MODULE 6
Alternative Septic Systems
Considerations for Boards of Health

Introduction

This module focuses on some selected issues associated with the use of alternative on-site

wastewater treatment technologies. Alternative technologies are generally proposed in an effort to achieve a higher degree of treatment than the standard septic system. They are variously called *alternative septic systems*, *innovative septic systems*, or *I/A systems* (innovative/alternative systems). This module by itself is not intended present a detailed technical discussion of how these systems actually work -- for that information, we have prepared a companion document for this module entitled ***A Compendium of Information on Alternative Onsite Septic System Technology in Massachusetts***, published in 1997 by this department and which has been more widely distributed. Throughout this module, you will see this document referred to merely as "the Compendium". If you do not have a copy, please contact us, and we will get one to you, since you will be referred to it many times in the following pages. If you are a Board of Health member or agent in Barnstable County, you may obtain one are free of charge by contacting our department. Others may obtain a copy by sending $6.00 to the department with your request. This module is intended to give Board of Health members information and suggestions on how to consider requests for the approval for installation of alternative systems.

Before we Begin........

Before we begin our discussion of alternative onsite systems, we would first like to briefly discuss some of the more "philosophical" and "big picture" issues related to alternative onsite septic systems and wastewater management in general. At some point in every town's existence, decisions are made as to how wastewater will be managed. In the past, the strategy relied heavily on the use onsite septic systems as a temporary solution until a permanent solution was determined. In Barnstable County, there once seemed to be no rush to finalize wastewater management plans, since our groundwaters and marine embayments were pristine and the situation did not seem to warrant a change in our wastewater strategy. The termination of programs that provided federal funding for construction of municipal facilities made it convenient to maintain the onsite system as long as possible to meet wastewater needs. Recently however, our understanding of the environmental impacts of wastewater on both drinking water aquifers and certain marine embayments has forced us to question whether the standard septic system is a viable long-term solution to our wastewater treatment and disposal needs. Standard septic systems offer very little treatment for nutrients and can degrade our groundwater and surface water resources. As a myriad of regulations and management plans emerge to address environmental issues related to wastewater, Boards of Health are frequently asked to approve advanced treatment modifications to the onsite system. But is this the best strategy to reverse the environmental consequences we are beginning to see? In the final analysis only you, in your communities, can decide the answer to that question. Most towns are, or will in the future be, involved in a DEP-mandated a wastewater facilities planning process. In this process, the town creates a plan for how wastewater will be managed over the coming 20 years. One of the purposes of this plan is to identify areas in town where remediation of existing sewage problems is needed. Problem areas may include neighborhoods with small lots where upgrades to Title 5 standards are difficult or impossible on each lot, and where a small package treatment plant could be built to serve the neighborhood. It may be that an entire watershed or subwatershed to an embayment demonstrates that watershed-based nitrogen removal needs to be implemented in some way. In each case, towns should be looking to determine the best *long term* solution for an area, whether that solution involves individual on-site systems, some type of shared treatment unit, or a combination of each. Rather than install alternative onsite treatment units on a random basis, that in the long run may not make a significant difference in protecting our drinking water and embayments, we encourage Boards of Health to consider taking the lead in initiating the comprehensive facilities planning process. We realize that implementing any solution different from the onsite septic system may be a slow and politically difficult process. We urge towns--and it will require effort and agreement on the part of many citizens, not just the Board of Health -- to use the wastewater facilities planning process as a basis for deciding what part nitrogen removal and other advanced wastewater treatment systems will play in the town's long-range plans for the treatment and disposal of wastewater. Facilities Planning is a process by which all pertinent factors are weighed such as financial impacts, growth potential, treatment technologies, potential strategies, etc.. It is within this type of process that a town can decide, for instance, if they want each home to have alternative systems, whether it is within the town's best interest to enlarge its present facility or whether to construct small "satellite" plants to treat highly impacted areas. It is the only process which will give a blueprint for the future of the town's wastewater strategy.

Despite the seemingly-monumental nature of the facilities planning process, in the long run it helps you, the Board of Health, decide an appropriate strategy for alternative septic systems in your town. If the thought of a town-wide facilities planning process is too much, perhaps a "mini" facilities plan for a watershed of particular concern could be attempted. As with the official DEP Facilities Planning Process, any mini facilities should enlist the input and support from local boards and commissions, citizen's groups, and technical advisors and consultants. We believe that only after the whole-picture for an area has been looked at, can the Board of Health confidently apply alternative onsite septic systems over broad areas of town.

That said, let's dig in to those situations where Boards of Health are being asked to approve alternative onsite septic systems.

Why are alternative onsite septic systems under consideration?

Alternative technologies are usually proposed when there is a desire to reduce selected contaminants. In our area, there is much talk about reducing nitrogen, but in some areas, there may be concerns for pathogens or Biochemical Oxygen Demand (BOD)[1]. Below, we will first look at some of the primary reasons you, as Board of Health members, may see

[1]See Page 4 of the Compendium

alternative onsite septic systems proposed.

Reduction of total nitrogen

Many of the alternative systems that you see proposed for use on Cape Cod are purported to be beneficial for nitrogen removal. Reduction of nitrogen in wastewater that ultimately recharges the groundwater is desirable for two reasons: nitrate can impact drinking water wells, and many of our embayments are sensitive to eutrophication caused by excess nitrogen that originates from septic systems leaching to groundwater that ultimately discharges to our embayments.

Nitrogen-removal alternative systems reduce nitrogen in wastewater by creating conditions that allow conversion of ammonia (NH_3) to nitrate (NO_3) (called *nitrificatio*n), and the subsequent conversion of nitrate to inert nitrogen gas (N_2) (called *denitrification*), thus completing the process of denitrification. A detailed discussion of these processes is presented on page 5-7 of the Compendium.

Presently, there are two alternative septic systems that are assigned a nitrogen "credit": recirculating sand filters and RUCK® systems (page 10 and page 30 of the Compendium respectively) under their **General Use Approval.** An alternative septic system attains the state's **General Use Approval** *for credit in nitrogen sensitive areas*, when there are enough data to suggest that these systems perform consistently enough assign this credit.

Very Important !!

All that glitters is not gold! It is very important that you understand the difference between General Use Approval with nitrogen credits and General Use Approval without nitrogen credits ! If you have any questions, read pages 78-101 in the Compendium. This section describes the limits of each technology with their approval status.

Certain other technologies have "**Provisional Approval**" for nitrogen removal. By this, we mean that they are going through a process of "proving" that they can remove a designated amount of nitrogen from wastewater. Under **Provisional Use Approval,** the first 50 systems of each technology installed statewide must undergo substantial monitoring over at least a 36 month period to determine their performance under conditions of actual use. It is important to note that although DEP is allowing the installation of provisionally approved alternative units with associated flow credits in nitrogen sensitive areas, it is still not fully known to what extent these Provisional Use Approval systems will ultimately function for nitrogen removal. Two examples of systems having provisional approval for nitrogen removal as of December, 1997 are Bioclere® and FAST® (pages 32 and 40 respectively in the Compendium). Provisional Use Approval acknowledges that residential systems are *provisionally* capable (based on limited data submitted to DEP) of removing 55% of the total nitrogen in wastewater and producing a finished effluent with total nitrogen of 19 mg/L or less (for non-residential systems these values are 40% and 25 mg/l respectively). Details on what exactly the manufacturer is seeking approval from the state for is outlined in their approval letter from DEP. A Board of Health should be provided (if they do not already have them) the DEP approval letters by the manufacturer prior to considering approval of a technology in your town. These letters from DEP also outline all of the conditions that must be met for their use. We can not stress enough the necessity for receiving and reviewing these approval letters.

