rhode Island Department of Environmental Management (RIDEM) has designed a program that would allow municipalities to set specific standards for homeowner maintenance. An alternative approach, an insurance requirement; is discussed and its relative merits are examined. The fifth section of this paper examines the potential effectiveness, efficiency, ideological concerns, and political feasibility of WWMDs and an insurance requirement (V. Comparative Analysis). Finally, this paper outlines the course of action RIDEM should pursue in attempting to regulate homeowner initiated maintenance and investment in the repair and/or replacement of inadequate systems (VI. Recommendations).

II. Scope of the Problem

In Rhode Island approximately one-third of all homes, 140,000, rely on individual sewage disposal systems (ISDS) for treatment and disposal of domestic wastewater (Governor's Advisory Committee on Wetlands and Septic Systems, 1995). This number is rapidly approaching 150,000 as 40% of housing starts construct these systems as a means of disposing of their wastewater. These systems can be as functional, last as long, and in some instances offer more cost-effective treatment than centralized sewage treatment facilities (GAO, 1994). The potential efficacy of these systems is acknowledged by the EPA's recommendation that communities consider on-site sewage disposal systems where 50 or fewer households will be connected to each mile of sewer (GAO, 1994).

Despite the abundance of use and potential of these systems they are far from infallible. In 1995 it was recognized that between 20 and 30 percent of Rhode Island's septic systems are failing (Governor's Advisory Committee on Wetlands and Septic Systems, 1995). As a result areas densely populated with septic systems have experienced a great many problems. Elevated levels of total and fecal coliform bacteria have been correlated with substandard septic performance (Rhode Island Nonpoint Source Pollution Management Plan, 1995). The impacts of these elevated levels surface in several of Rhode Island's waters in the form of human health risks and/or environmental quality problems. The Narrow River, which flows through the towns of North Kingstown, South Kingstown, and Narragansett has been closed to shellfishing since 1986. RIDEM attributes this closing at least partially to leachate and/or overflows from septic systems. Substandard septic system performance is also thought to be at least partly responsible for shellfishing closures in Green Hill Pond, portions of other salt ponds in southern Rhode Island, the Kickemuit River, the Island Park area of Portsmouth, and Greenwich Bay (Rhode Island Nonpoint Source Pollution Management Plan, 1995).

Groundwater is also at risk from ISDS contamination. Groundwater also acts as a route contamination takes to other water bodies (NSFCH#2, 1995). Samples from private wells, taken by the Rhode Island Department of Health between 1975 and 1985, exceed drinking water standards for bacteria in 40% of shallow wells and 8% of deeper, drilled wells (Rhode Island Nonpoint Source Pollution Management Plan, 1995). Poorly performing or improperly sited septic systems have the potential to contribute nitrates, phosphorous, and viral contaminants, in addition to bacterial contaminants, which can adversely effect human health and/or environmental quality in a number of ways (Husband, 1990). Additionally, household hazardous waste□ disposed of via septic systems may not only emerge untreated from the system, but actually hinder the system's ability to effectively treat domestic wastewater□ (NSFCH#2, 1995).

Human Health, Environmental and Economic Consequences

Thus far the problems associated with septic system performance have been discussed primarily in terms of elevated viral and bacterial levels or nitrate and phosphorous contamination. These chemical effects do not sum up the problem though. For an adequate evaluation of consequences one must look at the wide variety of human health, environmental quality, and economic consequences of water contamination from ISDSs. This segment examines who suffers the consequences and as a result who would be interested in bringing septic system performance in the State of Rhode Island to an acceptable level.

Perhaps the most salient, and certainly the most publicly recognized issue is human health. Failing systems can lead to contamination of ponds, streams, lakes and groundwater. Roughly 95% of rural communities rely on groundwater as a drinking water source, which exposes these communities to numerous health hazards if their groundwater supplies are contaminated by septic system discharge (NSFCH#1, 1995). Human waterborne pathogens have the potential to cause dysentery, gastroenteritis, typhus and probably hepatitis A in human populations (Husband, 1990). Diarrhea, poliovirus, hepatitis A, meningitis, respiratory diseases and eye infections can be caused by viruses in drinking water and nitrates have the potential to cause "blue-baby syndrome" (Husband, 1991).

The shellfishing industry has a considerable interest in water quality. Countless thousands of dollars a year are lost due to shellfishing closings, and it has been estimated that over 80% of closures can be at least partially attributed to failing septic systems (NSFCH#3, 1992). The State of Rhode Island also has a vested interest in maintaining, and in some cases improving, water quality. The Federal Water Pollution Control Amendment of 1972 (Clean Water Act) requires states to implement regulations limiting discharge into lakes, rivers and other bodies of water (GAO, 1994). The State is required to outline specific management plans for nonpoint source pollutants or run the risk of losing federal funding available under Section 319 of the Clean Water Act (Rhode Island Nonpoint Source Pollution Management Plan, 1995). Additionally, administrators may feel a public backlash if adverse human health, environmental and/or economic effects continue to mount.

Finally, homeowners have a twofold interest in addressing this problem. First, since rural communities rely heavily on groundwater as a drinking water source, and these are the same communities that use ISDSs for wastewater disposal, homeowners are potentially polluting their drinking water source when their septic systems do not adequately treat their domestic waste. Second, homeowners have a direct economic interest in maintaining their ISDSs. Septic system care has been likened to automobile maintenance□. Frequent low cost maintenance leads to a decrease in high future repair or replacement costs (NSFCH#2, 1995).

III. Septic System Function

The typical septic system consists of two parts: the septic tank, and the drainfield (Loomis, 1991). Wastewater flows from the home to the septic tank. The wastewater is retained in the tank for at least twenty-four hours, during which time the solids separate from the liquids. The solids that are lighter than water float to the top of the tank forming a scum layer. The solids heavier than water settle at the bottom of the tank forming a sludge layer. The resulting middle layer consists of partially clarified wastewater which flows through the outlet baffle to the drainfield. The drainfield acts to purify the wastewater by allowing it to trickle from a series of pipes out into gravel or sand and then down through the soil (Loomis, 1991). The waste moves through the soil where organisms work to remove toxins, bacteria, viruses, and other pollutants.

