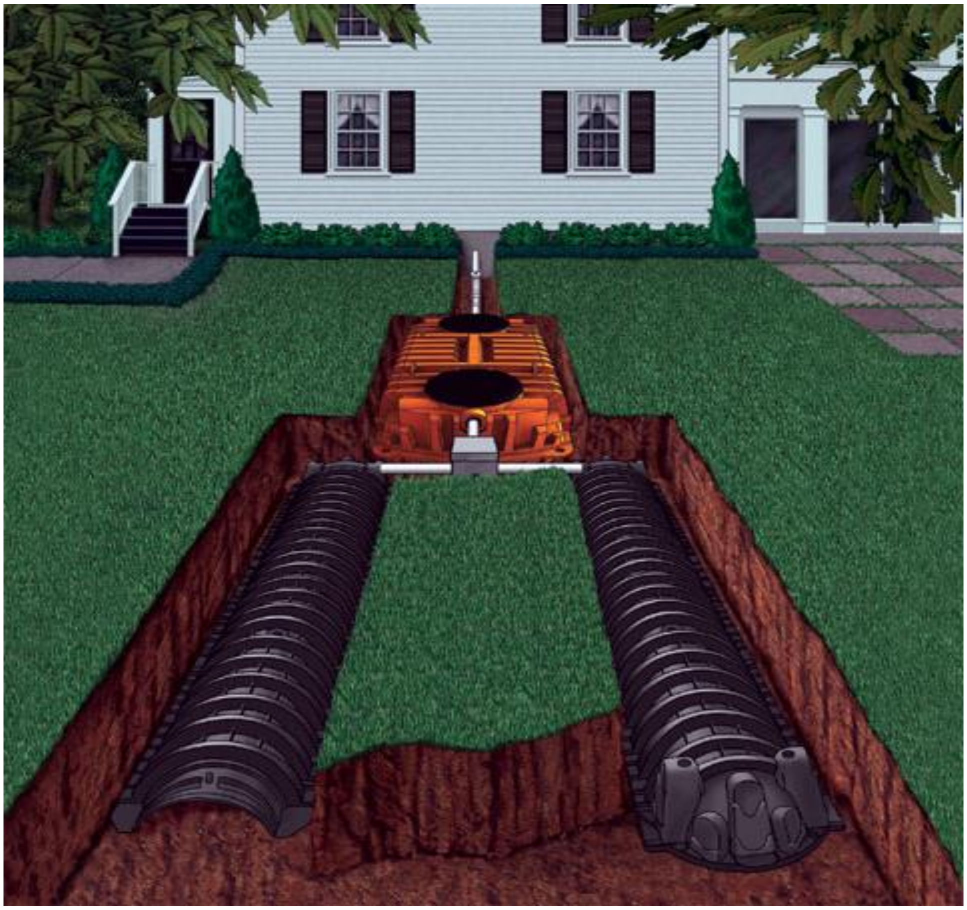
In My Backyard: An Innovative Look at the Advances of Onsite Decentralized Wastewater Treatment



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About the Scientific and Technical Advisory Committee

The Scientific and Technical Advisory Committee (STAC) provides scientific and technical guidance to the Chesapeake Bay Program (CBP) on measures to restore and protect the Chesapeake Bay. Since its creation in December 1984, STAC has worked to enhance scientific communication and outreach throughout the Chesapeake Bay watershed and beyond. STAC provides scientific and technical advice in various ways, including (1) technical reports and papers, (2) discussion groups, (3) assistance in organizing merit reviews of CBP programs and projects, (4) technical workshops, and (5) interaction between STAC members and the CBP. Through professional and academic contacts and organizational networks of its members, STAC ensures close cooperation among and between the various research institutions and management agencies represented in the watershed. For additional information about STAC, please visit the STAC website at www.chesapeake.org/stac.

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Executive Summary

In light of the overall challenge to meet the nitrogen (N) reductions necessary under the Chesapeake Bay Total Maximum Daily Load (TMDL) and the availability of new technologies to reduce N loadings from onsite wastewater treatment systems (OWTS), a holistic examination of new developments related to wastewater in a workshop setting seemed like a promising way to provide guidance to the Chesapeake Bay watershed states on how they may address the N loadings from OWTS. In addition to reviewing technologies on the market to reduce N discharged from OWTS, the workshop explored decentralized cluster treatment systems and new initiatives including eco-toilets and the potential of data sharing by states to save costs and enhance the advancement of new technologies. This workshop report attempts to capture important points from the presentations made during the workshop and highlight some of the discussions that took place. The following major recommendations to the CBP were a result of the workshop:

Major Recommendations

1. The Chesapeake Bay Watershed Model (CBWM) should be refined to reflect how soils interact with N loadings from OWTS.

2. The EPA, the CBP, and the Chesapeake Bay watershed states should work to educate the public in onsite wastewater treatment and seek public buy-in for demonstration projects like the Massachusetts eco-toilet project.

3. Federal funding is needed to address onsite wastewater treatment infrastructure needs.

4. The CBP should reach out to the states to see what kind of collaboration they are interested in and help provide the follow-through to make it happen.

5. Data sharing between states in a number of areas is critical – funding initial development of those efforts, including the sharing of test data from treatment units, should be considered by EPA along with the possible management and funding of interstate data sharing efforts.

6. Viable onsite options will save communities money over time, so we recommend that education and outreach efforts about such options be initiated and focus on communities in need of such support to address their wastewater issues.

Introduction

A residential household's wastewater needs can be met either by using an OWTS sized for the household, a community OWTS sized for a residential development, a regional OWTS sized for many users including commercial customers, or by hooking the home up to a central sewer system (OWTS will be used throughout this report as a catch-all term for a number of differently sized and operated onsite wastewater treatment systems). The OWTS functions to treat/dispose of wastewater from the home, stabilize sanitary waste, and render disease organisms harmless. The N discharged from the OWTS is often minimally treated and the CBWM estimates that 1.7 million OWTS currently exist in the Chesapeake Bay watershed. That number is estimated to grow to 1.9 million by 2015. In addition, many of the existing household OWTS are poorly documented and poorly maintained.

Implementation strategies needed to meet the Chesapeake Bay TMDL require the affected states to reconsider all of their potential sources of nutrient pollution to the Chesapeake Bay. OWTS are a source of N to the Chesapeake Bay that must be accounted for and addressed by the states in their TMDL Watershed Implementation Plans (WIPs), posing a unique challenge to the watershed states. While new technologies that can reduce N loadings from OWTS have recently been brought to market and are being used in new installations of OWTS, a holistic examination of other new technologies and alternatives for addressing the N loadings from OWTS is needed due to the sheer number of existing systems and the cost and complexity of addressing hundreds of thousands of systems currently owned by individual homeowners. This issue will require innovative thinking tempered by practical implementation considerations. Among the most critical of the implementation issues will be the long term management of new wastewater systems designed to achieve high levels of nutrient removal. In addition to the N-reducing technologies used currently in the Chesapeake Bay watershed for OWTS needs in new homes, the workshop explored the value of cluster septic systems, eco-toilets that separate urine from solid waste, and toilets that package or compost waste.

The four goals of the workshop were to:

1. Review technologies and strategies that may be used to reduce or eliminate nutrient discharges from OWTS to meet TMDL load allocations;

2. Identify obstacles to using those technologies or strategies;

3. Identify and develop strategies to address those obstacles; and

4. If additional research is needed, identify those needs.

The workshop featured 7 presentations, 2 panels, and question/discussion sessions, which are all reviewed in this report along with recommendations developed by the attendees of the workshop. The workshop discussions focused on current methods for reducing N, innovative methods for removing N (such as urine harvesting), long term management of N-reducing systems (including the use of cluster systems with management by third parties), and regulatory options for verifying N reduction.

Dr. Denice Wardrop (Director, Penn State Sustainability Institute) served as the workshop facilitator and helped to improve the workshop discussion sessions, the recommendations from the workshop, and consequently the information in this report.

Appendix B provides more information on available OWTS Best Management Practices (BMPs) and the reduction credits to be achieved under the Chesapeake Bay TMDL (*Technical Requirements to Enter Advanced On-Site Wastewater Treatment Practices into Scenario Builder and the Phase 5.3.2 Watershed Model*). The full report of the *Chesapeake Bay Program Expert Review Panel on Recommendations of the Onsite Wastewater Treatment Systems Nitrogen Reduction Technology* is provided as Appendix C (Adler et al. 2013).

First Presentation

EPA's State Model Program and a Proposal to Share Third Party Data Among the States

Joyce Hudson, Environmental Protection Agency (EPA) Office of Wastewater Management, and Mark Nelson, Horsley Witten

This presentation highlighted current EPA activities regarding OWTS, such as the SepticSmart Program, management case studies, the Rural and Small Systems Guidebook, and the Decentralized MOU partnership.

EPA's SepticSmart program is a nationwide public education program designed to promote proper OWTS care and maintenance by homeowners, while the 2003 Rural and Small Water Systems Guidebook helps small towns, rural water districts, and tribal systems make decisions regarding water needs, encompassing septic needs.

EPA's state-focused *Model Program for Onsite Management in the Chesapeake Bay Watershed* (see http://executiveorder.chesapeakebay.net/130627_Ches_Bay_Tech_Assist_Manual.pdf), issued in June 2013, resulted from the May 12, 2009 Executive Order on *Chesapeake Bay Protection and Restoration.*

The document assists the Chesapeake Bay watershed states by recommending how the states might address nutrient reductions from OWTS. The recommendations on treatment levels for OWTS are based on current best practices in the Chesapeake Bay watershed and across the country. States can use the EPA Model Program to assist in meeting their TMDL allocations. The EPA Model Program recognizes that N-reducing strategies differ from state to state and that an OWTS located closer to the Chesapeake Bay may require higher levels of treatment to remove N. The EPA Model Program also addresses maintenance, site evaluation, design protocols, and the other elements of a successful state program that manages OWTS (EPA 2013).

It should be noted that management of OWTS is primarily a state issue, although EPA will track how the states are reducing N from OWTS through the annual reports of state WIPs to the EPA. The EPA Model Program says the EPA will reach out to the states to work with them to improve wastewater databanks/other environmental databanks, and possibly contribute to OWTS data exchanges.

Hudson and Nelson presented an informal proposal to share data on the efficiencies and N removal abilities of OWTS technologies. Nelson distributed a draft December 2013 whitepaper titled, *Inter-State Collaboration and Improved Data Sharing for Advanced Onsite Technology Approvals* (in prep.; see Appendix A).