As advanced treatment devices for wastewater were developed for single family residences, new treatment challenges emerged. Whereas larger collective systems (such as municipal plants or packaged treatment plants) are somewhat buffered from changes in wastewater strength and volume from individual homes (inclusion of several homes offers an "averaging" effect), the single residence system is not. The wide differences in household use patterns account for the wide differences in treatment that are commonly reported, particularly for nitrogen removal. This has lead to the very general statement that shared systems, which afford the averaging effect of more users, typically achieve more stable end results. Notwithstanding this principle, however, the legal requirements and the general desirability to have independent onsite systems, will undoubtedly keep individual alternative onsite systems on stage for years to come when advanced treatment is required and/or desired. Data presently being collected under the various approvals should give regulators an idea which systems are more sensitive to variability in single family wasteloads than others.

Another issue relating to the sensitivity of denitrifying technologies to changing or unsteady flows and wastewater strength is that of seasonal use. It is important to remember that denitrification is a biological process, mediated by bacteria that require time for their populations to adjust to environmental conditions. Some manufacturers, in consideration of this, have suggested that their technology should not be applied in seasonal situations. This is particularly important in our area of Barnstable County where a high percentage of homes are seasonal. Unless a manufacturer can demonstrate that their technology can "come up to speed" or denitrify wastewater within a reasonable period of time after startup, Boards of Health should think carefully about encouraging or allowing their use in seasonal situations if nitrogen is the compelling factor driving their consideration. To meet the challenge of seasonal usage, some manufacturers of denitrifying units are experimenting with "jump starting" their units by seeding them with nitrifying bacteria after periods of extended nonuse.

Reductions in biochemical oxygen demand (BOD) (page 4-5 in Compendium)

Most alternative technologies that remove nitrogen also reduce the levels of biochemical oxygen demand (BODs). This reduction is usually the result of active aeration of the sewage during the treatment process. Typically, BODs can be reduced from average household levels of 200 mg/L to a level of <30 mg/L, the EPA secondary treatment standard. For septic systems, removal of BOD can be important in two situations: where soil absorption systems are located in low-permeability (slow percolation) soils, and where the wastewater strength (BOD) is high, and there is a desire to prolong the life of the leaching field. To explain how BOD reduction can serve these situations, remember that the long-term ability of leaching facilities to dispose of waste (Long Term Acceptance Rate or LTAR - page 8-13 in Module 2) is a function of the thickness of the biomat and the texture of the underlying soil. The thickness of the biomat is a function of the strength of the wastewater feeding it. The LTAR for instance, of sandy soil "fed" with standard household wastewater is 0.74 gal/sq ft/day. If the wastewater is half that strength (say it has a BOD of 100 mg/l) than the ability of the soil to accept the effluent over the long term is higher than 0.74 gal/sq ft/day. In this sense, the reduction of BOD can be both good and bad. On the positive side, technologies that remove BOD can enhance disposal of effluent in tighter silt and clayey soils by reducing the "food" that in turn will produce a less flow-restrictive biomat or "clogging layer" at the soil interface and allow for better hydraulic performance. In these tighter soils, the loss or lack of formation in the biomat has less implication to treatment because significant attenuation of viruses and bacteria occurs on the soil particles themselves. This is due to both the electrically charged nature of silts and clays that causes the adsorption of viruses, as well as their high surface to volume ratio that enhances surface film treatment. In sandy soils, however, much of the treatment for pathogens occurs in the healthy biomat,
and any diminishment of this feature in sandy soil systems can significantly reduce the overall treatment. This is because in sandy soils, once effluent proceeds through the biomat, it can be rapidly transmitted to the groundwater beneath it. The lack of small pore spaces (compared to silt or clay), and electrically charged clay particles, reduces treatment of the effluent, particularly for the viruses. In short, in sandy soils, a healthy biomat slows filtration of the

wastewater to the underlying soil, and provides much of the treatment that the wastewater receives. In addition, a healthy biomat across the entire infiltrative surface produces unsaturated flow (=better treatment) prior to reaching the underlying ground water.

Reduction of Total Suspended Solids (TSS) (page 5 in Compendium)

Many of the alternative technologies that remove nitrogen and BOD also reduce the levels of total suspended solids (TSS) in finished wastewater. This can be accomplished either through filtration which occurs as part of the treatment process (for example, recirculating sand filters) or by passing finished wastewater through some type of effluent filters prior to introducing the waste to the SAS[2]. The main advantage to a reduction in TSS is that it enhances effluent disposal in slowly permeable soils. It does this by keeping the soil interface from getting clogged with inert materials (grit), and solids that might have a higher BOD. For these later solids, it is more desirable to mineralize them (break them down into soluble or gaseous components) in the septic tank or the treatment unit itself. Their presence in the leachfield can physically limit percolation. Reduction in TSS is also critical for systems which are used in conjunction with ultraviolet disinfection units described below. This is because suspended solids intercept and scatter UV light and physically shield target bacteria, viruses and other pathogens from UV radiation. Wastewater must be made relatively clear and free of TSS for the UV disinfection process to be efficient.

Removal of pathogens: bacteria and viruses

Most alternative systems are not designed to remove pathogens, unless they are used in conjunction with some type of disinfection unit. The majority of alternative systems have only moderate ability to remove bacterial pathogens, including fecal coliform, as part of the treatment process. Bacteria can be removed from wastewater in two ways: filtration which physically traps the bacteria, and predation by other microorganisms present in the system. In addition, many bacteria that are native to soils and present in the biomat can outcompete enteric pathogens for nutrients, and thus merely retaining some pathogens in the biomat cause their "starvation". Systems such as recirculating sand filters, Waterloo Biofilter® (page 34 in the Compendium), peat systems (page 22 in the Compendium), and RUCK® systems (page 30 in the compendium) which filter wastewater through various textured filtration media are capable of the best reductions in bacterial numbers. Recirculating sand filters, for example, typically show a 2 to 3 log (99%-99.9%) reduction in fecal coliform in finished wastewater, because the wastewater has been filtered through sand extensively. Other systems where fine filtration is not provided, such as the Bioclere and FAST units, are less efficient at removing bacteria, typically showing a 1-2

[2]Remember that some TSS reduction occurs in a functioning septic tank by allowing settling and digestion of wastes (see Module 1 for details).

log reduction in bacterial number[3].

The ability of alternative systems to remove viruses is generally unknown. Due to the difficulty and expense of testing for viruses, very few manufacturers have documented viral removal capabilities of their systems. In the absence of data, virus removal can be presumed to be minimal, unless the manufacturer has demonstrated otherwise or unless the system is equipped with a disinfection unit[4].

As you remember from Module 2, there are three things in the leaching portion of the septic system that act together to remove pathogens from wastewater: a healthy biomat, an appropriate application rate of effluent that ensures unsaturated flow (< 0.75 gal/sq ft/day in sandy soils), and adequate separation to groundwater. The role of the biomat is key in ensuring that effluent is ***evenly*** distributed across the infiltrative area of the soil absorption system. It does this by slightly restricting the flow over the entire infiltrative surface until unsaturated flow conditions develop beneath the entire biomat. This unsaturated flow condition, in turn, results in the effluent being exposed to more soil particle surface area. As you may further recall, the surface of the soil particles is where all the treatment action occurs (see Module 2 page 5). The present loading rate requirements of Title 5 were developed based on normal household strength wastewater, in an attempt to anticipate the effect of a healthy biomat on hydraulic performance. This concept is called Long Term Acceptance Rate (LTAR). Alternative septic systems may affect this process in the following way. As alternative septic systems reduce the BOD of the wastewater being applied to the soil absorption system, they reduce the "food" for the biological community in the biomat. In turn, unsaturated conditions in a SAS serving an alternative septic system take longer to develop. During biomat formation, you will recall, ***saturated*** flow conditions between the SAS and the groundwater results in reduced pathogen removal. This is graphically represented in figures presented on page 11 of Module 2. **Thus, treatment units that remove BOD but do not substantially reduce bacteria or viruses as part of the treatment process may reduce the ability of the leachfield to remove these microorganisms.** The degree to which this occurs is not fully known, and likely varies from system to system. The important thing to remember is that, unless a manufacturer demonstrates otherwise, there is little reason to assume that an alternative unit will be more
efficient at pathogen removal than a standard Title 5 system.