Performance Factors

ISDSs rely, in part, on natural systems to treat domestic wastewater (NSFCH#1, 1995). If these systems are broken down or overloaded, wastewater may emerge from the treatment process contaminated. Five factors contribute to the performance of septic systems: design, construction, siting, installation, and maintenance. When all five are sufficiently managed, an ISDS has the potential to operate effectively for twenty years or more (NSFCH#1, 1995). Overlooking any one of these, though, can lead to subpar performance. RIDEM outlines specific minimum standards for the design and construction of new septic systems (RIDEM, 1992). An extensive site suitability test is required before an ISDS can be built or altered and the installation must be certified by a licensed master plumber or installer. Statewide regulation falls short with respect to maintenance though. Although the RIDEM states that, "All building sewers and individual sewage disposal systems shall be maintained in good repair by the owner," the Governor's Advisory Committee reported that homeowners do not take adequate maintenance measures (RIDEM, 1992; Governor's Advisory Committee on Wetland's and Septic Systems, 1995).

Due to increasingly stringent standards on design, construction, siting and installation, maintenance initiated by the homeowner has been recognized as a key determinant in septic system performance (NSFCH#2, 1995). Though faced with the possibility of health risks and economic loss, homeowners do not keep up their systems adequately. Statewide regulation does not seem to provide the immediate incentives necessary for homeowners to appreciate the importance of maintenance. This in addition to homeowners' ability to determine maintenance levels, makes maintenance a promising arena for regulatory action to improve septic system performance.

IV. Goals

As mentioned in the previous section, the first four factors influencing septic system performance are heavily regulated using traditional "command and control" methods (RIDEM, 1992). The question at hand is what further action can be taken to improve the performance of ISDSs. What is apparent from the information outlined in the previous pages is that some regulatory action is necessary. Traditionally, the alternative to on-site sewage disposal systems has been the installation of conventional sewage treatment facilities. Due to the extensive infrastructure necessary for a centralized sewer system, these arrangements are cost-prohibitive in most rural communities (GAO, 1994). The regulatory approach, then, needs to focus on the systems that are currently in place and insure that future installations can be accommodated by the natural systems.

The first step in formulating a regulatory approach is to explicitly establish goals (Hogwood, 1984). It is obvious that a minimization of human health, environmental and economic risks associated with poor septic system performance is first and foremost. It is necessary to improve the quality of waters falling within watersheds contributed to by septic systems. To accomplish this, performance of existing septic systems must be improved and new systems must cause no further degradation. Finally, addressing the weak link in the current regulatory strategy, homeowner maintenance, is necessary. For this reason, the focus will be on those steps currently being taken to induce homeowner maintenance and potential options for improving maintenance. Additionally, since septic system performance is, in part, a function of the system's age, a regulatory tool for identifying and upgrading antiquated systems is necessary. These are the output goals, or human health and water quality objectives. There is an entirely separate set of goals dealing with inputs. The most efficient means of reaching these human health and ecological objectives is the second goal.

V. Regulatory Options

Informational Distribution

An examination of the current regulatory approach is the first step in sifting through potential regulatory options. Although the State of Rhode Island outlines a minimum standard that all ISDSs must be "maintained in good repair," no specific requirements are made (RIDEM, 1992). The strategy presently in place relies primarily on informational distribution as a means of persuading homeowners to take appropriate maintenance measures. The EPA has established the National Small Flows Clearinghouse to collect pertinent information and disseminate it to ISDS owners at the national level (NSFCH#1, 1995). At the State level, RIDEM sends out an ISDS factsheet entitled "Maintaining Your Septic System" when a new system is installed□ (Loomis, 1991). The idea is that if homeowners have access to the information necessary to evaluate and understand the consequences of their actions, they will act in a manner consistent with their best interests, which in this case correspond with societal goals (Fiorino, 1995). An example of this type of strategy is addressing radon levels in housing. Information about the health risks associated with elevated radon levels is distributed and homeowners are encouraged to test their level. If the test reveals an elevated level taking appropriate steps to manage this risk is recommended. Nowhere in this scheme are specific requirements made. Individuals are presented with information meant to influence behavior in a manner that will reduce environmental, health and economic risks.

Homeowners are not responding to this informational distribution as policy makers would have them. This can be attributed largely to three factors. First, although most of this information is made available in the form of mailers, homeowners may not take the time to read them. Without the necessary information disseminated the effectiveness of this regulatory strategy crumbles. Secondly, even if homeowners read through the informative materials, they may not go through the conscious decision making process that would lead them to invest in septic system maintenance. After the information is digested by the homeowner (assuming it is digested), a certain amount of processing is necessary to arrive at the policymakers' goal. The third limiting factor in informational strategies is the inconsistency of individual decision making. Decision theory states that in the case of uncertain, future events, potential risk managers (homeowners) vastly underestimate the likelihood of the event. Additionally, individuals excessively discount future costs and take present costs at full value (Cairncross, 1993).

Direct Regulation

Having examined (albeit briefly) the system currently in place, it is now possible to move forward and discuss alternative, or supplementary regulatory strategies. There are two additional options for reaching public policy goals. The first of these is direct (or command and control) regulation (Fiorino, 1995). Direct regulation has been the main tool in environmental regulation since the 1960s and is largely responsible for the progress made thus far (Cairncross, 1993). Direct regulation is a method of making individuals or firms "internalize" their societal costs. The internalization comes in the form of investment in technological controls, obtaining permits, restricting use, etc. (Fiorino, 1995). In a system of this sort, regulators set standards to which all must adhere. In some instances this is a maximum level, as with emissions standards. Polluters are forced to limit their emissions to a specified level (generally given in numerical terms, ie. parts per million), or face a penalty (Fiorino, 1995). In some cases the maximum level is zero, as with the DDT ban. Direct regulation may also be applied as a minimum level, as with best-available technology requirements. Regulated parties must install and use pre-approved technological controls. This is the case with new septic systems in Rhode Island. Specific minimum standards relating to the design and construction of septic systems are outlined in the RIDEM's "Rules and Regulations Relating to Individual Sewage Disposal Systems" (RIDEM, 1992).