The whitepaper, recognizing that many Chesapeake Bay states are requiring advanced N treatment technologies for OWTS in the Chesapeake Bay watershed, encourages the states to consider the advantages of interstate data sharing on OWTS technical issues, the testing of new OWTS technologies, and other related issues.

Mark Nelson, on the topic of data sharing, asked, "Can we agree upon a set of data sharing protocols that states can use to review and approve alternative wastewater treatment technologies?" The December 2013 EPA whitepaper evaluates the issues associated with moving this process forward in a cost-effective manner.

Hudson and Nelson discussed the issue of reciprocity and emphasized that the EPA is not trying to set up a program that works in one state and must be agreed upon and applied to other states. Instead, EPA wants to improve data sharing and exchange, so information can be adapted based on all state needs. It is hoped that through collaboration the EPA will be able to identify methods that are successful in reducing nutrient loads across multiple states, but with differing approaches.

The EPA whitepaper discusses a number of issues associated with data sharing, including issues of test centers versus field testing, testing protocols (frequency and duration, selection of sampling parameters), the complexity of interstate collaboration processes, soil and climate considerations, oversight of testing facilities/programs, and the long term management of the data sharing process.

The immediate questions are: "How should we move forward with data sharing between the Chesapeake Bay watershed states; who will lead this effort; and what next steps are needed?" EPA would like to overcome past efforts that have not worked. The EPA is formulating ideas to answer these questions, and will require additional suggestions to work through the challenges they face.

Wardrop initiated a group discussion and reminded the attendees of the stated goals of this workshop, how they apply to the EPA data sharing effort, and questioned who should house the data generated from this effort. The EPA, CBP, and perhaps an organization such as the Water Environment Research Foundation (WERF) were recommended to house the data.

Many of the above organizations that could potentially house the data already receive EPA funding and audience members asked if the lead organization would be offered additional EPA funding in this scenario. Hudson said the likely answer is no - at least not long term funding. Such funding is decreasing in the EPA's budget, but it was noted that the EPA has a long term contract with the consulting firm, Horsley Witten, to conduct wastewater planning and design efforts.

Hudson explained that the data sharing effort would involve collecting third party-evaluated data and data verified by the states. The CBP should help house this data because they already have advisory committees and other panels looking into this issue and how it could be applied within the CBP partnership. Such an arrangement would also allow the EPA to contribute resources and manpower to the data evaluation effort through the CBP. But that option raises the question of: "How do you take this to the national level if you originally focus it in the Chesapeake Bay watershed only?"

Another question was raised: "Will the organization be evaluating OWTS data that already exist, or seeking new data?" Greater financial resources and/or greater brainpower will be needed to determine what additional data may be needed or desired by the states.

Development of a new test center for OWTS is likely out of the question due to financial and other logistical reasons. It is uncertain if the data that exists today is consistent with the approval guidelines of one state compared to another. That is an issue that will eventually be confronted as efforts to encourage data sharing and databank development continue.

Maryland, Virginia, and other Chesapeake Bay watershed states understand and efficiently share each other's OWTS programs. Consideration of other state programs is one way for states to better evaluate and adapt their own programs. The ultimate goal is to have one proposal that meets the testing requirements of all state programs. Actual data evaluation may not result from this data sharing effort, but the development of protocols for that evaluation could be a useful result.

One option to facilitate state collaboration and data sharing relies on the OWTS industry to develop a package of information needed from OWTS manufacturers so the manufacturers know how to properly test their technologies based on real-world functionality. The package should be approvable by all the states and relevant to them, but also adaptable, so the package can be improved by the individual states for their needs.

Questions remain: What parameters do states want for this data package? What do states need to know to be assured that the data is both reliable and valid? Some of the existent CBP expert panels could set these data guidelines, but the panels can't fully implement them without outside support and assistance.

Hence, it should be asked: "Which state will volunteer to give up some of their state and jurisdictional authority to jumpstart the data sharing effort?" The biggest barrier is that each state is different, but if we get a few Chesapeake Bay watershed states to agree to this, then it could encourage a "domino effect." In order to seriously consider such an effort, there is a need for political support and this push for support needs to come from the states to increase the frequency and ease of data sharing.

Throughout the data evaluation process, there should also be a focus on soils. Soil differences from state to state and region to region have a big impact on how local wastewater treatment systems respond. Soil data must be incorporated and promoted in the data analyses.

The OWTS industry should focus first on pre-treatment technologies rather than soil treatment because when it comes to removing N, pre-treatment is very important and it is the focus of state approval processes. Soils are important, but the soils have to be addressed on a site-by-site basis, whereas pre-treatment technologies can be reviewed and adapted on a larger scale.

The biggest obstacle in this case is "controls" (ensuring that the OWTS testing is realistic). For instance, if OWTS testing is done in Massachusetts, it is uncertain whether the data are applicable in Maryland. Developing a database and comparing historical performance in each state is crucial to our improved understanding of these different processes in the long term.

Virginia is writing protocols for accepting data from field testing of treatment units from other states. In order to accept the data, a number of questions must be answered to determine the validity of the data, including: Was the data collected by an independent third party? Were the samples handled appropriately? What climate was the test conducted in? Were the systems tested in single family homes?

Delaware's representatives, on the other hand, said getting a similar set of protocols approved statewide in Delaware could be as difficult a prospect for them as getting a set of protocols approved across several watershed states at once.

A short discussion took place about the possibility of benefits being derived from groundwater monitoring, as well as pre-treatment monitoring, to create a long term data set in community wastewater treatment systems. The CBWM will need to recognize the implications of this new data. The opinion was voiced that "we are discussing a lot of technicalities here when we need to answer the question of whether the political commitment exists to do this."

Establishment of a long term data set can be accomplished for less money today than in the past, but is still a substantial undertaking. Taking a coalition or partnership approach with a primary lead organization and starting with seed money from the EPA could be the best option to establish such a data set. But to introduce new protocols for data sharing, which were not applied to previous data sets that have been shared, could present issues because the data sets were not handled the same way. An action was agreed upon that the EPA will continue to lead the effort to promote standardized data sharing and will consider the issue of housing the data at a later time.

However, other participants held that if the states do not have representation in the project, it will not be implemented. Each state needs to have a representative so everyone will accept and use the protocols when developed.

First Workshop Panel Discussion

How the States are Addressing Septic Loads and Related Septic Matters

Speakers: Jay Prager, Maryland Department of the Environment (MDE); Marcia Degen, Virginia Department of Health (VDH); and Derrick Caruthers, Delaware Department of Natural Resources & Environmental Control (DNREC)

Jay Prager explained that Maryland uses a specific funding source, the Bay Restoration Fund, to upgrade OWTS. Approximately $12 million per year has been available in recent years to upgrade OWTS in Maryland.

Connecting OWTS to an enhanced nitrogen removal (ENR) wastewater treatment plant[1] can be the best solution in some areas, but there is no standard site-by-site fix. In different circumstances, developers may want to upgrade OWTS, or build cluster systems for a number of homes, or connect the OWTS to a sewer system. Each of these different scenarios requires vastly different approaches by the state.

In order to operate in Maryland, OWTS testing is required for denitrification systems (limited to the first 10-15 years, composite samples, no ongoing testing). In many cases, it is unknown how these systems are working 5 years after the mandatory testing. Operation and maintenance in Maryland are issues that need to be addressed. Maryland is looking at alternative BMPs to credit for reducing N, and Maryland has N reduction goals for OWTS that would cut N by 40%. This is a difficult goal to reach already, and under the TMDL the state will need to account for growth in OWTS while also cutting N loads, presenting an additional challenge.

Derrick Caruthers said all new OWTS within a certain distance of any water source in Delaware are required to reduce N loads by 50% or 20mg/L. In Delaware, there is an impaired watershed on the southeast side of state (the Inland Bays watershed) with very similar problems to the Chesapeake Bay watershed, and the same 50% reduction in N applies.

Delaware has required that all new systems have in place field monitoring (one monitoring well up-gradient, two monitoring wells down-gradient), all sampled quarterly, and with data submitted to DNREC. The department has kept a database for the past 5 years, so it is not new practice for Delaware to collect that kind of data on a larger, statewide scale.

Marcia Degen spoke of Virginia's recently adopted state regulations that address N in the Chesapeake Bay watershed. Builders can still install conventional OWTS in Virginia, but if site conditions require an alternative system, then the project will have to comply with new regulations and adhere to new standards (50% reduction of discharged N and no more than 20 mg N/L, as in the other states).

Virginia is also pushing for a BMP approach for small systems that process less than or equal to 1,000 gallons per day. The CBP Watershed Technical Workgroup (WTWG) and BMP Expert Panels (see presentation by V. D'Amato (Tetra Tech) – Appendix B) recommended BMPs for the OWTS industry, including both soil-based and pre-treatment-based BMPs. Virginia does not require sampling to be done when an approved BMP is used, based on the assumption that the BMP is robust enough to obtain the correct reduction of N. For systems over 10,000 gallons per day, the N limit drops to 8 mg/L.

[1] ENR wastewater plants utilize the highest performing pollution reduction technologies and thus discharge nitrogen at very low levels.

A statewide database, the Virginia Environmental Network Information System (VENIS), is used to track design components of an OWTS, such as treatment method, soil information, installation depth, and dispersal type. VENIS was brought online in 2004. New systems and systems that have been upgraded since this database was established are added to the database on a regular basis. Virginia is currently working on moving more legacy data into VENIS.

Workshop attendees agreed that the adoption of additional new OWTS BMPs (beyond those already recommended by the CBP Expert Panels) is unlikely at this point. The current effort for the recommended BMPs was initiated in January 2012 and is still not complete. Additional BMPs should anticipate a similar timeframe to acceptance.

The Onsite Wastewater Treatment Systems Nitrogen Reduction Technology Expert Review Panel discussed issues associated with proprietary OWTS technologies in its February 2014 final report[2] and outlined a recommended protocol for accepting proprietary products as recognized BMPs in the Chesapeake Bay watershed. Ning Zhou (EPA-Virginia Tech) discussed the BMP review process and how the credits are incorporated into the CBWM. It is clear that more collaboration and planning are needed with respect to the BMP databases. More information needs to be provided to the states and researchers to help evaluate the extent to which OWTS BMPs are working to improve water quality.