---

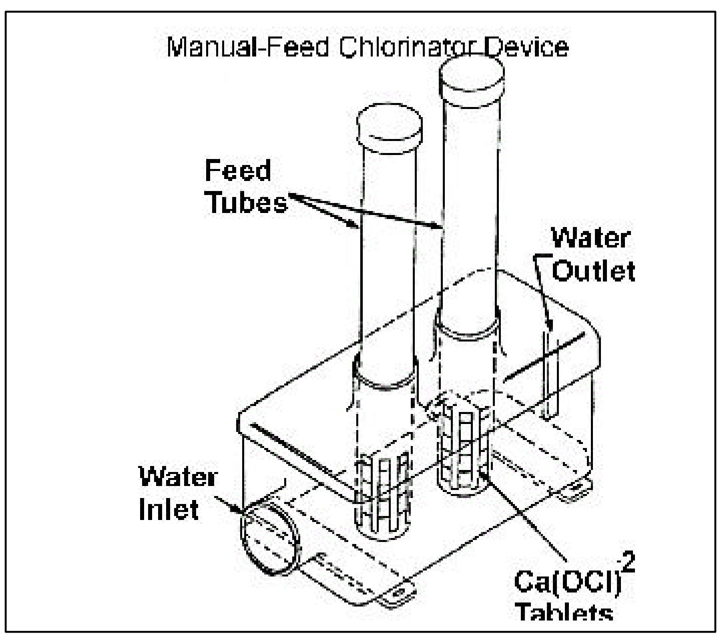
[3]If wastewater has 1,000,000 fecal coliform/100 ml, a 1 or 2 log reduction would reduce these numbers to 100, 000 or 10,000 fecal coliform/100 ml respectively.

[4]BCDHE is presently conducting research on various alternative onsite septic system to test their ability to remove viruses under a 319(b) Grant from DEP.

Disinfection units

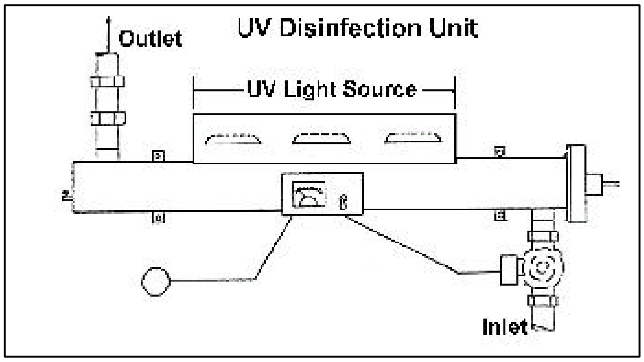
Many alternative systems can be equipped with disinfection units when necessary (and we will discuss below when this may be appropriate). There are three basic methods by which disinfection can be achieved in an onsite system: ultraviolet light, ozone, or chlorination. Some systems use bromine instead of chlorine. Disinfection units are usually installed between the alternative treatment unit and the leaching field. When operated properly, each type of unit can be very effective at removing both bacteria and viruses. However, there are usually a few requirements which must be met in order for the units to function effectively. In general, BOD and/or TSS must be reduced to low levels (30 mg/l) in the wastewater before it can be economically disinfected. With chlorine and ozone units, BOD reduction is necessary so that the chlorine or ozone will not be used up oxidizing the residual organic matter rather than killing pathogenic bacteria. UV units only function well when TSS is low enough to prevent substantial scattering and absorbing of the UV light that is responsible for killing organisms and denaturing viruses. Although disinfection units themselves are not that expensive, the costs of the pretreatment units necessary (to remove BOD and TSS) to make them effective results in fairly high overall costs.

The type of disinfection that is best, depends on the environmental situation. Chlorine, while used in some parts of the country where discharge to surface waters is allowed, is generally not appropriate for septic systems with final discharge to a leachfield for two reasons: residual chlorine will kill beneficial bacteria and protozoa within the biomat, and chlorine may cause the formation of trihalomethane compounds such as chloroform that might enter the drinking water aquifer and result in a public health threat. The appeal of such units is their simplicity, since they basically look like distribution boxes (see above) into which chlorine tablets (generally $Ca(OCl)^2$) are added as needed. Ozone has not been shown practical for onsite application. These authors have



found no information on products relating to ozone units for single residence onsite use, so if you know of any, please let us know so we can update our course. UV units are effective but must be monitored regularly to ensure the UV bulb remains clear of biofilms which will attenuate the light. The UV bulb (see below) must be replaced at least yearly, or more often if water tests show diminishing die-off of fecal coliform with treatment.

All disinfection units need to be maintained and it is our recommendation that the units be sampled on a ***monthly*** basis to ensure they are working properly. Water sampling for fecal coliform can be performed for about $10-15 per sample. For systems located near sensitive environmental receptors such as shellfish areas or bathing beaches, we believe that it is



reasonable to require finished effluent to meet the bathing beach standard of 200 fecal coliform per 100 ml. This is based on the assumption that if wastewater breaks out into the environment and comes into contact with humans it is not likely to be directly ingested but will contact humans in the same manner as swimming water. For systems located near drinking water wells, a higher standard of 10 total coliform per 100 ml may be appropriate[5].

When should a Board of Health think about requiring disinfection? This will be discussed in more detail below, in the sections regarding use of alternative systems, but briefly, disinfection is appropriate:

1) When granting a variance for a three foot vertical separation between the bottom of the leaching field and groundwater (especially near critical resources);
2) When minimal Title 5 setbacks from leaching field to wetlands (50 ft.) cannot be maintained;
3) When minimal Title 5 setbacks from leaching field to private wells (100 ft.) cannot be maintained, and:
4) When the Board grants variances to local horizontal setback requirements (i.e.

[5]This standard is somewhat subjective, but lies between the drinking water standard of 1 total coliform/100 ml, and the shellfish water standard of 70 total coliform/100 ml.

many towns have setbacks of 100 ft. to wetlands and 150 ft. to private wells) and is requiring an alternative treatment unit to be installed as a condition of granting the variance, based on the environmental sensitivity of the site.

WHERE WILL ALTERNATIVE SYSTEMS MOST LIKELY BE PROPOSED, AND HOW SHOULD BOARDS OF HEALTH APPROACH THE REVIEW OF THESE REQUESTS?

Alternative septic systems may be proposed in a number of different situations, to solve wastewater treatment and disposal problems. Now that we've reviewed the major treatment objectives of alternative systems, let's look at some typical scenarios where alternative systems may be proposed to address potential environmental or public health problems.

There are three basic scenarios where alternative systems may be proposed:

1) for remedial use for upgrade of an existing system with <u>no increase in design flow</u> (situations where increases in design flow are proposed are new construction by definition in Title 5);

2) for new construction (which includes upgrade of an existing system with increases in design flow) in Title 5-defined nitrogen sensitive areas; and

3) for construction in areas which have not formally been designated as nitrogen sensitive but which the Board of Health or other boards and commissions consider to be environmentally sensitive, such as sites abutting wetlands or located in recharge areas to nitrogen-impacted embayments.