The advantages of direct regulation lie in its simplicity, its equity, and its ideological delineation between right and wrong (Fiorino, 1995). The simplicity and equity lie in the same standards being applied to each regulated party. Everyone must comply with the same standards. Ideologically, standards more clearly define the policy's goals and objectives. These regulations become imbedded in societal norms, eventually providing an element of "moral suasion".

Limitations of Direct Regulation

Despite the progress made thus far with direct regulation, there are a plethora of disadvantages associated with this approach. First, the simplicity of standard setting is questionable (Beckerman, 1990). A variety of economic and technical factors need to be taken into account when setting any standard. In the case of emissions standards the centralized authority must have information on the current level of emissions, the distribution of these emissions, the goal for reduction and economic and social factors that may hinder compliance. For technology-based controls regulators must have information on the current level of technology, the goal for emissions reduction, the technology that will produce this reduction, and again, economic and social factors that may hinder compliance. The enforcement of direct controls is also often a monstrous task. Monitoring on the part of the regulating body is often necessary and in instances where the polluter provides data showing compliance there is a strong incentive to lie. Additionally, the regulating body may need sufficient evidence to satisfy a court of law that a polluter has exceeded the standard (Beckerman, 1990).

Direct regulation is also criticized for its lack of incentives to develop new technology for pollution control. Regulators decide the appropriate level of emissions or technological innovation and there is little or no incentive to surpass these levels. In the case of technology-based controls, the choices available are limited, and therefore may remove all incentives to improve technological processes (Jaffe, 1995). In addition, regulated firms may fear that if cleaner technology is developed, the standard will be tightened. An argument can also be made as to whether the standard setting process is truly uniform. New sources and old sources may be treated differently. This is the case with new ISDSs in Rhode Island versus systems that "grandfather" the technology-based controls.

Perhaps the most compelling argument against direct regulation is the inefficiency of uniform standards. Example: It may cost firm A five dollars to reduce emissions by one unit. Firm B may be able to reduce emissions by one unit at a cost of only one dollar. This leads to an inefficient allocation of resources in the case of commensurate standards. A six dollar investment is necessary to reduce emissions by two units. The same level of reduction could be achieved for a cost of only two dollars if Firm B reduced emissions by two units with the same societal gain.

Wastewater Management Districts

Despite these shortcomings the State of Rhode Island is hoping to employ a direct regulation scheme to address the problems presented by ISDSs. In 1986 the RIDEM organized a task force to examine the ISDS regulations and recommend revisions (Rhode Island Department of Administration, 1987). A key finding was that existing regulations did not adequately address the problem of regular maintenance. Also, it was determined that the State did not did not have the resources to implement an ISDS maintenance program. For this reason, it was recommended that municipalities establish maintenance programs to prevent septic system failures. These local regulating bodies are known as Wastewater Management Districts (WWMD) and enabling legislation was passed by the General Assembly in 1987 allowing municipalities to establish WWMDs (Rhode Island Department of Administration, 1987).

The adoption of a WWMD ordinance allows municipalities to (Rhode Island Department of Administration, 1987):

1. Allow passage of district officials and septage haulers onto private property when necessary for inspection, maintenance, and repair or replacement of ISDSs.

2. Raise funds for the administration and operation of the WWMD by assessing property owners taxes or annual fees, borrowing or issuing bonds, or setting and levying rates for pumping.

3. Establish the administrative, financial, and technical structures to implement and support WWMDs.

4. Establish a public education program to make property owners aware of proper maintenance and the need for regular pumping.

5. Receive grants and establish a fund to make low interest loans available to property owners for the repair or replacement of failed septic systems.

6. Levy fines for noncompliance.

7. Regulate and contract septage haulers and the eventual means of of disposal.

In essence, a regulating body is created at the local level to insure that ISDSs are inspected on an annual basis and adequate maintenance measures (inspection and pumping) are taken. Direct regulation relating to inspection and maintenance are devised and the WWMD is the body responsible for making sure that these regulations are carried out.

One such WWMD is found in the town of Narragansett, Rhode Island. In 1992 Narragansett passed an ordinance which requires homeowners with ISDSs to have their system pumped out at least once every four years□. The burden of proof of compliance is placed on the homeowner as he/she is required to provide proof of pumping to the Building Inspector's Office. Additionally, the disposal of hazardous waste is prohibited as are garbage disposals except for existing units.

Though touted as "a realistic and affordable solution to the problem of failing septic systems," Narragansett is one of the few communities which has adopted WWMDs in the decade since the enabling legislation was passed (Rhode Island Department of Administration, 1987). The problem is that there is no immediate incentive for communities to adopt WWMDs□. They are seen as politically unpopular intrusions into the personal freedom of one's own home by residents, and an administrative hassle by the community□. The Conservation Commission had designed an ambitious regulatory system for implementation in Narragansett, which would include a rotational pumping schedule□ and water-use based annual fees□, but was forced to fall back on simply requiring pumping due to public dissention.

To put immediate incentives in place for communities to implement WWMDs, RIDEM is currently working on a plan to tie Clean Water Management Funds to the adoption of these Districts□. Once a community shows proof that an adequate management plan is underway, the State will provide monies in the form of a grant to the community. Criteria for receipt of grant monies are as follows□:

1. Description of the management area. Municipalities must map area to be managed; as well as identify the impacts of failed/ failing ISDSs.

2. Description of the community assistance programs for ISDS repair/ replacement.

3. Description of method to ensure or encourage regular ISDS maintenance- information initiative, pump-out subsidies, a

maintenance requirement, etc.

4. Description of administrative plans.

5. Description of septage disposal method.

Grant monies are intended to defray costs of development of a management plan and administrative costs, provide septic system inspections, and initiate public outreach. WWMDs should emerge in communities serviced by ISDSs at a much higher rate with funds tied to their adoption.