One major research need is to monitor the impact that these upfront BMP activities have on water quality. There are various water monitoring programs and we must find a way to connect the disjointed monitoring programs into a comprehensive result-gathering process to assess expected water quality improvements from the use of a BMP. Cost is a major factor in this discussion, and an assessment of who provides the money and where the most efficient use of those dollars are, is necessary for moving forward.

Water quality trading and/or OWTS cost offsets may prove to be viable alternatives for the states to address with their onsite septic nutrient loads. Glynn Rountree (National Association of Home Builders – NAHB) said he thinks trading and crediting will become important because the costs to upgrade OWTS are substantially higher, while the amount of N reduced per dollar remains low.

States may wish to offset septic nutrient loadings by implementing agriculture BMPs or stream restoration projects. Industrial sites and some Municipal Separate Storm Sewer Systems (MS4s) are expected to act as consumers of trading credits in state water quality trading programs. With

[2] February 2014 Final Report, *Recommendations of the On-Site Wastewater Treatment Systems Nitrogen Reduction Technology Expert Review Panel*, submitted for approval to the Wastewater Treatment Workgroup of the Chesapeake Bay Partnership. A short summary and a link to the full document (http://www.chesapeakebay.net/channel_files/21245/owts_expert_panel_final_report_02-17-14.pdf.) are provided in Appendix C.

regard to water quality trading, Lisa Wainger (University of Maryland Center for Environmental Science – UMCES) asked: "How do you trade with a homeowner who may wish to offset their OWTS pollution?" Prager said that decisions are being made between paying a fee, purchasing credits, or upgrading technologies in Maryland, and with each successive run of the CBWM, less of the total nutrient load is attributed to the onsite wastewater sector. Zhou said this is the result of better data delivered to EPA from various sources.

Second Workshop Panel Discussion

Decision-making to Address the Septic Needs in new Residential Developments

Speakers: Katie Maloney, Maloney and Associates; Ellen Frketic, Maryland Environmental Service (MES); Amy Hart, Howard County, Maryland; and Dave Clark, Rural Community Assistance Partnership

Katie Maloney contended that housing policies are more often driven by EPA Smart Growth goals, rather than a goal of decreasing N loads from OWTS, and the two goals may often be 'out of sync.' Maloney outlined Maryland's new growth mapping policy, which is categorized in a four-tier arrangement: Tier 1 growth areas must be currently serviced by hookups to sewer; Tier 2 areas are scheduled to be served by central sewer systems within 30 years; and Tiers 3 and 4 are rural areas where sewer connections will not occur. Open parcels outside the water and sewer areas are Tier 3 and Tier 4 areas dominated by agriculture or forest land and only allow a construction maximum of 7 units per subdivision.

MDE requires third party controlling capability (via the county's Department of Public Works, for example). This was a stumbling block for implementation for many Maryland facilities because of discrepancies between building permits and changing requirements. Maryland now has a hybrid system, meaning if someone is building a subdivision serviced by sewer, they will only have a stormwater offset requirement under Maryland's offset requirements, and no wastewater offset.

The cost of central sewer connection ranges from approximately $8,000 to $50,000 per unit in Maryland. When looking at OWTS subdivision work, proximity to water and transport rates for that landscape and distance must be taken into account, as well as the type of OWTS being used.

Ellen Frketic explained that the MES is an independent state agency, created to provide water and wastewater operations for state parks, institutions, prisons, etc. MES can also act as a controlling authority for these shared use systems. MES has grown and now operates 200 facilities on various levels.

Amy Hart said a shared OWTS program began in Howard County, Maryland 20 years ago, when the building boom hit in the 1990s-2000s. As larger OWTS proposals became more prevalent in the county, officials changed laws to disallow large OWTS. A set of five large systems already started were grandfathered as the only large systems in the county. In one case, the developer did not sign the OWTS (a cluster system serving a number of residences) over to Howard County because if they had, operation and maintenance would have cost $6,000 per year per homeowner for this particular shared system subdivision. Costs are still a huge issue with smaller systems and sometimes the cost of treating a pound of N can be excessive for homeowners to take on alone.

Dave Clark (Rural Community Assistance Partnership - RCAP) explained that RCAP assists small rural communities with their wastewater issues. However, they are not a funding organization. RCAP provides technical assistance and training, working mainly with people in low income locations, and rarely in new developments. Clientele generally include old, secluded developments in Appalachia and aging colonial developments. An operating principle includes the approach that before obtaining funding, an engineering report must be conducted. RCAP can offer funds to complete the engineering report, with the sum to be repaid by the community after completion of the project.

Bob Mayer (American Manufacturing Company, Inc.) asked if the permit could be rewritten to use more process monitoring and less compliance monitoring, and if that would lower costs for monitoring. Mayer also noted that the cost of analysis is relatively inexpensive but the manual labor required to conduct additional monitoring is costly.

Anish Jantrania (NCS Wastewater Solutions) suggested that some of these permits should indeed be rewritten. Jantrania said that the OWTS industry needs to re-evaluate monitoring practices and the frequency at which they need to sample, and most importantly, they need to learn to "sample smart" and learn from monitoring activities moving forward. Money should be put towards renovations, upgrades, and replacing OWTS parts, but the cost of monitoring for a particular OWTS system takes away from the systems' other needs. The current monitoring network cannot provide adequate and necessary data.

Wainger asked if the permits require daily visits regardless of size. The question was answered in the affirmative, but Virginia's representatives offered a caveat, saying that if a site has the telemetry to remotely monitor status and relay alarm conditions, daily visits are not required until a very large design flow is reached. Prager said there is a new reality for what the cost of new growth and development is, and the OWTS industry does not necessarily need to accept it, but will need to assess what efforts are worth the investment and prioritize which aspects are most important now and in the future. Removing small amounts of N gets very expensive when you have to upgrade existing treatment plants. In addition, yearly maintenance costs are expensive and require daily monitoring; assume approximate annual costs of $100,000 for the operator, $50,000 for parts, and $50,000 for other expenses.

In the overall comparison of centralized and decentralized systems, there should be efforts to remove people from central sewer instead of trying to take people off OWTS because the sewer model requires more land area. Interestingly, Maloney mentioned that a Maryland administrator told her OWTS are meant to be temporary until a central sewer system is put in place in that area. However, Prager said that in his experience "…in Maryland we have never been told to think of OWTS as temporary systems waiting to be replaced by sewer connections." This disagreement illustrates the prevalence of miscommunication among state OWTS practitioners. Maloney indicated that she wants the administrator who made the above comment to talk to the Maryland stakeholders and discuss these differences in the perception of the value of OWTS versus central sewer.

Maureen Tooke said her EPA branch works with low income communities and in many cases, sewer connections are not coming to their area(s) any time soon. Additionally, incidents in which Publicly Owned Treatment Works (POTWs) fail due to storm events and release raw sewage into waterways in underserved areas are rarely acknowledged. These weakening systems must be re-evaluated and refurbished on a regional basis, and managers cannot assume that "the sewer will come."

Charles Bott (Hampton Roads Sanitation District - HRSD) spoke about the cost of small OWTS, including small cluster systems. Small systems are more expensive to operate and the liability associated with permitting non-compliance for these facilities is much higher. Virginia indicated that, given an opportunity to shut down these small cluster systems and switch to a centralized system, most utilities would do so.

The wastewater industry also has a communication problem in that there is variability in N measurement and although this is well established within both the OWTS and the larger wastewater treatment plant (WWTP) industries, it is not communicated well to the public or to other partners outside the wastewater industry. The OWTS industry also needs to very carefully characterize and measure performance in both large and small systems and report that variability using statistical methods (i.e., Coefficient of Variation, percentiles, etc.).

Recap of Morning Discussions

Facilitator: Denice Wardrop, Penn State University

The group discussed the possibility of creating a shared data system, new policies and systems at the state level, and challenges posed by new development and a growing human population in the Chesapeake Bay watershed. Audience members raised key questions: "What is our priority? Are we just trying to reduce N or are we trying to increase OWTS efficiency and incorporate a land use component too? Have we ever discussed the advantages and disadvantages of centralized versus decentralized sewer systems?"

Discussion shifted focus to a comparison of centralized septic (aka POTWs), decentralized systems (also called cluster systems, regional systems, or shared systems), and individual onsite systems. There should not be any regulator preference based simply on cost or ease of regulatory pathways. Sometimes regulations allow for easier paths to be taken, but do not always provide the best paths for environmental improvement.

Charles Bott (HRSD) presented examples of where he has seen struggles with smaller decentralized systems, some caused by membrane fouling because of membrane integrity issues. Those issues would not arise with a larger OWTS system. For those cluster systems discharging to surface waters, particularly very small receiving streams (as is normally the case), very stringent copper (Cu) and zinc (Zn) limits are now being applied and can result in tremendous costs for compliance, the need for expensive clean sampling methods, and considerable additional burden. This could well exceed the difficulty and cost of implementing biological nutrient removal (BNR) and ENR at these facilities. In relation to Bott's concerns, it was noted that the National Onsite Wastewater Recycling Association (NOWRA) has been promoting performance-based standards for years.

Degen said that Virginia has the ability, within regulations, to allow engineers to diverge from prescribed OWTS construction methods as long as they can show the system performs similarly. This approach provides more flexibility in terms of installation and maintenance, but does not provide a baseline efficiency measurement and lowers the confidence level that system designs will be able to routinely achieve the design requirements.

Hudson asked, "When it comes to shared systems, are we seeing any uptick in the frequency of such community systems?" Some mid-size shared systems with discharges to water bodies are sometimes unable to meet TMDL requirements or it becomes more expensive to meet them. An OWTS can be installed more cost-effectively and for that reason, there has been a move towards installation of smaller, community-based system rather than shared systems.

Virginia is seeing some conversion of discharging systems to community systems. In Maryland, the distribution is almost equal, but Prager said he does not know where the state is headed because cost is rising (see the discussion after the 2nd Panel on "Decision-making to Address the Septic Needs in new Residential Developments" that mentions Howard County's ban on large sewer systems). The OWTS industry must consider whether they want better treatment or better management, and examine which systems work best in different scenarios.

Some states have made their own decisions. In Delaware, three out of four subdivisions are being converted to a regional system rather than separate community systems. In Pennsylvania, local government seems to be the main roadblock to installation of community OWTS systems, and in other areas the portrayal of OWTS systems serving mainly as temporary systems acts as another roadblock at the local level.

During a discussion of a possible requirement to have people monitoring these systems on a daily basis, Hart said that two of the systems in Howard County, Maryland are required to be checked every day and a monthly report is sent to MDE. Virginia requires quarterly visits and reports for 10,000-40,000 gallon a day systems. It would benefit the states to keep monitoring activities and data sharing protocols consistent and transparent.