Many of these situations will involve variances, either from Title 5 or local Board of Health regulations. As you know, one of the primary criteria for the granting of any variance is that the applicant demonstrates that "a level of environmental protection at least equivalent to that provided under 310 CMR 15.000 can be achieved without strict application of the provision of 310 CMR 15.000 from which a variance is sought" (section 15.410). The information presented below provides a framework for evaluating whether the requirement of equal environmental and public health protection will be met by the use an alternative system in each case. But before we get too far into these scenarios where the use of alternative systems will be proposed, let's first review a short list of some basic requirements and restrictions in Title 5 pertaining to the use of alternative systems.

1) DEP's certification of an alternative system means that DEP has evidence that the system will provide a degree of environmental protection at least equivalent (but not necessarily greater) to that of a standard on-site system constructed in conformance with Title 5.

2) When an alternative system is installed under ***Remedial Use Approval***, no increase in design flow is allowed (section 15.284(2)(b)).

3) Alternative systems with Piloting or Provisional Use approval may only be installed for upgrades of existing systems with no increase in design flow; for most purposes use of these systems for new construction or increased design flow is allowed only when a system in full compliance with Title 5 can be constructed on the site (sections 15.285(2)(a,b) and 15.286(4)(a,b))[6].

4) Nitrogen removal systems which have received design flow credits for enhanced nutrient removal must still comply with the requirements of 310 CMR 15.100 through 15.293 with respect to system siting and design; the credit does not affect any other siting or design requirement (section 15.217(2)).

These things said, let's now look at those scenarios where alternative systems may be proposed. We'll first start with the use of alternative technology in ***remedial use*** situations, secondly we'll discuss the use of alternative technology for ***new construction***, and finally, we'll discuss the many issues that go with use of alternative technology in ***nitrogen sensitive areas***: We'll try to present this information is in the context of the real life scenarios and variance requests that you're most likely to see as Board of Health members.

ALTERNATIVE SYSTEMS IN REMEDIAL USE SITUATIONS

In an effort to make septic system upgrades easier for homeowners, the 1995 revisions Title 5 allow a number of alternative systems to be

[6]Less common situations where alternatives may be used for new construction or increased flows include projects that have access to a municipal sewer and sites owner or controlled by and agency of the feceral government, subject to approval by DEP.

installed with reductions in leaching field size, depth to groundwater, or depth of naturally occurring soil under the leaching field. The primary focus of DEP's approvals in this area is the purported ability of the systems to reduce BOD and TSS. If you are reading the various approvals from DEP, however, you will notice that many of the systems in this category are seeking approval ratings for nitrogen removal as well. You may also notice that little is said regarding actual pathogen removal.

If an alternative system has a Remedial Use Approval for these type of reductions (leaching facility size, distance to groundwater or the requirements for naturally occurring material), the Board of Health may grant these variances and allow installation of the system under local upgrade approval. No further DEP approval is required as long as the use of the technology is consistent with the DEP approved conditions for its use[7].

For reductions in leaching field size

Requests to reduce the size of SAS are becoming more common as "old code"[8] systems are gradually replaced. These requests are necessary because the designers of the original systems often did not anticipate the larger area requirements needed to accommodate the Title 5 revisions of 1995. Old code systems were commonly situated with little room to spare, despite the fact that "reserve" area designations were required even under the old code. In remedial use situations, DEP allows a reduction in the area of the leaching field for a number of alternative systems due to their ability to reduce those wastewater constituents (BOD, TSS) responsible for soil clogging. Examples of systems allowed in remedial use situations and permitted to reduce the size of the SAS are Bioclere, FAST, Jet Aerobic, Waterloo Biofilter systems, intermittent sand filters (Low-rate Intermittent Sand Filter, Saneco, Inc.), and recirculating sand filters which may be installed with a 50% reduction in leaching field size.[9] It is important to remember that decreased size of the SAS translates to higher hydraulic loading rates (gal/sq ft/day), which in turn provides the potential for less treatment in the soils. Boards of Health should keep this in mind when reductions in SAS are being requested in sensitive areas.

There are two basic scenarios where reductions in leaching field size may be appropriate. The first of these is in slowly permeable soils where a standard leaching field must by necessity be very large to dispose of wastewater at the loading rates required by Title 5. In this case, a 50% reduction in leaching field size can provide a financial incentive for

[7] The Health Agent or Board of Health should insist on seeing and reviewing the approval letter that is issued with the technologies' approvals.

[8] Systems designed in conformance with the old (1978)Title5 or systems installed prior to the 1978 Code.

[9] Several other technologies -- Amphidrome, Waterloo biofilter--which are in the early stages of the DEP approval process are seeking further reductions in leaching field size, up to a reduction of 67% or loading rates as high as 5 gal/sf/day, and are seeking to be allowed to install these systems for new construction.

installation of an alternative unit, with the added benefit that wastewater is treated to a much higher degree for certain constituents than in a standard Title 5 system.

The second scenario, more common on Cape Cod, is the repair of a system on a lot which is too small to accommodate a full sized leaching field. This circumstance seems to be especially common on small lots with old houses located on or near the water. On the surface, installation of nitrogen removal technology may appear to be a win:win situation for the Board of Health and the applicant: the board gets a system upgrade (often from a cesspool located too close to the waterbody) with the added benefit of wastewater which has been treated to a higher level, and the applicant gets to upgrade his system in a relatively painless way. The Board must remember, however, that two aspects of this situation are counter to the objective of pathogen removal:

1) decreased leaching field means higher loading rates and less virus removal (Module 2 - page 18), and;
2) lower BOD means slower forming biomat and more chance for localized very high actual loading rates, exacerbating the problems associated with higher loading rates.

Both these features together can translate to potentially-higher breakthrough of pathogens to the groundwater. This is especially true in coarse sandy soils which have limited filtering capacity for pathogens, especially viruses.

The following mitigation measures can help to ensure an equal degree of environmental protection if the Board of Health chooses to grant a reduction in leaching field size with the use of alternative technology:

1) No increase in design flow (required by Title 5)

2) Require adequate (5 ft or greater) separation to groundwater, since vertical separation is the key parameter for pathogen removal (***also required by DEP as part of the system's remedial use approval; an applicant can be granted a variance for <u>either</u> a reduction in leaching field size or a reduction in depth to groundwater, not both unless variances are requested and granted directly from DEP***)

3) Require a minimal 100 ft setback to water bodies where effluent can potentially come in contact with humans or shellfish, and 150 ft to drinking water wells.

4) If the 100 ft. setback to watercourses or 150 ft. to wells cannot be maintained, consider requiring either: a) pressure dosing[10] of the leaching field to ensure that effluent is distributed evenly. Pressure dosing prevents some areas of the leaching field from being accidentally dosed at higher rates as can occur with gravity-fed systems; and/or b) disinfection, based on the environmental sensitivity of the site. For example, at a site directly abutting shellfishing waters or less than 150 ft. to a well, disinfection may be preferable. For a site abutting a salt marsh or freshwater wetland, where open water is a good distance away, pressure dosing may provide an adequate degree of environmental protection.

Reductions in vertical separation to groundwater

In remedial use situations, DEP allows up to a 2 foot reduction in the vertical separation to groundwater under the leaching facility with the use of some alternative systems. For example, in remedial use situations, the Bioclere, FAST, Jet Aerobic, Waterloo Biofilter, intermittent sand filters (Low-rate Intermittent Sand Filter, Saneco, Inc.), and recirculating sand filters may be installed with these reductions. DEP's rationale for allowing these reductions is apparently based on the assumption that the generally-achieved 1-2 log reduction of these systems equates to about 1 ft. of passage through soil. Remember that for repairs under the local upgrade approval process (no alternative system involved) DEP allows a one-foot reduction in the required depth to groundwater when a system cannot be upgraded in full compliance with Title 5. In soils with a percolation rate of less than 2 minutes per inch, this one foot *reduction* in required depth maintains a minimum separation of four feet between the bottom of the leaching field and groundwater. The introduction of alternative technology is apparently "worth" (equates to) enough to warrant an additional one foot reduction. This means that the alternative system can be installed with a three foot separation between the bottom of the leaching field and groundwater in soils with a percolation rate of less than 2 minutes per inch.