Limitations of WWMDs

WWMDs are very likely to be effective in addressing the problem of poor homeowner maintenance. A rigid schedule for inspection and maintenance will greatly improve the likelihood that these activities are carried out. The Town of Narragansett has seen a significant improvement in homeowner maintenance since the implementation of its management plan□. Additionally, if these municipalities make low-interest loans available for the repair or replacement of failed septic systems, this investment is much more likely to occur. One of the foremost questions that needs to be addressed when considering this plan is that of efficiency. The recommended means of raising funds for the operation of a WWMD is assessing each homeowner within the district a flat fee based on the number of units owned (Rhode Island Department of Administration, 1987). The result of a flat fee and a uniform inspection and maintenance schedule would be the same inefficiencies as mentioned previously. Some homeowners' systems are more reliable than others and need less service. For example, it is recommended that a household with a 750-gallon septic tank and two year-round residents pump-out said system once every 4.2 years (NSFCH#2, 1996). A household with a 1000-gallon septic tank and two year-round residents requires pumping only once every 5.9 years. It would be unnecessary for the second household to abide by the same pumping schedule as the first. The result is an unnecessary expenditure by the second household. The recommended flat fee also provides no incentive to go above and beyond, in terms of ISDS upgrade. The fee is flat regardless of the technology used.

Additionally, a very limited maintenance program is required to receive the Clean Drinking Water Management funds. A local management plan that uses an educational initiative to ensure ISDS maintenance would be eligible for grant monies. This closely resembles the strategy RIDEM is trying to improve upon. The theory is that communities will be more likely to take small strides than to adopt a full-scale WWMD□. Once a minimum maintenance program is in place, the community and its constituents will acknowledge the virtues of such a program and take further steps to ensure adequate homeowner maintenance. There are two problems with such a plan. First, gradual policy implementation tends to produce scattered results. Approaching a problem piecemeal leads to less effective results. Second, there is also no guarantee that communities which implement maintenance programs to the degree necessary to receive Clean Drinking Water Funds will take any further steps toward establishing a complete WWMD.

Market-Based Regulation

Due to the shortcomings of direct regulation, additional regulatory approaches are being increasingly studied. The third regulatory mechanism, market-based control, is a popular alternative to traditional command and control regulation. There are two basic types of market-based approaches. These policies differ in whether they are quantity-based or price-based (Farber, 1991). The first type is deemed "direct" regulation, direct in that in that they explicitly state the ceiling of emissions. An example of this strategy is marketable permits (Fiorino, 1995). The appropriate governmental agency decides the maximum aggregate level of emissions. Each source presently emitting the pollutant then receives a specified number of emissions credits. The firms then buy or sell these credits depending on their individual cost of pollution reduction. The second type of market-based approach is an "indirect," indirect in that no specific ceiling is stated (Farber, 1991. There are several indirect market strategies, an example of which is a pollution tax. Pollution taxes also recognize that different firms have different pollution control costs (Fiorino, 1995). A fee for each unit of pollution is leveed and firms are expected to reduce their discharge to the point where the marginal cost of an additional unit of pollution equals the per unit fee. The level of reduction is a function of the size of the tax and the tax is tailored to reach the goal of aggregate reduction. Some firms will reduce emissions below the level of a commensurate standard and others will not reach the level a standard would set, the aggregate effect being the same overall reduction.

As might be expected given the economic origins of this regulatory approach, many of its superior qualities are derived from its ability to produce results efficiently (Cook, 1988). Proponents of this system argue that the same policy objectives can be achieved at a lower cost through market-based financial incentives than through a command and control system (Gordon, 1994). The EPA estimated that the tradable permit system for reducing acid rain would save approximately $4 billion (Page). Costs differ with each individual and, as a result, the cost of reducing emissions (or reducing the risk of ISDS failure) differs as well. Those individuals who can reduce pollution cheaply will take more pollution control measures than those with high abatement costs (Beckerman, 1990). They use fewer resources for this purpose and thus, reduce the societal cost of pollution control.

Market-based controls also provide continuous incentives for the development of environmentally superior technologies (Jaffe, 1995). It is always in the individual or the firms best interest to reduce emissions if inexpensive technologies can be found, because this reduction generates revenues in the case of marketable permits or reduces costs in the case of a pollution tax. The ability to change is one of the key attributes of a market system. A market necessitates efficiency in processing and distributing information, which is where the information distribution strategy falls short (Cook, 1988). Prices provide uniform signals to individuals that are less subject to distortion than a set of rules (Gordon, 1994). Furthermore, only information essential to each individual is collected and used. One of the criticisms of a command and control system is that it cannot match the information processing ability of the market. Under market-based regulatory systems, individuals who have access to their costs act as the processor of this information. The advantage is that resources are not wasted through centrally collecting information or misallocating resources because of incomplete information.

Limitations to Market-Based Approaches

Market-based approaches are not without flaw, though. The argument for the aforementioned strategies is the notion that the market is an adaptive and accurate tool for decision making. This has been attacked from a number of angles. First, very little systematic empirical evidence exists documenting the effectiveness of market-based policies (Jaffe, 1995). As a result there is little more than academic theory to base regulatory assumptions on. Second, setting the tax level, permit level, etc.., requires information not only about the desired level of emissions, but also about costs to individuals (Cook, 1988). Another critique of this method involves the monitoring system. Regardless of the instrument used, the amount of emission must be measured, a costly and technologically challenging endeavor. Self-monitoring may be used, but in these circumstances the market provide a great incentive to lie. These information gathering processes run counter to the informational advantages mentioned in the previous section. Third, in the case of a pollution tax, uncertainty would remain about the eventual emissions reduction the tax will achieve (Beckerman, 1990). It is impossible for the regulating body to know the eventual level of reductions with a pollution tax. Fourth, standards give polluters and regulators clearly defined goals and objectives that market-based strategies lack. The goal of reduction is clearly stated and measuring progress toward this goal is possible (Cook, 1988).

The question when addressing the problem of poor septic system performance is, "What type of market-based system to consider?" The first distinction that needs to be made is between output-based controls and input-based controls (Fiorino, 1995). Output-based controls apply the tax or marketable quota to the level of emissions. Input-based controls apply the tax or marketable quota to raw materials used or preventative measures taken in the pollution producing activity. Those approaches using outputs as a means of applying the incentive can immediately be discarded. Applying incentives to outputs would mean measuring the discharge of each ISDS. This type of monitoring system is simply not realistic. With nonpoint source problems it is nearly impossible to show a causal link between a single failed ISDS and human health and/or environmental consequences. For these reasons retroactive liability will be avoided. It would make far more sense to apply the incentives to inputs. In the case of ISDS performance, there is a strong relationship between inputs and failure. Additionally, these inputs can be easily measured. Information on lot size, soil type, system type and age, household size, and maintenance schedule are readily available through census data or purchase receipts. Performance determinants such as these can be used to form a risk matrix and using this matrix potential future liability can be modeled, thereby eliminating the need for output measurement.