Second Presentation

Overview of Best Available Technologies for Onsite Septic Systems and Management Considerations

Dr. Albert Rubin, NC State University

Rubin reviewed such wastewater issues as treatment by an in-ground tank, an Aeration Treatment Unit, or by reuse and dispersal issues by traditional soil absorption systems or by alternative soil absorption systems (Low Pressure Pipe or Drip). Important non-technical wastewater needs include: presence of competent personnel, adequate supplies and equipment, consistent and accurate monitoring/measuring/reporting, corrective actions, program management, sustainability, financing, improvement/repair, and infrastructure.

BOD (biochemical oxygen demand) is the rate at which organisms use oxygen to break down organic matter. High BOD levels indicate high levels of organic matter which may remove dissolved oxygen from water, making low BOD desirable in some circumstances. The oxygen required to degrade BOD (OWTS must eliminate BOD compounds first) is about 1.5 units of oxygen per unit of BOD. BOD is easily removed in properly managed systems, but alkalinity is necessary to complete the process.

Both organic and inorganic N can be found in wastewater. This N (primarily in the form of ammonia, NH_3) is broken down by bacteria in the septic or wastewater system. Wastewater treatment designs intended to remove N via nitrification and denitrification processes must provide both aerobic and anaerobic conditions to operate properly.[3] In aerobic conditions, the

[3] "Compendium of Information on Alternative Onsite Septic System Technology in Massachusetts." See http://www.barnstablecountyhealth.org/ia-systems/information-center/compendium-of-information-on-alternative-onsite-septic-system-technology/basics-of-wastewater-treatment.

bacteria will convert the ammonia to nitrate (NO_3), a process known as nitrification, which consumes oxygen. Nitrates are considered undesirable in public water and can have serious health effects on humans and the environment. Thus, they must be reduced and the conversion of nitrates to nitrogen gas is a process called denitrification.

Denitrification occurs under anaerobic conditions. Alkalinity, the capacity of an aqueous solution to neutralize acids[4], is a key component of the denitrification process, but in many systems, the required alkalinity in not present to achieve desired levels of denitrification.

Bott asked, “How many of these systems are adding alkalinity on a regular basis?” Rubin replied that, in his experience, none of them and there are no requirements to test for alkalinity. Bott said that alkalinity may not be added at small residential systems, but it is often added at slightly larger cluster systems. Also, for systems performing pre-denitrification, approximately half of the alkalinity used by the nitrification process is returned to the system during denitrification. So, in many cases, more efficient denitrification can result in lesser or no need for supplemental alkalinity. The OWTS industry needs to better educate the regulatory community and provide detail on the consequences of some currently used methods.

Beyond those conditions, soil systems remain a vital part of the dispersal component. There is a need to design OWTS systems for site and soil limitations. Some systems are hydraulically limited and need to be designed appropriately – that is, the system must be designed to accept, transmit, and discharge the liquid entering the site through the soil system on the site. In addition, the system must be designed to accept the process load (the organic matter introduced to the site). Finally, the site must be developed with some awareness of the fate of the nutrients (N and Phosphorus (P)) applied.

N reactions are very dependent on temperature (low temperatures retard reactions) and opportunistic – they typically follow BOD reduction, require significant oxygen, and depend on alkalinity. P occurs in three forms in wastewater (orthophosphate, polyphosphate, organic phosphate), usually measured together as total P. Both N and P can promote eutrophication, the growth of algae in surface waters, but in some cases the growth of benign aquatic plants is boosted through the same processes.

Ways to reduce N and P include one not-so-popular option: urine harvesting. If urine was collected rather than flushed, 12 lbs. of N would be removed per person per year, which equates to about 48 lbs. of N per year per four-person family (but it must be considered who picks up the waste, who processes it, and determination of its final use). No-mix, or urine/source separation, toilets were also discussed, and projects involving such technologies are already in use in Europe and some U.S. locations.

[4] “Environmental Health – Toxic Substances.” See http://toxics.usgs.gov/definitions/alkalinity.html.

The National Sanitation Foundation Program (NSF International) provides certification, environmental technology verification, research services, professional accreditation, field effluent modeling, field service, and maintenance monitoring for OWTS needs.

Typically, two general types of systems are recognized by NSF International: suspended growth and fixed growth. The organisms which bring about the conditions necessary for treatment are either attached to some media (fixed growth) or suspended in the water source requiring treatment (suspended growth). Both systems perform well in nutrient removal, but both must be managed properly. For effective nutrient removal, aerobic and anaerobic conditions must be achieved in the treatment process.

Suspended and fixed growth aerobic treatments (aerobic treatment units – ATUs) all require oxygen and time. The suspended treatment units require slightly more energy than the fixed growth systems simply because energy is required to supply oxygen and to maintain organisms suspended in the water column for the required time. It is important to examine overall program performance to identify how each segment of the system is operating. Proper management must be included as an integral part of these efforts and it should be included in permitting, specification, regulation, technology choice, etc.

Some states mandate routine inspections and maintenance. Where this is required, 2 to 4 inspections are conducted in the first few years of a system's operation, and monitoring requirements can be reduced if data show proper system function. Inspections include both process monitoring (flow, dissolved oxygen (DO), pH, turbidity), and other water quality and health-related parameters as listed on the permit (BOD, total N (TN), coliforms).

Individual OWTS are more time consuming to construct on a per capita basis than the shared or cluster systems, but these small systems may be easier to manage and maintain than larger systems. Shared or cluster systems treating many thousands of gallons per day often require daily inspection.

Third Presentation

EPA's Expert Panel Review Report on Onsite Nitrogen Reduction Technology

Victor D'Amato, Tetra Tech

The EPA OWTS Expert Panel originally convened in 2012 to review the available science on the N removal performance of treatment practices provides concise definitions and percent reductions for N load reduction practices, developed a definition for each treatment practice, and defined any qualifying conditions. The Expert Panel only addressed treatment technologies that were on-lot and did not examine soil attenuation. Soil attenuation will be addressed in another EPA research effort.

The baseline load from traditional OWTS in the current CBWM is estimated at 4 kg of total N per person per year as measured at edge of drainfield. For a conventional wastewater tank-drainfield site (aka the baseline configuration), 5 kg N per person per year is assumed in the effluent of the tank. If one assumes a flow of 60 gallons per capita per day (gpcpd), then the resulting effluent total N concentration is 60 mg/L. Given that the model states that 4 kg N is measured at the edge of the drainfield, the N loss across the drainfield is assumed to be 20% ((5 kg – 4 kg)/5kg). Currently, the CBWM assumes a further 60% reduction in N in the discharge from the edge of the drainfield to the edge of the waterbody that receives the OWTS discharge.

Originally, there were three septic BMPs for states to use for credit under the Chesapeake Bay TMDL – connection to central sewer (100% reduction credited to the state's onsite sector), 50% reduction credited for use of a denitrification system, and routine OWTS tank pump-out (5% reduction credited, in the year the pump-out occurs).

In summary, baseline load recommendations for OWTS are 5 kg TN per person per year in raw wastewater and tank-treated effluent, with 4 kg TN per person per year achieved at edge of drainfield. OWTS technologies may include *ex situ* BMPs (pre-treatment), and/or *in situ* BMPs (enhancements/upgrade). Reductions of 20% - 69% may be credited depending on the combination of *ex situ* and *in situ* BMPs utilized.

When examining proprietary BMPs versus non-proprietary BMPs, proprietary BMPs are developed, marketed, and constructed by the manufacturer. Non-proprietary BMPs are designed on a case-by-case basis for each site using non-specific and readily available materials and mechanical equipment.

Research and management recommendations include controlling alkalinity in the OWTS (as noted above, alkalinity is essential for effective nitrification), simplifying BMP verification to avoid laboratory testing samples of effluent, data sharing between states concerning approved septic BMPs, consideration of modifying the baseline conditions of the model to more fully reflect site variation, and BMP performance by soil type.

The wastewater management continuum recognizes that OWTS needs may be addressed by individual onsite systems, by small cluster systems serving a few homes, by large clusters that often may serve a residential development, by small wastewater treatment plants that may serve a small community or a large shopping center, or by a large POTW that may serve a town or a small city.

A decentralized approach allows a community to adapt its OWTS as it grows, whereas centralized systems are installed to accommodate expected build-out wastewater flow. However, the actual wastewater flow rate may never reach the expected level and the result is an oversized facility and wasted capital.

D'Amato said that a recently funded research project[5] at the WERF is of interest to the OWTS industry. The research focuses on use of distributed infrastructure approaches, including decentralized wastewater treatment where traditional centralized approaches would normally be used. The goal of the project is to develop information and tools to help communities make decisions about which approach may work best in their particular location. Case studies include sites located in Canada and Australia, as well as the U.S.

Fourth Presentation

No-mix Toilets and Other Eco-Toilet Technologies

Matt Patrick, Westport River Watershed Alliance

Matt Patrick described N eutrophication in Falmouth, Massachusetts. Fifty years of continued development in the Falmouth area produced excess N loads, with at least 75% of the controllable N input coming from OWTS systems, according to the Massachusetts Department of Environmental Protection (DEP). Falmouth appropriated \$2.7 million to move forward with sewer design and alternative demonstration projects. Voters approved the measure on a town-wide ballot by a 2-to-1 margin in every precinct.

Patrick, acting as a former Falmouth Selectman, state representative, and current director of the Westport Watershed Alliance, advocated for the installation of urine-diverting or composting toilets at a town meeting. The project did not receive serious initial consideration, but Patrick explained that 80% of household N discharge can be attributed to urine alone, effectively convincing the town to take part in an eco-toilet demonstration project and invest in implementation and incentives. Such toilets are already being used in Sweden and elsewhere in Europe.

Research objectives include scientifically validating the amount of N removed from household effluent when human waste is removed through the new toilets; determining the real cost of retrofitting the toilets into existing homes; documenting the technical feasibility of retrofits; and studying whether urine-diverting fixtures function as expected.

[5] "When to Consider Distributed Water Systems in an Urban and Suburban Context", see www.werf.org/distributedwater.

Remaining questions about urine-diverting technologies include: Will they be accepted and used? Will they cost less to retrofit than other alternatives? How much N will be removed from local waters by urine-diverting technologies alone?