With these considerations in mind, how should a Board of Health proceed with a request for use of an alternative system with a reduction in depth to groundwater? In a word - ***cautiously!*** First, remember that DEP considers reductions in depth to groundwater to be the **least preferable option** for a variance under local upgrade approval. Where possible, a variance for a reduction in depth to groundwater should be avoided. If the variance is unavoidable, the Board of Health should consider requiring that the SAS be pressure dosed[11]. Also, remember that reductions in depth to groundwater **cannot** be combined with a reduction

---

[10] Pressure Dosing is ***required*** under most of the remedial use approvals. Boards of Health should check the special conditions for approval that are outlined in the approval letters for each technology.

[11] If not already required in the DEP approval conditions.

in leaching field size under local upgrade approval.

If the Board of Health approves a reduction to three feet of vertical separation to groundwater with use of an alternative system, the Board must require:

1) No increase in design flow or square footage of the building (required by Title 5 section 15.405 (1)(i)).

2) No reduction in leaching field size (required by DEP as part of the system's remedial use approval; an applicant cannot be granted a variance for <u>both</u> a reduction in leaching field size and a reduction in depth to groundwater)

3) No reduction in required Title 5 setbacks from public or private wells, bordering vegetated wetlands, surface waters, salt marshes, coastal banks, vernal pools, water supply lines, surface water supplies or tributaries to surface water supplies, or drains which discharge to surface water or their tributaries (required by Title 5 under local upgrade approval, section 15. 405(i)(5)).

4) No reduction in the requirement for naturally-occurring permeable material under the leachfield.

Depending on the environmental sensitivity of the site, we strongly recommend the Board consider requiring disinfection of the wastewater as part of the alternative treatment process. This would be appropriate especially when local horizontal setbacks to wells, watercourses and wetlands cannot be maintained.

A final note: several systems that are in the DEP approval process have requested even larger reductions in required depth to groundwater and have requested to be able to use these reductions for new construction, not just repairs. The Waterloo Biofilter is seeking approval for an 18 inch separation to groundwater. Several distributors of composting toilets and graywater leaching systems are seeking similar approval for graywater leaching fields. It is not known whether DEP will grant these types of approval. We certainly hope they do not do so until much more is known about these systems' ability to remove viruses. At any rate, we would urge Boards of Health to view any large reductions in depth to groundwater with extreme caution.

Reductions in depth of naturally occurring permeable soil below the leaching field

DEP also allows up to a 2 foot reduction in the depth of naturally occurring permeable soil under the leaching facility for some alternative systems in remedial use situations. As above, in remedial use situations, the Bioclere, FAST, Jet Aerobic, Waterloo Biofilter, intermittent sand filters (Low-rate Intermittent Sand Filter, Saneco, Inc.), and recirculating sand filters may be installed with these reductions. DEP's rationale for allowing these decreases is based on alternative systems ability to remove BOD and TSS, thus aiding percolation of the effluent through the soil and thereby making a lesser depth of permeable soil necessary under the leaching field. This is presumably more important in other areas of the state, where there are many areas with an inadequate depth of permeable soil above bedrock. In Barnstable County there are relatively few localized areas
which have layers of slowly permeable soils such as marine clays or dense glacial tills. The important thing to remember about these impermeable layers (whether they are bedrock or impermeable soils) is that they have the potential to channel sewage effluent horizontally to unexpected places. When sewage is applied to the ground, it percolates downward until it hits the impermeable layer where it can be channeled in a horizontal direction with the potential to intercept wells or break out into surface waters. These aspects are further incentive for Boards of Health to avoid granting such variances if feasible options are available.

Similar to the recommendations for reductions in vertical separation to groundwater, if the Board of Health chooses to grant a reduction in the required depth of naturally occurring soil under the leaching field with use of alternative technology, the following mitigation measures may be appropriate:

1) No increase in design flow (required by Title 5)

2) No reduction in leaching field size (required by DEP as part of the system's remedial use approval; an applicant cannot be granted a variance for <u>both</u> a reduction in leaching field size and a reduction in depth to of naturally occurring soil)

3) Require a minimal 150 ft setback to wells or 100 ft to water bodies where effluent can potentially break out and come in contact with humans or shellfish.

4) If these horizontal setback cannot be maintained, consider requiring either or both: a) pressure dosing[12] of the leaching field to ensure that effluent is distributed evenly; or b) disinfection; based on the environmental sensitivity of the site.

5) No reduction in required groundwater separation.

[12] Again, pressure dosing may be required as part of a technology approval. Boards of Health should check the special conditions in the DEP approval letter.

USE OF ALTERNATIVE SYSTEMS FOR CONSTRUCTION IN ENVIRONMENTALLY SENSITIVE AREAS

We'll now discuss the use of alternative systems for construction in areas which have not ***formally***[13] been designated as nitrogen sensitive but which the Board of Health considers to be environmentally sensitive. This usually includes sites which do not have adequate horizontal separation to critical environmental receptors such as watercourses. For many towns on the Cape this will primarily apply to lots abutting salt water or wetlands. These are areas where the board may believe nitrogen reduction is desirable but which have not been formally designated as nitrogen sensitive.

Reductions in horizontal setbacks to critical environmental receptors

Nitrogen removal and other alternative technology is increasingly being proposed as a solution on lots where horizontal setbacks to critical environmental receptors, such as drinking water wells, watercourses, or wetlands cannot be met. For new construction, DEP does not allow alternative systems to be used to gain reductions in required Title 5 vertical or horizontal setbacks to groundwater, wetlands, watercourses, wells, etc. Nitrogen removal systems cannot be installed where a system cannot otherwise be constructed in conformance with Title 5. Hence, an applicant cannot propose the use of an alternative system for new construction in order to obtain any Title 5 setback variances necessary to proceed with building on the lot.

What about the situation where the applicant can meet all Title 5 requirements, but cannot meet local regulations which require greater horizontal setbacks? Most Boards of Health on Cape Cod have local regulations requiring horizontal setbacks of 100 ft to wetlands and 150 ft to private wells. An increasingly common scenario encountered by many boards is the request for a reduction in these setbacks if a nitrogen removal system is used. This request usually comes as part of a proposal for either brand new construction or expansion of an existing dwelling. For example, an applicant owns a 2 bedroom home on a small lot abutting a salt marsh with an existing cesspool located in or near groundwater, 45 feet from the edge of the wetland. The owner wishes to renovate the house and add a third bedroom. This, of course, means the septic system must be upgraded but, due to the size of the lot, the new leaching field can only be placed 75 feet from the wetland. In an effort to prove equal environmental protection, the applicant offers (or the board considers requiring the applicant)

[13] Title 5 implies that there is(will be) a process by which nitrogen sensitive areas will be formally recognized in the Code (See Section 15.215(2).

to install a nitrogen removal treatment system as one of the conditions of the variance being granted and the expansion allowed to occur.

How should a Board of Health view a request of this type? On the one hand, if the board allows the variances and expansion, the board gains the real benefits of an upgraded septic system located farther from groundwater and wetlands. In addition, use of the alternative treatment unit means the wastewater will be treated to a much higher degree in terms of nitrogen, BOD and TSS, and this certainly contributes to protecting the environment. On the other hand, allowing the variances means use of the system may be intensified (especially if there will be a conversion from seasonal to year-round use, as if often the case).