Insurance as an Environmental Risk Manager

The insurance industry is extremely experienced in calculating future losses and applying these in the form of user fees. In application of a prospective measurement of liability few are as proficient as the insurance industry.

The insurance industry can act as an environmental risk manager in two ways. First, underwriting guidelines provide a minimum standard. Without a certain level of technology, the industry will not insure the risk. This is applicable to antiquated ISDSs in Rhode Island. ISDSs installed before minimum standards were set in 1968 may not effectively treat domestic wastewater. One of the primary goals of the RIDEM is replacement of these ineffective systems that "grandfather" current technology-based standards. The second method insurance uses to regulate environmental risk is imposing different costs on the insured depending on the expected losses the insured is likely to incur. Using a risk matrix which predicts future losses the insurer differentiates between policyholders. Differentiation in expected losses will then be reflected in risk-based premiums producing a proactive "user fee". In the case of septic system insurance the insurer would charge homeowners different premiums based on environmental risk. Risk reduction steps (maintenance) then result in reduced premiums.

A good example of a risk-based classification scheme is automobile insurance. The insurer predicts accident risk using such variables as sex, age, make and model of car, and additional variables such as "good student" discounts, etc.. An example of a potential risk matrix for ISDS function can be found in Paige Newby's Masters Thesis "Predicting Septic System Failure" (Newby, 1991). Two predictive criteria are found to correlate with ISDS failure: system age and lot size. System age potentially contains two predictive variables. First, there is an obvious correlation between the age of an ISDS and its likelihood of failure. ISDSs last only so long even with periodic maintenance. Second, the age of an ISDS may reflect the system's level of technology. Since 1968, when regulations where first enacted, minimum technological standards for new ISDSs have become increasingly stringent. The newer the system the higher the level of technology. If maintenance levels could be worked into this predictive framework, an ideal model for risk-based premiums would be the result.

The classic example of insurance as a risk manager is in the fire insurance industry. The Factory Mutual Companies were one of the original fire insurance providers that incorporated premiums which reflect fire prevention efforts (Cheit). As a result of these risk based premiums monetary losses to the insurer decreased from 63 cents per $100 of insured value in 1835 to 2 cents per $100 of insured value one hundred years later. This decrease in monetary losses reflects significant risk reduction steps taken by the insureds and the resulting reduction in property damage from these risk reduction measures. In 1982 the EPA hope to rely on the insurance industry's potential as a risk manager when it passed the Comprehensive Environmental Response, Compensation, and Liability Act□ (Katzman, 1987). The Act utilized market incentives provided by the insurance industry to regulate hazardous chemicals. Handlers of these chemicals were required to establish "financial responsibility", a guarantee to pay damages in the case of an accident. Unless a firm can self-insure, financial responsibility must be met by a traditional insurance arrangement.

The benefits of a system such as that outlined in the previous paragraphs are manyfold. First, a portion of the costs presently borne by society (those incurred by a failing septic system) would now be placed on the offending party, the homeowner. The insurance policy is designed to protect ISDS failure. The homeowners ISDS is being insured. The premium paid by the homeowner reflects the likelihood that the system will fail, which reflects the potential for future damage. It can be said that a portion of the external costs have been internalized if accurately reflect potential future damage. The economic incentives are now in place to lead to an efficient level of private investment in septic system maintenance, repair and/or replacement.

The insurance mechanism also has the potential to correct the problem of imperfect information currently causing under-investment in septic system upkeep. The insurance industry's underwriting process serves as a control mechanism requiring a formal risk justification (Katzman, 1987). Having performed this risk evaluation, the insurance industry then imposes the thought process on the homeowner in the form of premiums. This relieves the homeowner of the burden of going through this thought process which many will not perform even with access to the information. The informational distribution can flow both ways. If the insurer knows of a way to reduce losses they can inform the homeowner and homeowner can decide whether or not these risk reduction techniques are worth implementing. Conversely, if the homeowner is taking risk reduction steps that the insurer does not acknowledge in its risk matrix the homeowner has an incentive to inform the insurer of the efficacy of this preventative measure. The insurer has the incentive to incorporate this into premiums because the insured can take their business to a provider that acknowledges these preventative measures.

Frequent premiums□ also address homeowners' propensity toward overly discounting future costs. A limited concern exists for uncertain future events (Katzman, 1987). Homeowners' limited concern is reflected in expenditures on risk reduction measures. Individuals do not see the same rewards for preventing remote, future risks as for alternative investments. A $150 investment in ISDS maintenance could be forgone in lieu of a new stereo, etc. The stereo can be enjoyed now, whereas the benefits from ISDS maintenance are more abstract and distant. With risk-based premiums homeowners see an immediate financial benefit from undertaking ISDS maintenance measures. As a result they are forced to acknowledge costs now. Present costs induce homeowners to weigh the costs of premiums and risk reduction measures and depending on their individual costs, take steps to minimize aggregate payments.

Insurance also acts in its traditional risk spreading capacity in this scenario. An example of this function would be a homeowner who takes steps to minimize risks and whose system still performs poorly. Although inputs might predict ISDS performance well, there are instances where septic system maintenance does not prevent failure. In this case the homeowner would have access to resources for repair or replacement of the failed system through the insurance provider's fund. This risk spreading also allows flexibility. Although it may be counter to their economic best interest, individuals can choose whether or not to maintain or upgrade their system. Even with economic incentives people may not always make appropriate decisions, but with an insurance policy available to cover costs of repair or replacement, these decisions can be accommodated. While inducing ISDS maintenance and investment in upgrade, this behavior is not mandated.