Massachusetts proposes to answer the above questions through the following actions:

- Verify N removal factors for the new toilets and get state DEP approval for monitoring grey water;
- Calculate public acceptance rates for the toilets;
- Estimate average installation costs for different types of homes;
- Set up residuals recycling and management programs; and
- Estimate lifetime cost/unit of N removed for each type of eco-toilet.

Packaging toilets (toilets that package waste for off-site disposal) have not been approved in Massachusetts. However, composting toilets, with a fan in their vent stack to pull air through the toilet and mitigate odor issues, are approved by the state. Traditional flush toilets near local, coastal ponds have greatly contributed to the N loads degrading water quality. Massachusetts DEP hopes for 62 toilet installations to determine actual N removal rates and to obtain certification of those rates by EPA. Incentives for homeowners include $5,000 to cover the purchase and installation of the toilets and a $300 pump out fee. If desired, the homeowner can receive an exemption from future sewer connection and tax credits for that exemption.

Toilet installations must be a state approved eco-toilet system (i.e., urine-diverting or composting toilets approved by the Massachusetts Plumbing Board); all toilets in the home must be replaced with eco-toilets; the OWTS tank must be pumped out and water records must be made available; residuals must be removed by a licensed liquid waste hauler; and property access for testing is required.

Patrick mentioned a concept from E.F. Schumacher's book, *Small is Beautiful*: instead of taking first world technologies to third world countries, first world nations need to enable third world nations to help themselves to make current technologies simpler and/or more cost-efficient, yet just as effective as existent technologies (Schumacher 1973). The concept works in much the same way here. Why use expensive, complicated sewers when the systems are not sustainable or absolutely necessary? Public demonstration projects are a good way to inform many about a new and potentially more effective technology for a particular locale.

It was asked if the Falmouth community has looked into land application sites for urine disposal. The state allows some farms to apply “sewage sludge” (biosolids) to their fields, but no urine disposal is currently allowed – and it is not the farmers taking issue with urine; rather, it’s a social construct of the public at large. In Vermont, there is a project run by the Rich Earth Institute and approved by the Vermont DEP that uses urine on hay fields, which has been very successful in fertilization. Urine has been used on cereal crops in Sweden for years.

The discussion following Patrick’s presentation emphasized the concept that a “one size fits all” approach is not necessarily the best approach for wastewater treatment. The OWTS industry must rethink their future and allow for adaptive management later. It will be costly in the long run to implement a technology that will work now, but could be outdated soon after, just as it would be astronomically expensive and wasteful to install large sewer projects that may never serve their intended population.

How do we make this effort in Falmouth both a waste disposal opportunity and also a waste residual reallocation project? Collaboration is crucial, communication needs to increase, and the education of local government and the public is increasingly important. There also needs to be a push towards more instrumentation control, greater telemetry, and improved monitoring. In addition, the very structure of discharge permitting needs to be reviewed.

Sustainability is important moving forward. Virginia’s HRSD is currently involved in a WERF-funded urine harvesting pilot program in the Chesapeake Bay watershed[6], but the OWTS industry needs to determine the value and applicability of such systems for society where it is not yet accepted. In addition, the public should be made aware of the necessary management component and the technologies that are being considered.

Fifth Presentation

Florida’s Study of Nitrogen Reduction Strategies for Onsite Septic Systems

Damann Anderson, Hazen, and Sawyer

Anderson highlighted four primary tasks in a study by the Florida Department of Health to assess nutrient loads from the wastewater systems. The tasks consist of an evaluation of onsite wastewater system N reduction technologies; field testing of full-scale treatment technologies; an evaluation of N reductions achieved by these technologies; and N fate and transport modeling.

[6] “WERF Receives $2 Million Grant to Establish National Research Center for Resource Recovery and Nutrient Management - http://www.werf.org/c/PressReleases/2014/WERF_Receives__2_Million_Grant_to_Establish_National_Research_Center_for_Resource_Recovery_and_Nutri.aspx.

Only the first two tasks were discussed during this presentation. Anderson reviewed the process of biological N reduction for onsite wastewater treatment (as discussed above). The steps are primary treatment, then nitrification (in an aerobic environment), then denitrification (in an anaerobic/anoxic environment), and dispersal of the effluent.

Most current N-reducing OWTS are mechanical treatment units. Passive N-reducing Onsite Sewage Treatment & Disposal Systems (OSTDS) are rarer, but more similar to conventional OWTS in their operation and maintenance.

Passive N-reducing systems (PNRS) are systems that reduce effluent N using reactive media for denitrification and a single liquid pump, if necessary.

The Florida study was designed to further explore previously developed concepts and follow up with larger, pilot-scale units and various media combinations. Study administrators developed detailed performance data for passive biofiltration designs and produced scalable design criteria from pilot scale biofilters for subsequent full-scale testing. Various nitrification and denitrification media were evaluated in single-pass biofilter systems. Also examined were recirculating biofilters – where the OWTS effluent and a portion of the nitrified effluent is cycled back into the initial stage.

Results using the nitrifying clinoptilolite media and sulfur media in biofilters were very encouraging, producing effluent total N concentrations below 3 mg/L from a primary treated influent.

Many of the lessons learned from pilot tests were also encouraging. For instance, if all N in an OWTS is nitrified, denitrification follows easily, but the nitrification step is more difficult to initiate. Highly reactive elemental sulfur media reduced nitrate quickly, but the option for lignocellulosic treatment was much longer.

Study administrators decided to take advantage of both processes and look at a combination of lignocellulosic followed by the use of sulfur to polish its effluent in the next step, using mixed oyster shell with sulfur to counteract alkalinity issues that would have prevented the process from working. The study also looked at the performance of in-ground, “stacked,” two-stage biofilter systems.

Overall, the results in these tests show that OWTS should be able to achieve nutrient removal levels similar to large wastewater treatment plants and play a role in N reduction in sensitive watersheds. Anderson thinks with these methods a community-scale OWTS can be created that can meet the performance of a municipal POTW system.

Sixth Presentation

What Cluster Systems Can Offer

Anish Jantrania, NCS Wastewater Solutions

Jantrania gave an overview of managed, decentralized (cluster) OWTS; the various technologies available; soil and nutrient loading issues; and the management of decentralized systems. When planning for the development of a subdivision, a developer can evaluate two possible alternatives. Plan A might be to spread a cluster system over a larger area. In that scenario, everyone in the community gets a larger lot because an OWTS is installed on each homeowner's property.

Plan B might be to install a community system servicing all the homes in the community, but in this scenario the homes are clustered closer together giving them smaller tracks of land. Plan B allows for greater land conservation rather than tying up valuable land that would be used for drain fields in Plan A (where OWTS are expected to serve each home and require their own individual drainage fields). In addition, Plan B would be more cost-effective and sustainable than installing OWTS for each house and it would continually utilize industry professionals in order to maintain the system on a regular basis.

Decentralized technologies cover wastewater collection, wastewater treatment, and effluent management. With the tools available, a decentralized solution can be found for any community, whether new or existing, where funding can be identified. These decentralized systems are all soil-based disposal drip systems and many have been in operation for 20 years (WERF 2009; complete report ((DEC1R06)) and information on nitrogen reductions in the "N-Cal and STUMOD" spreadsheet).

Responsibly managed decentralized systems can fill the void between poorly maintained conventional systems and highly managed centralized treatment plants in both new and existing homes/communities.

Private (non-government) OWTS utilities can be successful by employing professional management, charging market rates, and maintaining bond security for three years of operating costs, and an allowance for equipment replacement and/or upgrades. Such utilities offer a predictable monthly budget amount for homeowners' sewer costs with regulatory oversight of rates and performance of the system.

Jantrania stated that decentralized technologies are ‘here to stay’ because decentralized systems are more efficient and better able to meet stringent wastewater and stormwater requirements and often serve as the best available option in areas not linked to public sewers.

Seventh Presentation

Beyond Nitrogen

Rich Piluk, Anne Arundel County Health Department

Piluk covered the many challenges to an OWTS's N removal by detailing the biological processes involved, wastewater characteristics, monitoring, and the operation of the OWTS.

The Anne Arundel County Health Department became concerned about N loading from OWTS in 1983 due to data from an intermittent sand filter. Using sand to filter the effluent from an individual home's OWTS made a huge improvement on the OWTS performance with reductions in BOD and coliform, and large reductions in organic N, TKN (Total Kjeldahl Nitrogen), and NH_4 (ammonium), but nitrates actually <u>increased</u>, so there was very little actual reduction in total N. Essentially, the system was converting the ammonia into nitrates (through nitrification). Nitrates move much more easily through soils and the groundwater than NH_4, so the N situation actually worsened with the use of intermittent sand filters. The county then pioneered the use of recirculating sand filters that incorporate denitrification to improve the removal of N from wastewater.

It is important to know whether an OWTS is working and, based on that functional information, how to best improve the performance of the system if it is not operating at its optimum level. OWTS's are inherently variable due to a number of factors and should be monitored and adjusted for site-specific conditions when necessary. Factors that may limit nitrification include oxygen levels (3mg/L or higher in the aeration tank is appropriate); temperature (30^{o}C, 86 F is optimal; nitrification ceases at 5^{o}C, 41 F); pH (preferred 6.5 – 8.0); alkalinity (at least 50 mg/L as calcium carbonate (CaCO3) residual); and various chemical inhibitors, organic and inorganic, that may accumulate in the OWTS. Biological nitrification is a living system and temperature control and chemical inhibitors are crucial aspects of the nitrification process (see sections above).

Nitrification consumes alkalinity (7.2 parts alkalinity consumed for each portion of ammonia converted to nitrate) and can lower pH levels. Low levels of pH can inhibit nitrification levels, so alkalinity is best maintained at 50 mg/L or above. Using baking soda in laundry loads can increase alkalinity to acceptable levels for nitrification. The wash load is also improved when using baking soda because less detergent is required. Typically too much detergent is used in laundry, which can leave a detergent residue on clothes that can clog septic drainfields.

Many water wells in Anne Arundel County have very high levels of iron. If the backwash from water conditioners treating high iron levels is discharged into the wastewater treatment system, the iron can precipitate in the aerobic section and clog the system. Hence, discharging the backwash from water conditioners into the OWTS is not recommended.

Some Anne Arundel County residents are also using <u>tons</u> of salt per year to treat their iron heavy well water, polluting groundwater with excessive amounts of salt. Unfortunately, this practice is unregulated.