As always, the Board's role in debating the variance is to ensure that a standard of equal environmental protection will be met if the variances are granted. In a situation such as this the board must identify the real public health issues that go with the granting of the variance. You may remember from Module 3 that horizontal setbacks from sensitive environmental receptors, such as drinking water wells, bathing beaches, and shellfish areas, are based on concern that *pathogens* from septic systems could travel horizontally and reach these receptors. Although the majority of treatment for pathogens in a septic system occurs in the unsaturated zone beneath the leaching field, it is inevitable that some pathogens will reach the groundwater. Once pathogens reach the water table, they become entrained in the flow of groundwater and move through the soil under saturated flow conditions. This filtration will remove the majority of bacterial pathogens but viruses may continue to travel long distances in the groundwater (distances of over 200 ft. travel have been demonstrated in sandy soils). If the direction of groundwater flow is towards a sensitive receptor, there is potential for human contact with pathogens when the groundwater meets this receptor. And, again, keep in mind the information we've discussed above regarding most alternative systems' limited ability to remove pathogens. ***It is clear in this situation that, while nitrogen removal technology may provide a real environmental benefit in terms of nutrient removal, it will do little to address the more important (from a public health viewpoint) issue of pathogens.*** In this situation, alternative technology does little to meet the test of equal environmental protection. Although the board may see the use of alternative technology as a net benefit and choose to allow its use, the pathogen issue must be mitigated in some other way, possibly by requiring disinfection.

What about brand new construction on undeveloped lots where local horizontal setbacks cannot be met? Let's take the case of an undeveloped small lot abutting a salt marsh, where

only an 80 ft setback can be maintained between the marsh and the leaching field. In an effort to persuade the board to allow construction, the applicant offers to install a nitrogen removal system. This scenario presents a more difficult decision for the board. In cases involving upgrades to existing systems, the board is more sensitive to the financial hardship of the homeowner's situation. Even in cases involving some expansion of use, the Board might reason that the effects are
only incrementally greater than what already exists. But with new construction on undeveloped parcels, instead of merely incrementally increasing flow, sewage will be disposed of where it has never been before, and in a location that does not meet what the board considers to be minimal public health requirements. In addition, the board may be under pressure from abutters or other concerned citizens to not allow development of the lot. This must be balanced against the fact that the lot does meet Title 5, which the state considers protective of public health. To deny the variances that allow building also brings up the issue of a regulatory taking.

Again, the critical issue for the Board remains the same: pathogens. If the board believes that the pathogen issue can be properly mitigated, granting the variances for construction is reasonable. There are several approaches the Board can take to determine whether the pathogen issue can be mitigated. The Board can:

Ask the applicant to demonstrate that the setback is not critical in this situation: for example, the applicant cannot meet a setback to the edge of a salt marsh but open water, where effluent could break out and contact humans, may be several hundred feet (or > 200 days travel time) away.

Require the applicant to install sufficient monitoring wells to demonstrate whether groundwater flow is or is not traveling in the direction of the sensitive receptor.

If groundwater is flowing toward the sensitive receptor, the board can deny the variance or require disinfection, based on sensitivity of the receptor.

If pathogen concerns can be met, the board may wish to grant the variance and let the project proceed. In granting reductions in horizontal setback requirements, it is appropriate to require the following in addition to alternative treatment:

1) Maintain a minimal 5 ft. vertical separation to groundwater, and more if possible.
2) Allow no reduction in required leaching field size, since this results in a higher

wastewater application rate with potentially greater breakthrough of pathogens beneath the leaching field.

3) Consider requiring pressure dosing of the leaching field to provide even distribution of effluent.

4) Consider requiring disinfection, based on environmental sensitivity of the site.

Seasonal use

A brief note on seasonal use. Alternative systems are often proposed for upgrades or new construction of homes that are used only seasonally. Data suggests that these systems do not function particularly well in seasonal-use mode. Most of the sewage treatment, whether it is BOD or nitrogen removal, is performed by bacteria within the treatment unit. Bacterial populations must become fairly high before sewage treatment can become effective, and this usually takes a number of weeks after start-up. Data suggest that a minimum of 6 weeks are needed, and for some systems as long as twelve weeks before the system is functioning efficiently. Theoretically, it may be possible to "jump-start" systems by adding bacteria and a food source for a number of weeks before the home is occupied, but to date no alternative system distributors or operators that we know of are willing to provide this service. Until this problem is overcome, if a home is going to be used only seasonally, the installation of an alternative treatment unit probably does not provide much benefit.

USE OF ALTERNATIVE SYSTEMS IN NITROGEN SENSITIVE AREAS*:*

Whether Boards of Health are ready or not (and we hope this module will help you get ready), it is likely that you will increasingly have to deal with the installation of nitrogen removal systems in nitrogen sensitive areas. In some cases they will be virtually required by Title 5 and in other cases the board will be requested to approve them with associated increases in allowable design flow. Although you may be hesitant to commit to the widespread use of nitrogen removal systems, you will feel increasing pressure and responsibility to do so. For most of us here on Cape Cod, nitrogen sensitive areas, in the form of Zone IIs of public supply wells, make up a significant portion of our towns. As Board of Health members, we will increasingly be called upon to enforce regulations to protect these sensitive areas from the effects of nitrogen.

At present, two types of nitrogen sensitive areas have been defined: Interim Wellhead Protection Areas and Zone IIs to public drinking water supplies, and nitrogen sensitive embayments or other areas which have been designated as nitrogen sensitive through the

Massachusetts Water Quality Standards, 310 CMR 4.00 (though none have been adopted yet). In recognition of their nitrogen sensitivity, DEP restricts sewage design flow in these areas to 440 gallons per acre per day. In addition, areas served by both private wells and on-site septic systems are also limited to 440 gallons per acre per day for residential systems. In practical terms this means that lots of less than an acre will be limited proportionally in their sewage flow: half acre (20,000 sf) lots will be limited to a 220 gpd design flow (a 2 bedroom home), etc. In addition, a recirculating sand filter or equivalent technology will be a required design component for all systems with a design flow of 2000 gpd or more to be located in a nitrogen sensitive area.

In an effort to quantify how much the effects of nitrogen in wastewater are offset by nitrogen-reducing systems, and how these factors should adjust allowable housing densities, DEP has approved a number of nitrogen removal systems for design flow credits. These credits are based on the system's nitrogen removal ability and allow the systems to be used to obtain a design flow greater than 440 gpd per acre. For example, DEP has issued ***Provisional Approval*** to certain models of the Bioclere and FAST systems as being capable of removing 55% of total nitrogen with an associated design flow of 660 gpd/acre (or 330 gpd per half acre, etc.). The RUCK system has been granted a ***General Use Approval*** in this reduction category. Other technologies, still in the DEP approval process, are seeking even higher nitrogen- removal based design flow credits. DEP intends that design flow credits will provide an incentive for installation of these systems with a net result of better quality wastewater being recharged to the ground in nitrogen sensitive areas. From this viewpoint, it is hard to deny an applicant the use of one of these systems.

It is important, however, to realize that design flow credits increase the density of development. In terms of reducing nitrogen loading to the groundwater, design flow credits merely offset nitrogen reduction gained by use of the system. For example, the Bioclere, FAST and RUCK systems reduce total nitrogen by 55% (from an assumed 42 mg/L to 19 mg/L) but are allowed a 50% increase in design flow (from 440 to 660 gpd/acre). Mass nitrogen loading calculated (see box on next page) for an acre lot with and without a nitrogen removal system shows that the net effect of installing the system, with the assigned design flow credits, is only a 30% reduction in the mass nitrogen load. This is especially significant for developments where the design flow might actually be realized, for example, congregate housing and cluster subdivisions. In considering approval of these systems, the Board of Health will have to weigh whether it believes the effects of increased density, and some of the attendant potential environmental and public health issues associated with such, are offset by the nitrogen reduction gained.