Limitations of an Insurance Requirement

While an insurance requirement has the potential to proactively charge septic system owners for future environmental damage they are likely to produce, legitimate questions remain. The first question when dealing with public health concerns is, "Will a certain minimum level of performance be achieved?" It is believed that a major advantage of direct regulation is that the regulating body knows exactly where the minimum level stands, and whether or not this level is achieved (Beckerman, 1990). This is only an advantage to the extent that the target level is the appropriate target. The advantage of a price mechanism is that if premiums are to low and an inordinate number of systems fail, the insurance industry will respond by raising premiums until this is corrected. With a specific maintenance standards, ISDSs may meet this minimum and no one would know if it is the right target.

For a look at other potential limitations an examination of some of the shortcomings of the "financial responsibility" requirement put into effect under the

Superfund Act will follow. First, the implementation of a "financial responsibility" requirement suggests that a market in pollution liability should emerge (Katzman, 1987). And there is considerable demand for such a market. The limiting factor is supply. Although all risks can be insured if the price is high enough, it is not possible to insure all risks at a price that everyone can afford. This the case with Leaking Underground Storage Tank (LUST) insurance, despite the present and increasing demand (GAO, 1988). By the mid 1980s insurers were maintaining that the riskiness of insuring environmental releases and court decisions involving liability made it difficult to write LUST insurance at a profit. As a result many firms dropped out of the market and LUST owners stopped buying insurance because it was so expensive. EPA estimated that 65% of LUST owners would not be able to comply with "financial responsibility" requirement imposed in 1988 (GAO, 1988). Single service station owners or those who do not meet current underwriting guidelines have serious difficulty obtaining insurance in the current limited market. The result is an uninsured problem. The single station owners who are not likely to comply because of prohibitively high premiums, are precisely the parties whom this regulatory strategy was meant to reach. Members of this group are those who need insurance to be able to guarantee financial responsibility and these are the same individuals that cannot obtain insurance. An insurance requirement for ISDSs has the same potential. Homeowners with antiquated systems would fall into the high end of the risk matrix, and would likely be the same homeowners who do not have the funds to pay high insurance premiums or upgrade their systems.

Another concern is that the presence of insurance will cause a "moral hazard", in that the insured would feel safe with higher risk activities because they are insured

(Heimer, 1985). ISDS insurance is an instance where moral hazard could arise, because the tank is insured. If its replacement is covered entirely by the insurance policy, then the insured has a perverse incentive to underinvest in ISDS maintenance and upgrade. To address this problem the insurer must link the homeowner's interests to septic system performance. There are two components to this link. First, the insurer will design the policy such that repair/replacement costs are shared with the policyholder. Homeowners may be responsible for 10-20% of replacement costs in the form of a deductible. Second, precise and extensive risk classification is necessary. If the risk classification system does not accurately reflect expected losses, homeowners would undoubtedly respond to insurance with a reduction in preventative measures.

Additionally, it is often argued that market-based regulatory approaches do not provide the same element of "moral suasion" as direct regulation. Standard setting draws a line which is not to be crossed and the public takes comfort in this ideological establishment of right and wrong. The symbolic value of establishing a definitive line that is not to be crossed is a legitimate argument.

Weighing Potential and Potential Limitations

As mentioned earlier, individuals and the insurance industry evaluate potential risks differently. A diversion between the insurer's and the insured's estimate of the expected losses arise as a result (Katzman, 1987). While the insurer demands a premium that exceeds expected losses, individuals are willing to pay considerably less that the insurer's premiums. The greater the difference between estimated expected losses, the greater the difference between what the insurer is willing to accept for coverage and what the insured is willing to pay for coverage. This suggests that an insurance market would not arise without an insurance requirement. This being the case the first step in developing an insurance market for ISDSs is an insurance requirement.

Mandatory insurance does not address the regressiveness of such a program (i.e. those most in need of insurance would be least able to pay), which raises equity questions. The question is, "What is to be equitably distributed?" Is it cost per individual or is it cost as a function of future expected losses? To bring private costs in line with societal costs, insurance premiums must reflect potential environmental damage. This does not address the regressiveness of such a policy, but if proper incentives for ISDS maintenance and upgrade are an objective, then it is a necessary evil that some will be more affected than others.

VI. Comparative Analysis

Having briefly outlined two regulatory strategies for dealing with the problem of poorly performing ISDSs, and having discussed some of the advantages and disadvantages of both, it is necessary to hold these contrasting approaches up to the same criteria for evaluation. To accomplish this the two methods are juxtaposed and scrutinized from four different angles. In essence, four questions are asked to determine how well the proposed solutions would work. The criteria for evaluation are as follows:

1. "Which of the approaches will be the most effective in addressing the environmental quality and human health concerns resulting from failed ISDSs?"

2. "Which is the most economically efficient method of

accomplishing ISDS performance goals?"

3. "What values are formed and shaped as a result of each policy option?"

4. "Is it politically feasible to implement each method?"

Effectiveness

The first step in evaluating these two policy options is predicting the impacts they will have on the existing water quality and human health risks (Weimer, 1991). Neither approach attempts to remediate existing water quality problems. The question is, "Which method will more effectively deal with the problem as it has been defined in the previous pages, poor septic system maintenance and underinvestment in ISDS repair or replacement?" Strict command and control approaches, such as WWMDs, have proven their efficacy (Cairncross, 1993). The Town of Narragansett has documented an improvement in ISDS maintenance□. But although an improvement has been made, Narragansett only has a 65% compliance rate, which leaves considerable room for improvement. Conversely, very little experience exists regulating environmental problems with market-based approaches, especially one as obscure as an insurance requirement (Jaffe, 1995).

Moving past the question of experience, what are the expected effects of the respective options? In short, what will happen to homeowner maintenance and ISDS upgrade and repair? It is important to note that improving maintenance may not result in an improvement in ISDS repair and/or replacement, and vice versa. For this reason they should be examined separately. With respect to maintenance, WWMDs are very likely to have a substantial positive effect. Periodic inspection and maintenance are mandated with penalties for noncompliance. As mentioned in the previous paragraph, Narragansett has seen an increase in homeowner maintenance. An insurance requirement, on the other hand, leaves the resulting level of maintenance up to the homeowner. What can be said is that the incentives will be in place to induce homeowners to improve maintenance. With respect to inducing ISDS repair/replacement, WWMDs are lacking. One of the biggest disadvantages in the WWMD approach is that there is no immediate incentive to upgrade an antiquated system. The homeowner pays a flat fee regardless of what type of ISDS is in place, whereas insurance premiums reflect the age and type of system a homeowner uses. The effect is higher premiums for antiquated systems, and thus, an incentive to upgrade.