Other household practices can also have unintended consequences for OWTS. Nitrification inhibition can be caused by the use of toilet bowl tablets, liquid fabric softeners, and disinfectants. Not only is the amount of laundry detergent used a significant factor, but also the type of laundry detergent used can inhibit the nitrification process. EPA has a program called "Design for the Environment" that approves less toxic household products. Homeowners have improved the N-reducing efficiency of their treatment systems by simply switching to one of the EPA-approved detergents called *Ecos*.

Reducing the levels of N from individual OWTS is very challenging and many experts believe that the amount of N reduction that might be achieved is not practical considering the high costs and effort. If, however, in the process of trying to reduce N homeowners can use less toxic and more biodegradable products, the benefits for the environment will be greater than just reducing N levels, since proper disposal of the products will be less of an issue.

Workshop Wrap-Up Discussion

Moderator Wardrop asked attendees to discuss recommendations and findings to consolidate workshop ideas for the workshop report. It was agreed that the most important recommendations should be limited in number, so additional secondary recommendations are offered following the priority recommendations below. Many recommendations were discussed and a voting procedure was adopted to identify the recommendations of greatest importance to the workshop audience and the CBP.

Priority Recommendations from this Workshop:

- The Chesapeake Bay Watershed Model (CBWM) should contain detailed information on the soils used in wastewater drainfields and how those soils interact with nitrogen. <u>The</u>

report recommends that the CBWM be refined to reflect how soils interact with nitrogen loadings from onsite wastewater treatment systems (OWTS).

- Education and investment are needed to further develop onsite technologies. Both consumer interest and public support will be a key to success. Even if all of the engineering goals for OWTS are attained, there can be no success if homeowner education. The report recommends that the EPA, the CBP, and the Chesapeake Bay watershed jurisdictions work to educate the public in onsite wastewater treatment and seek public buy-in for demonstration projects like the Massachusetts eco-toilet project.

- Both federal and local funding is necessary as well as community education and outreach to ensure proper management of septic infrastructure and to reduce costs into the future. The report recommends that federal funding is needed to address the onsite wastewater treatment infrastructure needs.

- Interaction and collaboration between states needs to occur regarding the use of septic onsite and decentralized technologies. Such interactions are often underrated and the buy-in is necessary for adoption to occur. The report recommends that the CBP should reach out to the Chesapeake Bay watershed jurisdictions to identify possible collaboration options and help provide future assistance to ensure continued progress.

- Data sharing between states in a number of areas is critical. The report recommends that funding the initial development of those efforts, including the sharing of test data from treatment units, should be considered by EPA along with the possible management and funding of inter-state data sharing efforts.

- The proper management of infrastructure, including OWTS, is critical and so is the balance of federal and local funding for such efforts. Viable onsite options will save communities money over time. The report recommends that education and outreach efforts about the options be initiated and focused on communities most in need of such support to address their wastewater issues.

Additional Recommendations from this Workshop:

- Demonstration projects of the various technologies from the Florida project, as presented by Anderson, would be useful in the Chesapeake Bay watershed. However, Florida has higher temperatures, and not as much of an alkalinity problem, but these technologies could be refined to work in the Chesapeake Bay watershed. A connection between Florida's OWTS efforts and the CBP should be established.

- A failsafe method to add alkalinity in alkalinity- poor OWTS is needed as low alkalinity poses a problem to OWTS functionality.

- Better collaboration across the suite of septic options is necessary (sewer hookups, decentralized septic options, OWTS technology options, and possibly water quality trading for OWTS (see below for more on trading)).

- Monitoring funds are decreasing – monitoring for performance and control of alkalinity will allow us to better account for OWTS operations. If the system is built correctly and the alkalinity accurately tracked in the system through monitoring, the costly and time-consuming process of sampling effluent discharges and laboratory testing may be minimized.

- How can the wastewater industry collaborate with the stormwater industry, the latter receiving funding at this time? We need to identify pathways to cross-fertilize these two disciplines for mutual benefit.

- Water quality trading – EPA/CBP is encouraged to explore how trading might work for offsetting pollutants generated from OWTS. Such trading may save money and add flexibility to the state WIP plans, which will be amended for a final time in 2017.

- Maryland has proposed a program called "Accounting for Growth," with trading offsets to be a part of the program. For an OWTS there may be $15,000-$40,000 cost for OWTS installation when these offsets go into effect. The above recommendation on trading may be helpful in these state "new growth" programs that are mandated under the Chesapeake Bay TMDL.

- Data collection for OWTS should be consistent among the states so the data can be shared and compared.

- Public education about the OWTS options available is needed as well as education of state and local regulators on when the options are economically viable and functional.

- It would be advisable to create a new state standard approach for septic needs for new communities, while recognizing that the Chesapeake Bay watershed states are beginning to formulate standards that address the issue of an integrated water infrastructure (wastewater, recycled water, stormwater, and drinking water).

- Prince George's County in Maryland is considering private-public partnerships for wastewater systems. Maybe the CBP and/or Chesapeake Bay watershed jurisdictions could set up a similar approach to evaluate the management and maintenance of these systems.

- It would be very helpful to have a set of design standards for OWTS. However, a huge hurdle is the differing regulations not only between states, but between counties within states.

- In general, there is a need for septic standards rather than guidelines. Standards are more stringent and more appropriate for septic issues which may affect public health.

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Appendix A: U.S. Environmental Protection Agency Office of Wastewater Management Inter-State Collaboration and Improved Data Sharing for Advanced Onsite Technology Approvals

Whitepaper
December 2013

Executive Summary

Onsite wastewater systems (also called septic systems or decentralized systems) are used throughout the Chesapeake Bay watershed, and contribute nitrogen and other contaminants to groundwater. Some Chesapeake Bay watershed states have started implementing and promoting the use of advanced nitrogen treatment technologies in the watershed to reduce nitrogen loads to the Bay. However, technologies are approved at the state level, and there is currently no national clearinghouse for advanced systems. Manufacturers must seek approval in each state on an individual basis, which creates a burden on states and manufacturers, and potentially impedes innovation.

While states should maintain their oversight and authority on technology approval, protocols could be developed for data sharing so information developed in one state could be used in the approval and verification process in other states. This whitepaper provides an overview of past efforts at inter-state cooperation for technology verification and approval, and existing protocols, or standards for technology evaluation. It is focused on treatment technologies that reduce nitrogen concentrations in the effluent before it enters the drainfield. This whitepaper also identifies the following technical issues that should be discussed when developing data sharing protocols between states for technology verification:

- Use of test centers versus field testing, or both,
- Frequency and duration of testing,
- Selection of sampling parameters,
- Selection of a standard protocol for inter-state collaboration,
- Varying climate and geologic settings,
- Oversight or accreditation of testing facilities and organizations, and
- Operation, maintenance, and monitoring considerations.

In addition, the whitepaper identifies organizations that could potentially lead the streamlining effort for technology verification, and discusses the responsibility of the leading entity. This document also outlines the next steps for starting the process in the Chesapeake Bay watershed states. Next steps will include reviewing state verification and approval programs for onsite technologies to identify commonalities and constraints, establishing a leadership group for the effort, and drafting a memorandum of understanding or agreement for states to participate in the process.

While starting with Chesapeake Bay watershed states, the approach could be expanded to a more national application at a later time.

1. Introduction

Onsite wastewater systems (also called septic systems or decentralized systems) are used throughout the Chesapeake Bay watershed, and in other areas of the U.S. where connecting homes to a centralized system may be expensive, or impractical. Residential wastewater effluent reaching an onsite system comes from a variety of sources, including toilet flushing, sink and shower drains, and washing machines. A conventional onsite system collects the effluent from all these sources into a septic tank, and a drainfield then disperses the effluent from the tank to the subsurface. A conventional onsite system provides limited nitrogen removal from the effluent, but advanced treatment components can be added to a traditional system, often between the septic tank and the drainfield, to provide advanced treatment of nitrogen. While advanced treatment can also be obtained through soil-treatment units and soil amendments in the drainfield, data on the performance of soil-based technologies is more difficult to come by because performance is more challenging to verify than that of pre-drainfield technologies. Therefore, this document focuses on treatment technologies that treat nitrogen before the effluent reaches the drainfield. Unless specified otherwise, advanced or alternative treatment refers to technologies that treat nitrogen before the effluent reaches the drainfield, and does not include soil-based technologies or units.

Some of the Chesapeake Bay watershed states have started implementing and promoting the use of advanced nitrogen treatment technologies in the watershed. In an effort to make advanced technologies available, many states have developed their own technology approval and verification process to confirm the performance of the advanced systems prior to approval in their state. However, there is currently no national clearinghouse for advanced systems, which are approved by states on a state-by-state basis. Manufacturers must seek approval in each state on an individual basis. This creates a burden on the states and manufacturers, and potentially impedes innovation. This results in less choice for customers, potential delays in the implementation of nitrogen-reducing technologies, and increased impacts from nutrients to receiving waters. While states should maintain their oversight and authority on technology approval, data collected during the approval process in a given state could be shared across states to streamline approval and verification in other states. At this time, states have their own technology verification and data collection requirements, making data sharing a challenge.

While the term reciprocity may come to mind to the reader of this whitepaper, promoting direct reciprocity of technology approval is not the intent of this effort. The focus of this effort is on streamlining data collection processes to encourage data sharing across states, reduce data collection costs, and promote collaboration. This does not imply that approval of a particular technology in one state should lead to approval in another state. It should also be noted that collaboration for establishing common protocols for data collection and sharing will need to be formalized by some type of signed agreement between participating states. Without an agreement, the cooperation may have limited value, because commitment by the states to follow common protocols and data sharing would be unclear, and manufacturers may be reluctant to follow this new evaluation framework. It is not the purpose of this whitepaper to draft an inter-state agreement, but rather to identify technical issues states will need to consider when developing a common data sharing framework.

This whitepaper was developed to provide an overview of past efforts at data sharing and inter-state cooperation for technology verification and approval, discuss existing standards for technology evaluation, compare state verification processes in the Chesapeake Bay watershed, identify technical issues in data sharing cooperation, describe organizations that could potentially lead the effort, and present preliminary steps to begin the process.