For projects with design flows exceeding 2000 gpd located in nitrogen sensitive areas, Title 5 might be somewhat confusing. Although these projects are required to provide a recirculating sand filter or equivalent (40% nitrogen removal - Section 15.202(1)), these large systems ***do not qualify for credit for enhanced nitrogen removal.*** In these cases, the Board may be asked to permit the use of another alternative treatment system (that has proven performance greater than a recirculating sand filter), in order to qualify for nitrogen-removal credit. Guidelines and regulations for this scenario are still in the making at DEP, so Boards of Health should get the latest developments from DEP in this regard and act appropriately, but for now (as of January, 1998), no increased nitrogen credits are allowed, despite the technology used.

.***Nitrogen sensitive areas and the issue of "maximum feasible compliance"***

One of the most difficult issues the board will confront in nitrogen sensitive areas is the issue of maximum feasible compliance as it relates to nitrogen loading. As you know, the goal for construction of any septic system, whether it is an upgrade or new construction, is full compliance with the requirements of Title 5. In the case of nitrogen sensitive areas, this includes compliance with Title 5's wastewater flow requirements of 440 gpd per acre.

Lets first look at the case of an upgrade with no expansion of the dwelling, a frequent scenario with failed systems or upgrades upon transfer of real estate. The Board must first examine the design flow and size of the lot to determine if the system is in compliance with wastewater loading requirements (i.e. 440 gpd on 40,000 sf , 330 gpd on 30,000 sf, 220 gpd on 20,000 sf, etc.) If the system is not in compliance the Board must decide whether to require a nitrogen removal system as part of the upgrade. Because it is an upgrade, the applicant clearly fits into the maximum feasible compliance section of Title 5. Section 15.404(1), Maximum Feasible Compliance, clearly states a goal of full compliance: "<u>wherever feasible</u>, a failed or non-conforming system shall be brought into full compliance through the installation of one or more of the following.....(b) an alternative system which has been approved for such use pursuant to 310 CMR 15.284 (remedial use), 15.285 (piloting), 15.286 (provisional), or 15.288 (certification for general use)". Clearly, the board's goal should be full compliance with all aspects of the code, including nitrogen loading requirements. But, under maximum feasible compliance, the board has latitude to consider economic factors, such as the cost of a nitrogen removal system compared to the value of the home, in determining what is feasible.

A different picture is presented in the case of septic system upgrades where an expansion of the dwelling is planned. This scenario is frequently encountered when a homeowner wants to add a bedroom. If the existing system was not designed to accommodate the projected new flow the system must be upgraded (i.e., if an applicant has a 3 bedroom home and wishes to add a 4th bedroom, the system must be upgraded unless the septic system was designed for a 440 gpd flow). However, this project is by definition new construction because new design flow will be added. **Because it is new construction, the applicant is not entitled to the flexibility inherent in "maximum feasible compliance" and the project must be constructed in full compliance with Title 5 including the nitrogen loading requirements of section 15.214.** Let's look at several examples of how this works. Take the case of an existing 2 bedroom home on a half acre lot where the owner wishes to add a 3rd bedroom. Under the wastewater loading requirements of 15.214, design flow is restricted to 220 gpd on this lot. To construct a 3rd bedroom, the owner will have to install a nitrogen removal system with a 660 gpd design flow credit (i.e. 330 gpd per half acre) to be in full compliance with Title 5. Now lets take the case of an existing 3 bedroom house on a half ace lot, where the owner wishes to add a 4th bedroom. The existing system is already out of compliance with the nitrogen loading requirements (although it is grandfathered for existing flow) and to expand to a 4th bedroom the owner would have to install a nitrogen removal unit with a design flow credit of 880 gpd (i.e. 440 gpd on a half acre lot). There are no nitrogen removal systems currently approved by DEP for this design flow credit. Realizing this, DEP has granted some relief to homeowners by approving several alternative systems for extra design flow when they are used for expansions at existing homes. The Amphidrome, Bioclere, Solviva Biocarbon Filter®, Singulair®, FAST, and RUCK systems can be used in the following way: on a 10,000 sf lot, an existing 2 bedroom home may expand to 3 bedrooms (330 gpd) and on a 15,000 or 20,000 sf lot an existing 2 or 3 bedroom home may expand to 4 bedrooms (440 gpd).   It is clear that DEP, in granting this relief, intends that these nitrogen removal systems be used for upgrades at existing homes to bring them, as close as is reasonably possible, into compliance with the nitrogen loading requirements of Title 5.

What about undeveloped lots of less than an acre size located in nitrogen sensitive areas? It has been argued that, under the transition rules of Title 5, these lots are grandfathered to allow the construction of a 3 bedroom home (assuming that a system in conformance with the 1978 Title 5 could have been built on the lot), regardless of whether this meets the wastewater loading requirements of section 15.214. Recent advice from DEP suggests that this may not be so. The transition rules, section 15.005, state that "the owner of a lot....on which construction of a system in full compliance with 310 CMR 15.00 is not feasible, is entitled to construct a system with a cumulative design flow of up to 330 gpd provided that all of the following conditions are met...**(c) the system is constructed to the maximum extent feasible, as determined by the local approving authority pursuant to 310 CMR 15.404 and 15.405 (maximum feasible compliance)...**" Thus, Title 5 first requires that the applicant demonstrate whether it is feasible to construct a system in full compliance with the new code, and compliance includes meeting the wastewater loading requirements of section 15.214. For example, on a half-acre lot, if a 220 gpd system could be constructed in full compliance with the code, the Board of Health is entitled to hold the applicant to this design flow. On the other hand, if the Board believes, because of the transition rules, that they should allow the applicant a 330 gpd design flow (or if the lot is too small to accommodate a 220 gpd design flow, a 220 gpd design flow), the board can require the applicant to install a nitrogen removal system in an effort to meet maximum feasible compliance. Section 15.404(1) (Maximum Feasible Compliance) states "wherever feasible, a failed or non-conforming system shall be brought into full compliance through the installation of one or more of the following.....(b) an alternative system which has been approved for such use pursuant to 310 CMR 15.284(remedial use), 15.285 (piloting), 15.286 (provisional), or 15.288 (certification for general use)". In the example above, an applicant on a half-acre lot who wished to build a three bedroom home would have to install a nitrogen removal unit approved for a 660 gpd design flow credit, or demonstrate to the Board that its installation is not "feasible". As you know, the board is allowed some flexibility in determining what is feasible, and should include economic as well as engineering considerations. However, if the board wishes, it does have the right to require the installation of nitrogen removal units to meet maximum feasible compliance with the nitrogen loading requirements of Title 5 on lots grandfathered under the transition rules.

SOME BROADER CONCERNS THAT APPLY TO THE INSTALLATION OF ALTERNATIVE SYSTEMS

As you can see from the above discussion, Title 5 has been structured so that alternative systems will increasingly be considered as an option in nitrogen sensitive areas and in remedial use situations. The structure of the regulations place increasing responsibility on you, as board members, to either approve the use of alternative technologies or face the prospect of denying applicants the ability to use their property as they wish. There will be increasing pressure to permit alternative systems even though many concerns about the use of these systems remain unanswered. Below, we'll try to present some of the issues we believe merit your further thought as you consider permitting alternative systems.