WWMDs are a proven means of ensuring that maintenance measures are taken by homeowners. They fall short in promoting the upgrade of antiquated systems. The incentive structure of an insurance requirement is better suited to induce homeowner investment to upgrade potentially threatening ISDSs.

Economic Efficiency

The second angle for comparing the two methods is in terms of efficiency. For this comparison a modified cost-effectiveness analysis will be employed (Lave, 1981). Cost-effectiveness is an ideal means of comparing policy options as it measures efficiency in relative terms. It is generally used to find the alternative that will achieve the highest level of benefits at the lowest cost. The goal is to maximize net benefits (total benefits minus total costs).

One of the greatest difficulties when comparing costs and benefits in a field such as the Environmental Sciences is quantifying benefits. Additionally, it is impossible to hold benefits constant and compare costs because each method influences behavior differently producing different benefits. So, for a comparison of these two methods economic theory will be used.

Figure #1: Private Investment as a Function of Internalizing Social Costs

Currently, Rhode Island homeowners are investing in septic system maintenance and upgrade at a level where they are incorporating only the private costs of their potential pollution causing activity (Point A, Figure #1). At this level society bears the external costs of this activity. The goal is to influence Rhode Islander's behavior such that their level of investment incorporates both the private costs of their behavior and the social costs of their behavior, thereby internalizing the costs that are presently borne by society (Point B, Figure #1). WWMDs will charge homeowners between $30 and $50 a year, which will pay for periodic inspection and pumping (Department of Administration, 1987). This effectively moves the level of investment up the demand curve, but not the entire distance to Point B. Homeowners have internalized a portion of the societal costs, but since $30-$50 a year fee does not reflect the adequacy of their ISDS they have only internalized a portion of the societal costs. The incentive structure of an insurance requirement pushes investment further up the demand curve. In addition to assuming the costs of maintenance, homeowners pay a premium which reflects their ISDS's age and level of technology.

Figure #2: Maximizing Net Benefits

The incorporation of social costs into investment strategy is integral to maximizing net benefits. Currently, Rhode Islanders are at a level of investment such that an increase would lead to greater net benefits (Point A, Figure #2). WWMDs reduce the amount of costs borne by society and raise the level of net benefits. But because commensurate standards are applied some of the investment is made inefficiently, and as a result some of the benefits are lost. For example: If an ISDS needs to be pumped once every six years and is pumped once every four, between $60 and $100 are invested by the homeowner with no direct effect on the performance of their ISDS (Point B, Figure #2). In this scenario net benefits cannot be maximized. An insurance requirement where premiums more accurately reflect future environmental damage internalizes more of the costs presently borne by society. Homeowners are made to realize their private and societal costs. With these incentives in place the individual level of investment will move closer to the point where an additional dollar of investment will produce a dollar of benefits, the level where net benefits are maximized (Point C, Figure #2).

Another factor in producing an efficient allocation of resources is the management of administrative costs. Simply stated, the private sector makes a profit by keeping administrative costs to a minimum.

Maximizing net benefits is the objective. An insurance requirement utilizes private interests and market forces to bring the level of investment in ISDS maintenance and repair or replacement closer to this level than either the current regulatory approach or WWMDs.

Ideological Analysis

Having compared and contrasted the two regulatory approaches in terms of effectiveness and efficiency, this discussion will move on to a method of analysis often left out of the public policy mix, an ideological evaluation. The normative questions in this section will focus on the more elusive second-order effects of public policy. These will be broken down into two categories; those addressing issues of equity, and those asking whether the values reinforced by the policy option further the human-environment relationship policy makers wish to produce.

The first comparison will be in terms of equity, or the equality of each policy option. The first question when trying to determine relative fairness is "What is meant to be fair?" or "What is to distributed equitably?" The goal is a fair distribution of costs to ISDS owners, but this proves to be an elusive objective as fairness is a very subjective concept. If one favors a rugged individualism then fairness depends on very different criteria than if equal access is the objective (Stone, 1988). Each of these options embraces a different definition of fairness. An insurance requirement's pricing scheme equates fairness in terms of cost as a function of expected damage to the environment. In essence, each homeowner pays a sum in accordance with his/her expected environmental impact. This leads to regressive costs. Conversely, WWMDs distribute costs of ISDS regulation equitably in that each homeowner has equal access (flat fee). It would seem that while an accurate reflection of environmental impacts in pricing is desired, this must be sacrificed if it eliminates access for some. One objective of this policy should be to avoid forcing costs on homeowners that they cannot bear.

Next is an examination of the values that are reinforced as a result of each strategy. Government regulation provides an important form of social coordination (Cook, 1988). Rules of behavior work largely because they are left untested. WWMDs have the potential to ingrain in the heads of homeowners that regular maintenance is a requirement of owning an ISDS. This is the aspect of direct regulation known as "moral suasion". Direct regulation establishes protocol and this becomes the social norm. Insurance does not posses this delineation between acceptable behavior and behavior that is not acceptable. But, while insurance does not explicitly state the importance of maintenance, it employs a pricing system that may more effectively convey the message that environmental damage is unacceptable. Aldo Leopold stated that, "Perhaps the most serious obstacle impeding the evolution of a land ethic is the fact that our educational and economic system is headed away from, rather than toward, an intense consciousness of the land" (Leopold, 1949). Incentive programs such as an insurance requirement bring our economic system more in line with an environmentally conscious land ethic. If this can be coupled with an educational program it provides an economically coercive form of "moral suasion".

A fairly finite number of major democratic values are employed in policy analysis. These include: equality, fairness, efficiency, freedom, authority, tolerance and order (Ball, 1995). The desire to bring our economic system in line with a land ethic while acknowledging these values points toward a regulatory approach that through incentives force homeowners to recognize the importance of natural systems. This regulatory tool cannot sacrifice accessibility though. Forcing less privileged homeowners from their homes is not a desirable consequence.