2. Past Efforts at Data Sharing and Inter-state Cooperation for Advanced Technology Approval

A number of states and non-governmental entities have worked at implementing data sharing and data collection across multiple states for advanced technologies, including the Technology Acceptance and Reciprocity Partnership (TARP), and the New England Inter-state Water Pollution Control Commission's (NEIWPCC) regulatory cooperation project. While developed for a broad range of technologies, both of these programs apply specifically to nitrogen-reducing technologies for onsite systems. In addition, the National Onsite Wastewater Recycling Association (NOWRA) developed a Model Code Framework to help states regulate the performance and management of decentralized wastewater infrastructure, and explored reciprocity for technology approval across states. The description of these three programs in the sections below provides insight on past efforts of collaboration for technology approval, but also shows that none of these programs can be implemented or adopted directly as a framework for data sharing on onsite technologies without significant effort on behalf of the Chesapeake Bay Watershed states and stakeholders.

Finally, the Water Environment Research Foundation (WERF), the U.S. EPA, and other organizations developed and maintain an online database of monitoring and performance data for stormwater practices: the International Stormwater Best Management Practices (BMP) Database project (http://www.bmpdatabase.org/). While this database is exclusively for stormwater practices and does not address wastewater, it has been ongoing since 1996, and may provide valuable lessons for developing a similar database for onsite systems. This project is also described below.

2.1 TARP

Under TARP, the commissioners and secretaries of eight states (California, Illinois, Massachusetts, Maryland, New Jersey, New York, Pennsylvania, and Virginia) signed a Memorandum of Understanding (MOU) to participate in the development of common protocols that provide uniform methods for collecting and evaluating data on technology performance and costs. By sharing the workload for review across states, TARP estimates that up to 80 percent of the states' traditional application review time can be reduced.

The TARP signatory states agreed to a shared database of information on technologies tested under the protocols, and also agreed to conduct pilot projects for the review of new technologies. States identified three tests for the development cycle of new technologies that require state permits or regulatory approvals: a treatability study under lab conditions, a full-scale field demonstration test to collect performance data, and a start-up/compliance test of a technology's ability to meet performance standards.

Because TARP is designed for technologies across various industries and applications, it is based on three tiers of guidance. Tier 1 guidance addresses data collection and evaluation, applies to all technologies, and was prepared in December 2000 jointly by all participating states. Tier 1 guidance is complete and has been adopted by all signatory states. Tier 2 guidance is technology-specific, and such guidance was developed for stormwater technologies, but not for wastewater technologies. The stormwater Tier 2 guidance provides a uniform method for demonstrating stormwater technologies and developing quality assurance (QA) plans for certification or verification of performance. Tier 3 guidance relates to permitting and approval of certain technologies.

Data collected by TARP for stormwater technologies is hosted online by the University of Massachusetts Amherst (http://www.mastep.net/database/data.cfm). Almost 100 technologies are listed on the database, and a summary file of the best rated technologies can be downloaded to compare pollutant removal rates. Based on the website information, it appears that little activity under TARP for stormwater technologies has occurred since January 2008.

At this time, TARP is only applicable to stormwater technologies. Implementing TARP for wastewater would require the signatory states to develop Tier 2 guidance, which is an involved process that requires a significant commitment of resources and effort on behalf of each signatory state. In addition, while many of the TARP states are located within the Chesapeake

Bay watershed, TARP is not specific to the Bay. Some of the TARP signatory states are not in the watershed, while Delaware and West Virginia are located in the Chesapeake Bay watershed, but have not signed onto TARP. The District of Columbia has also not signed onto TARP. However, because its Watershed Implementation Plan indicates that no onsite systems are located in the district; DC may not need to sign onto TARP. Based on these limitations for TARP, it may not be the best framework for streamlining advanced onsite technology approval in the Chesapeake Bay watershed.

2.2 NEIWPCC Regulatory Cooperation Project

The NEIWPCC Regulatory Cooperation Project started in 1996 as a voluntary effort with the signature of a Memorandum of Agreement (MOA) by participating agencies interested in cooperating to evaluate new technologies on a regional basis. The purpose of the project was to bring together the interests of regulators and end users in evaluating wastewater technologies capable of enhanced protection of public health and the environment. Participants in the project include representatives from New England state agencies, NEIWPCC staff, and other selected regional or national academicians, experts, and consultants. The project is carried out by a Technical Review Committee, which assesses each technology on its merits, then renders an Advisory Opinion. The final Advisory Opinion is based on the applicant's proof that the technology meets the stated performance.

Technologies considered for evaluation by the Technical Review Committee must provide more cost-effective, efficient, and/or more environmentally friendly methods for the treatment and/or disposal of onsite wastewater. The project focuses on advanced technologies for small onsite wastewater treatment and disposal systems – i.e., less than 2,000 gallons per day (gpd) – that have measured performance data and/or existing state approvals. Technologies for evaluation by the project should fit in one of the following three categories: material replacement, system modification, and advanced wastewater treatment.

While advanced nitrogen treatment technologies could be evaluated under this framework, the NEIWPCC project is not focused on nitrogen reduction, and only one of the eight technologies evaluated provides advanced nitrogen treatment. In addition, advisory opinions for these eight technologies were issued between 1997 and 2000, with no new advisory opinions issued since then. HW consulted with NEIWPCC staff to understand the background behind the project, and the reason why advisory opinions have not been issued in over a decade.

According to NEIWPCC staff, when the project started, technology transfer was limited, and the partners involved were investigating reciprocal approval of technologies across states. While blanket reciprocal approvals for technologies could not be achieved, a group was set up to review existing technologies and make recommendations on those technologies (e.g., recommend further testing, confirm manufacturer claims). The purpose of the recommendations was to simplify state approvals of technologies already reviewed by the project. However, after a few years, it became clear that there were few new emerging and unknown technologies, and most states had established a process to approve technologies already approved in another state. With reduced budgets, many states had started looking into using data from other states for their own approvals. The NEIWPCC project initially met a need for improved communication between manufacturers and regulators, but the need did not last once communication channels were established.

This project is focused on New England states, and does not include states from the Chesapeake Bay watershed. While the NEIWPCC Regulatory Cooperation Project workgroup still exists, and could continue to evaluate new technologies for advanced treatment of nitrogen, it may not be the best solution for technology evaluation partnership among the Chesapeake Bay watershed states.

2.3 NOWRA

NOWRA developed a "Model Code Framework for the Decentralized Wastewater Infrastructure" to help state regulatory personnel write their state's code regulating the performance and management of decentralized wastewater infrastructure. The framework includes three main elements: code structure (volume I of the Model Code Framework), user guidance (volume II), and evaluation of treatment components. The first two elements of the framework have been developed into volumes I and II, published in 2006 and 2007. The third element was planned to include two protocols for technology performance evaluation: one for "confined treatment" technologies (i.e., treatment prior to effluent reaching the soil), and another for "unconfined-soil components," but the protocols have not yet been published. In addition to these three main elements, framework discussions included reciprocity for technology approval, but formal documents have not yet been developed to document this effort.

2.4 WERF BMP Database

Started in 1996 under a cooperative agreement between the American Society of Civil Engineers (ASCE) and the U.S. EPA, the International Stormwater Best Management Practices (BMP) Database project is now supported by a broader range of partners and led by WERF. The overall purpose of the project is to provide scientific information to improve the design, selection and performance of BMPs (i.e., share data). According to its website (www.bmpdatabase.org), the project features a database of over 500 stormwater BMP studies, performance analysis results, tools for use in BMP performance studies, monitoring guidance and other study-related publications. The project targets a wide range of users, including public agencies or officials looking for basic performance information or BMP monitoring guidance, independent university researchers seeking to download or upload BMP performance data, and designers and manufacturers interested in obtaining detailed statistical analyses for certain types of BMPs.

Before creating the database, a literature review of over 800 documents was conducted to identify the relevant parameters for the database. Approximately 70 documents were actually used to populate the database. At the time the database was launched, little data was available from manufacturers and vendors, and most proprietary data were submitted after the database was created. In terms of quality control for the data, only third party verified data are accepted for inclusion in the database. Analysts routinely check for data completeness, compare the data to performance measurements of similar technologies, and may correspond with the data provider if not all required areas on the form are complete. In general, if submitted by a verified third party, and following data checks by the analyst, the data are usually included in the database. Quality control of the entire database also occurs regularly to identify unusual data or other glitches, potentially leading to data being removed.

While the purpose of the BMP database project is not focused on state technology approval, and the database and protocols for data submittal are not directly applicable to wastewater technologies without modification, this project's proven track record and the type of information collected in the database make it a good case study for data sharing across state boundaries. This section focuses on features of the BMP database project that could be applied to a data sharing effort for wastewater technologies, particularly developing data collection and evaluation guidance, identifying requirements for study submittal, updating the information regularly, and encouraging adoption of the information by public entities and stakeholders (e.g., states).

In order to collect valid and relevant data, the project partners developed guidance on urban stormwater BMP monitoring, reporting protocols, and performance analysis methods (http://bmpdatabase.org/Docs/2009%20Stormwater%20BMP%20Monitoring%20Manual.pdf). The guidance has been regularly updated to incorporate lessons learned and address new stormwater management approaches. The monitoring guidance is not technology-specific, and addresses all aspects of data collection. The document provides guidance on the development and implementation of a monitoring plan for a wide range of data, such as hydrologic, hydraulic, and water quality data; on data management, validation, and reporting; as well as BMP performance analysis; among other topics. In addition, data must be submitted to the BMP database project in a specific data entry spreadsheet that can be downloaded online. The data entry spreadsheet includes 35 tabs, nine of which are "required" tabs (i.e., information within those tabs is required), with the remaining tabs classified as either "important," "nice to have," or "variable" when the tab applies only to certain technologies. A similar guidance and data entry spreadsheet focused on wastewater technologies could be mirrored from those developed for the BMP database project.

To ensure consistency and usability of the data, the BMP database project specifies certain criteria studies must meet to be accepted in the database, including the following;

1. The study must be conducted in the field for a post-construction, permanent BMP; laboratory studies are not acceptable;
2. The information requested in the "required" fields from the data entry spreadsheet must be provided; and
3. Studies conducted by vendors or manufacturers of proprietary devices must meet certain requirements to ensure study results are independent and unbiased. (A Proprietary Device Policy is posted on the project's website): http://www.bmpdatabase.org/Docs/Proprietary%20Device%20Policy%2011-29-10.pdf)

Data submitted to the project are continually assessed, and the database is regularly updated with new information to improve understanding of factors influencing BMP performance and to help promote improvements in BMP design, selection and implementation. Regular updates would also be necessary for wastewater technology assessment.

Other important features of the stormwater BMP database project that should be considered for a wastewater technology verification effort are the following:

- The database's adoption by public agencies, including state departments of environmental protection, flood control districts, and departments of transportation;
- Availability of the project team to answer questions and provide assistance to all target users; and
- The availability of the database online free of charge.