As you may know, our department (Barnstable County Department of Health and the Environment) maintains an alternative septic system initiative, of which this Training Course is a part. Our primary function in this regard is to provide training and information to Boards of Health regarding alternative onsite septic systems and Title 5 in general. An alarming trend that we have noticed relates to the actual tracking of alternative septic systems. In order for alternative technologies to be applied in a meaningful way, we believe that individual systems must be monitored and maintained. Within the conditions of granting permission and/or variances to use alternative onsite systems, the Board of Health should incorporate conditions that ensure that the system will be monitored and maintained in accordance with the DEP approval. In addition, and as mentioned elsewhere in this Module, if the system was installed with the expectation that nitrogen or pathogens would be removed, the Board should act to require monitoring for these parameters. Remember, systems that have General Use Approval ***do not necessarily have such for nitrogen removal.*** Accordingly, if they are installed under their General Use Approval, they are not mandated to monitor for nitrogen components of their waste (again, read pages 79-80 in the Compendium if you do not understand this concept). In short, before the Board of Health allows the widespread use of alternatives in the town, they should make sure that the resources are available to track them and make sure that requirements are being adhered to.

Another concern related to alternative septic system tracking is that of maintenance agreements. The DEP approval letters for most alternative treatment units states that "Throughout its life, the System shall be under a maintenance agreement. No maintenance agreement shall be for less than two years." Sometimes, a certified wastewater treatment plant operator (Class II) is required to maintain the system. These maintenance contracts usually cost from two to three hundred dollars per year. In some instances, for financial reasons, property owners may choose not to or neglect to keep the maintenance contract in effect. Boards of Health have little guarantee that property owners will keep maintenance contracts in effect over the long term. The only way to ensure that maintenance contracts are kept in effect, and that systems are monitored when required, again, is for Boards of Health to have a structured tracking program for alternative systems. Remember, there is a significant financial incentive for a proponent to discontinue service contracts, or even disconnect treatment units.

Once again, we would like the Board to consider to what extent alternative systems should be installed on a lot by-lot basis rather than as part of a planned effort. Installation of alternative systems on a case-by-case basis can be counter-productive because once people have spent the money to install alternative technology on their own lot they will resist group solutions to wastewater treatment even if, in the long run, these are better solutions. Also, approving alternative systems on a case-by-case basis may prevent the board from asking some basic questions whose answers are necessary for planning effective long-term treatment of wastewater. These questions include: Is the sensitive receptor (drinking water well or embayment) already receiving too much nitrogen? What percentage of the total nitrogen load to the sensitive receptor does this site constitute? Will nitrogen removal technology at this site make a significant difference in reducing that load? How does nitrogen removal on this one site fit in with the town's long-range plan for dealing with nitrogen? Is it prudent and cost- effective to require nitrogen removal on a lot- by-lot basis in this area, or should the Board of Health work with the town to develop a better plan, such as a small package treatment plant or sewering, even if this takes longer to implement? In the long term, which will provide a higher degree of environmental protection?

A FINAL NOTE ON SOME PRACTICAL CONSIDERATIONS THAT SHOULD GO WITH THE APPROVAL OF EVERY ALTERNATIVE SYSTEM

As the local approving authority, the Board of Health has the right to impose any additional conditions it considers necessary to ensure the safe and effective performance of any alternative system it chooses to approve. However, Title 5 sections 15.285(2), 15.286(5), and 15.288(4) requires that before you can impose these additional conditions the board must adopt a regulation, pursuant to 310 CMR 15.003(3), that allows the board to impose its own conditions and monitoring requirements on systems. A proposed regulation for your consideration is given on page 80 of the Compendium. We strongly urge your Board to adopt a regulation of this type for the following reasons:

Based on the type of use approval (provisional, general or remedial) under which a system is being installed, DEP will have different requirements for siting, maintenance, and monitoring. Many alternative systems have multiple types of use approvals and can be used in different ways depending on the conditions that go with each approval. For instance, the Bioclere system has General Use Approval (with no nitrogen density credits), Provisional Use Approval (with nitrogen density credits) and Remedial Use Approvals. The system can be installed under its General Use approval in place of a standard Title 5 system, with no expected nitrogen removal. This type of installation frequently occurs in areas that the Board considers nitrogen sensitive (for example, in recharge areas to embayments) but which have not been formally designated as nitrogen sensitive under Title 5. In these type of installations, ***DEP requires no monitoring of the system for nitrogen and it does not have to meet the 19 mg/L total nitrogen effluent standard that it would have to meet if it were installed under provisional use in nitrogen sensitive areas***. If the board wants to confirm the nitrogen reduction, it will have to require additional monitoring as part of its approval of the system.

So, when approving any system, the Board should carefully read DEP's approval letter for the technology and its category of use approval to understand what requirements the system will have to meet. If the Board believes these are not sufficient, it can to set its own effluent discharge standards and requirements for additional monitoring. Specifically, the Board should ensure that nitrates, ammonia and total nitrogen are monitored. Similarly, if the Board approves a disinfection unit, it should specify maintenance and monitoring schedules and effluent discharge standards as conditions of its approval. Copies of all monitoring results should be forwarded to the Board.

The Board may also wish to require that the system owner or operator send documentation that the systems is being maintained. This can include copies of the maintenance contract and documentation that the system has been inspected on a quarterly basis, noting any repairs or adjustments that have been made to the system.

Boards of Health must also consider the issue of change of ownership at properties where alternative technologies are installed. Because these technologies require financial obligations from owners for maintenance and monitoring, it is essential that any potential buyer be aware of these obligations before they purchase the property. As part of its approval for most systems, DEP requires that the owner provide written notice to any potential buyer of DEP's

approval for the system, including all conditions and requirements for the systems use, prior to signing a purchase and sales agreement. Although anyone who neglects to provide this notification may be subject to civil liability, it is in the Board of Health's interest to be sure that property purchasers understand their
responsibilities before they purchase property with an alternative system. For this reason, the Board of Health may wish to require that anyone who installs an alternative system, record use of such on the property's deed along with any restrictions imposed on the use of the property (such as number of bedrooms, etc.) by the Board of Health. The Board may also require, as one of its conditions of approval, that at the time of sale the seller provide a letter from the system operator stating that the technology has been properly maintained.

CONCLUSION

Whether you think you want the responsibility for alternative systems or not, you will increasingly be faced with requests for their approval. It is anticipated that within the next few years more and more alternative systems will gain General Use Approval. General Use Approval means that DEP considers the system equivalent to a Title 5 system and, as a practical matter, it will be difficult to deny the use of a systems with General Use Approval unless there is a specific reason for denial. We hope that this module has helped prepare your Board to better consider the use of these systems.

Some towns on Cape Cod have zoning or Board of Health regulations that restrict wastewater loading to 330 gpd/acre in Zone IIs of public supply wells and/or in areas served by both private wells and septic systems. In areas where a 330 gpd/acre rule applies, Boards of Health will have to decide whether to allow DEP's increases in design flow (based on 440 gpd/acre) or whether to scale down flow credits proportionally using a baseline of 330 gpd/acre (see Compendium page 79).

Mass nitrogen loading (mg/acre/day) for a system with and without a nitrogen removal system capable of 55% nitrogen reduction:

without nitrogen removal: design flow= 440 gpd/acre = 1663 L per day/acre
assume total nitrogen = 42 mg/L
42 mg/L x 1663 L per day = 69,846 mg N per day per acre

with nitrogen removal: design flow = 660 gpd/acre = 2495 L per day/acre
assume total nitrogen = 19 mg/L
19 mg/L x 2495 L per day/acre = 47,405 mg N per day per acre

47,405 / 69,846 = 0.68 i.e. about a 30% reduction in total nitrogen load