Political Feasibility

The science of policy analysis has become increasingly concerned with the likelihood that a policy option will be able to overcome political resistance during the implementation stage. One White House assistant to the Kennedy administration wrote, "The first question was always, 'Will it fly on the Hill?'" (May, 1986). As is pointed out by the previous statement, a policy option will only be as effective as it is possible to implement. This is the final portion of the four prong policy analysis.

When speaking of the political feasibility, WWMDs are far and away the winner. At the state level enabling legislation is already in place. The only question of feasibility lies at the local level. Although politically unpopular, WWMDs become that much more realizable with Clean Drinking Water Funds tied to their implementation. The fact that legislation is in place for WWMDs means that to implement an insurance requirement for ISDSs new legislation would have to be drafted and pushed through the General Assembly. Also, this is a radically new approach to regulating ISDSs. The checks and balances in our political system are designed to allow for only gradual change. Translated, this means an approach such as an insurance requirement would face numerous political obstacles. In addition to the obstacles of the regulating community, mandatory insurance is not well liked by the public. The popular political ideology of this country almost by definition despises paternalism on the part of government. One only has to cite the example of mandatory auto insurance to illustrate this point.

An alternative approach such as an insurance requirement has political advantages though. As Rhode Island DEM's Scott Millar pointed out, command and control techniques, such as WWMDs, are not "in vogue" in the regulatory community. It is widely held that government has become to big and bulky, inefficient, and ineffective in dealing with the problems of our society (Schultze, 1977). Terms like "downsizing" and "streamlining" are commonplace in political discussions, and the possibility of transferring a portion of the regulatory responsibility to the private sector is a popular alternative. An insurance policy is just such a policy option.

So, while WWMDs are in effect the incumbent, alternative approaches which address social concerns using the private sector have considerate political momentum. Even with this momentum it is unlikely that an insurance requirement will emerge as a means of dealing with ISDS performance problems.

Recommendations

As was illustrated in the comparative analysis of WWMDs and an insurance requirement, there are a great many advantages and disadvantages to each of these policy options. If RIDEM is able to tie Clean Drinking Water Funds to the implementation of WWMDs, these maintenance programs are well on their way to implementation. Insurance, on the other hand has the potential to offer significant economic benefits. For these reasons my recommendation will not be for the implementation of either of these methods are they are currently outlined. Instead, I will try to incorporate the advantages of each method in a tailor-made hybrid.

This tailored policy option closely resembles WWMDs. It utilizes the enabling legislation currently in place. Additionally, Clean Drinking Water Funds are tied to the implementation of these Districts. An incentive is necessary for communities to begin the process of implementation as the discretionary enabling legislation has led to virtually no implementation. The amount of the grant is directly tied to the extent to which the municipality adopts the WWMD and their similarity to the outline RIDEM provides. The grant monies are placed in a fund from which homeowners from which homeowners may draw low-interest loans to pay for ISDS repair or replacement.

It is also recommended that WWMDs are based on watersheds, not on political boundaries. This would involve municipalities working together. RIDEM's grant monies would be divided among cooperating communities. WWMDs based on watershed boundaries more effectively capture the nature of this problem, externalities.

The main difference lies in WWMD's basing their user fees on a risk matrix similar to that outlined in the insurance section. Performance factors are compiled to form a proactive environmental impact pricing scheme. Factors like age of system, type of system, lot size and water use have the potential to provide an accurate assessment of future environmental degradation. ISDS additions to high ISDS density or other high risk areas will have a surcharge to prevent future degradation of these areas. This may help to alleviate some of the regressiveness of the pricing scheme. The difference between the insurance pricing schedule and this proposal is that minimum maintenance standards are set. The pricing differences are based on additional performance factors such as the age of the system and water usage. This provides a baseline of homeowner maintenance while inducing ISDS upgrade and rewarding resource conservation. A necessary evil is that pricing is regressive. A minor concession is that low interest loans are available so that underprivileged homeowners can take themselves out of the high end of the pricing scale. With these loans homeowners have the means to respond to the incentives to upgrade.

The beauty of this alternative is that it draws from each of the outlined models and capitalizes on the potential of each. This hybrid is more effective than either of the two alternatives. It provides a minimum standard, provides incentives to upgrade, and gives homeowners access to funds to respond to these incentives. In terms of efficiency, WWMDs with risk-based fees closely resemble the insurance requirement. The minimum standard is just that, a bare minimum. From this baseline homeowners make their own decisions regarding investment in ISDS repair or replacement.

I believe the plan outlined in this section will prove an effective and efficient method of dealing with the problem of poor ISDS performance in Rhode Island. Perhaps more importantly, this plan can be implemented.

Notes

1. Cleaners such as bleach, disinfectants, and drain cleaners should be used in moderation. Some so called "system additives," which are designed to help septic systems operate more effectively, contain chemicals that can harm the soil in the drainfield and contaminate groundwater.
2. In large enough quantities; bleach, disinfectants, and drain cleaners may kill bacteria that act to break down wastewater in the septic tank (NSFCH#2, 1995).
3. Personal communications with Deb Robson, formerly of RIDEM- ISDS Division.
4. Refering to a conventional septic tank. Approximately 95% of ISDSs in the U.S. are of this type (NSFCH#1).
5. Personal communications with RIDEM ISDS section.
6. Information recieved through personal communication with Clarkson A. Collins, Narragansett Director of Community Development.
7. Personal communication with Scott Millar, RIDEM- ISDS Division.
8. Personal communication with Clarkson Collins, Narragansett Director of Community Development.
9. Each home would be pumped once every four years. One quarter of the ISDSs would be pumped each year.
10. Homeowners would pay an annual fee based in part on the amount of water used.
11. Personal communication with Scott Millar, RIDEM- ISDS Division.
12. Personal communicaiton with Scott Millar, RIDEM- ISDS Division.

13. Personal communication with Clarkson Collins, Narragansett Director of Community Development.
14. Personal communication with Scott Millar, RIDEM- ISDS Division.
15. Risk matrix is based on on easily quantifyible variables mentioned in the previous section (lot size, system type and age, household size, etc..
16. CERCLA.
17. Monthly, quarterly, bi-annually.
18. Personal communication with Clarkston Collins, Narragansett Director of Community Development.

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