The stormwater BMP database project has been ongoing for over 17 years, so a similar wastewater technology effort cannot be expected to reach this level of detail, involvement, and public acceptance overnight. However, this project demonstrates that it can be done, and provides valuable insight on elements of the project that should be considered as part of the wastewater effort.

3. Standards for Evaluating Alternative Technology Performance

State technology approval and verification processes share a number of elements in common across states, including data verification by entities other than the manufacturer (i.e., third party data). Certain states have developed their own protocols and requirements for data collection while others rely on existing national standards, such as the NSF International/American National Standards Institute (ANSI) standards, or the U.S. EPA's Environmental Technology Verification (ETV) protocol. Both the NSF/ANSI standards and the ETV protocol focus on treatment systems that reduce nitrogen in the effluent before it reaches the drainfield. These are briefly described below, because they may serve as templates for establishing common protocols.

In addition, this section summarizes efforts by WERF to develop methods for evaluating the performance of soil-based treatment technologies.

3.1 NSF/ANSI

Four NSF/ANSI standards were developed to assess wastewater system performance, including NSF/ANSI 46, which evaluates the performance of wastewater treatment system components (e.g., grinder pumps, septic tank effluent filters, disinfection devices) to establish minimum material, design, construction, product literature, and performance requirements. NSF/ANSI 46 does not directly apply to evaluating onsite systems for nitrogen management, and will not be discussed further. Both NSF/ANSI 40 and 245 evaluate residential wastewater treatment systems for a period of six months in a test center setting with controlled influent characteristics. NSF/ANSI 360 focuses on field performance evaluation of systems already certified under NSF/ANSI 40 or 245.

NSF/ANSI 40 evaluates the performance of residential wastewater treatment systems by monitoring systems for a period of six months during which the system is loaded with a wastewater design load meeting specific influent characteristics under specified stress conditions. Both influent and effluent are sampled to ensure that the system meets the specified requirements prior to approval under the standard. Effluent sampling occurs five days a week, and 24-hour composite samples are collected to characterize the influent. Influent and effluent are sampled for five-day biochemical oxygen demand (BOD5), carbonaceous BOD5 (cBOD5), total suspended solids (TSS), and pH. This standard applies to all onsite systems, and is not specific to evaluating nitrogen reduction technologies.

Nitrogen reduction performance is evaluated under standard NSF/ANSI 245, which is very similar to NSF/ANSI 40, except that influent and effluent are monitored for additional monitoring parameters, including nitrogen species, temperature, and alkalinity. Sampling occurs three times per week rather than five.

Standard NSF/ ANSI 360 establishes consistent site selection, sampling, laboratory analysis, and data evaluation methods for obtaining field performance results for onsite wastewater treatment systems capable of providing at least secondary treatment, and previously certified or aiming to concurrently achieve certification under NSF/ANSI 40 or NSF/ANSI 245. This standard requires the selection of at least 20 onsite systems and five reserve systems for testing that meet a specific set of requirements. Under this standard, the manufacturer and the verification organization develop a testing plan describing the methods and procedures for sample collection, evaluation, and analysis for each system. Samples must be collected at least once a quarter for four consecutive quarters at each field site, and tested for standard parameters that do not include nitrogen. Effluent from systems already certified under NSF/ANSI 40 is sampled for CBOD5, TSS, pH, dissolved oxygen, pH, and temperature. In addition to these parameters, effluent from systems already certified under NSF/ANSI 245 is sampled for nitrogen species and alkalinity.

3.2 The ETV Protocol

The ETV protocol defines methods for verifying performance of onsite technologies for commercial, industrial, and residential properties with flows up to 1,500 gpd. The protocol evaluates the system under operating field conditions and tracks the system's necessary inputs and operating cost, the range of operating conditions and ease of operation, and the adequacy of operation and maintenance performance. The minimum testing period is 12 months for non-biological systems or three months for biological systems, during which sampling occurs over four-day testing periods, which yield four daily composite samples. A set of core parameters for influent and effluent must be measured, with additional supplemental parameters as needed.

Some of the standards and protocols described above may be worth reviewing and potentially referencing as part of common protocols to be implemented in a common data sharing program by states. Overall, agreed-upon protocols and data requirements for approving wastewater treatment technologies will promote a shared verification process which can reduce costs and save time for state regulators by reducing duplicative testing and review. This approach would also reduce the burden on vendors and promote verification of new technologies and innovation. However, the existing standards described above may have some shortcomings. For example, standards NSF/ANSI 245 and 40 only monitor systems during a six month period, and while standard NSF/ANSI 360 monitors systems for an entire year, samples are only collected four times a year.

3.3 WERF Efforts to Evaluate Performance of Soil-Based Technologies

WERF recently published a guidance manual on "Quantitative Tools to Determine the Expected Performance of Wastewater Soil Treatment Units." The manual identifies and describes tools to help evaluate the expected performance of soil-treatment units (STUs). Most of these tools are based in science, and rely on mathematical and statistical models. However, they only provide a measure of expected performance for an STU. The guidance manual does not address actual performance for these technologies. While expected performance can be helpful in designing wastewater systems, it is unclear that states would approve technologies solely based on the expectation of performance.

Overall, most existing standards and protocols have been developed for technologies reducing nitrogen in the effluent before it reaches the drainfield. Other standards and protocols are needed for verification of soil-based treatment technologies.

Current technology verification and approval requirements for states within the Chesapeake Bay watershed should be compared to identify commonalities and differences, and select existing standards that may fit multiple states' requirements. The following section summarizes the regional commonalities and constraints for states in the Chesapeake watershed.

4. Regional Commonalities And Constraints

Regulations in the Chesapeake Bay states were reviewed to identify commonalities and differences in how the states verify and approve advanced technologies in general, with particular attention to nitrogen reduction technologies. States approach onsite system regulation differently, and the very definition of what constitutes an onsite system (e.g., size, or flow) may be a constraining factor to streamlining state verification for some states. Technologies appropriate for small systems may not be scalable to larger onsite systems. For example, wastewater systems with flows up to 200,000 gpd in Virginia may be considered onsite systems, but not all verified technologies for smaller systems can be verified and approved for the larger flows.

States typically have a verification and approval program, but program details for most states are not identified in their regulations. For example, Maryland has a very detailed and transparent program to verify and approve best available technologies (BATs). The BAT process is described online at: (http://www.mde.state.md.us/programs/Water/BayRestorationFund/OnsiteDisposalSystems/Pages/water/cbwrf/osds/brf_bat.aspx). Details of the BAT program are not part of the state's regulations, making it easier for the Maryland Department of the Environment (MDE) to adapt its process, and paving the way to accept data from other states.

Some states have review boards that approve advanced technologies on a case-by-case basis, but details on the application process, or the criteria for submitting data on advanced technologies are not always clearly identified. While this makes it more challenging to compare the systems based on a review of state regulations, it may simplify cooperation between states. If details for approval are not specified in state regulations, changes to the program do not need implementation through a legislative process.

5. Technical Issues

A common framework across states for evaluating advanced onsite technologies will require asking and answering a number of questions during the development of the framework, protocols, and agreements. This section identifies potential issues to help promote discussion.

5.1 Use of Test Centers versus Field Testing

The components of a conventional residential onsite system are located below ground on individual properties, and are typically not easily accessible. Once installed on a residential property, sampling effluent throughout the system can be a challenge because access to the property is needed. While some of the advanced technologies are designed to be more easily accessible, homeowner approval is still required for regular testing in situ. In general, states are also reluctant to approve the regular use of new technologies on residential properties before their performance has been evaluated over a certain period of time (e.g., six months, a year) with regular effluent sampling (e.g., daily, or at least multiple times a week). While in-situ field testing provides the best approximation of how a system can perform once installed on a residential property, it is usually limited to a few systems across the state, usually to confirm results obtained in a laboratory setting, or at a test center.

States and onsite system component manufacturers often turn to test centers to evaluate technology performance. At a test center, the onsite systems are constructed to allow for continuous monitoring of certain factors (e.g., temperature, pH), and for easier sampling (e.g., removable covers for the septic tank, sampling ports in the drainfield). However, the influent wastewater typically comes from a sewer system, capable of delivering "on demand" wastewater, rather than from an individual home. While the influent composition reaching the septic tanks is usually carefully monitored, some have argued that the wastewater reaching the onsite systems at a test center is more diluted than the residential wastewater that would reach a septic tank. Reduced influent concentrations can lead to reduced effluent concentrations, affecting apparent performance, depending on how performance for the technology is reported (i.e., percent removal vs. target effluent concentration). While test center experiments are easier to implement for long periods of time, a number of states have required that performance at a test center be followed by in-situ testing at a number of properties.

The locations used for standardized testing should be determined. Options include using test center data, field test sites on residential properties or a combination of both. A combination may be the most commonly accepted approach, but it can prove expensive to both states and manufacturers if each state requires both. If states can agree on common standards for test center technology evaluation and in-situ testing, the results from both types of tests can be shared across states.

5.2 Frequency and Duration of Testing

The frequency and duration of sampling needs to be determined as part of a data sharing protocol. As discussed in Section 5.1 above, sampling frequency may depend on whether the technology is being evaluated at a test center or in-situ in a homeowner's backyard. Issues to consider include the following:

Sample Timing: Morning and evening flows at a residential property may be greater in volume (showers, laundry loads, etc…) than at other times of day, but these may be diluted samples due to the greater water use. Sampling protocols should take these flow variations into account and composite sampling or continuous monitoring for certain parameters could be considered.

Testing Duration: A full year of monitoring would allow the evaluation of seasonal impacts on the treatment. If seasons bring different weather patterns (e.g.., cold winters vs. hot summers), technologies based on microbial activities may perform differently throughout the year. A longer evaluation translates into a greater cost to the state and/or manufacturer.

5.3 Selection of Sampling Parameters

The scope of the technology verification process will need to be identified. Sampling and analysis could focus solely on nitrogen or it could include other nutrients (e.g., phosphorous) or other constituents such as suspend solids.

If certain technologies depend on microbial activity, additional parameters may be needed to correlate performance to environmental factors such as temperature, dissolved oxygen, pH and total organic carbon.

These and additional issues may, or may not, apply depending on whether the data collection is completed in a laboratory setting, a testing facility setting, or an individual home.

5.4 Selection of a Standard Protocol for Inter-State Collaboration

As presented in Section 3, a number of national standards for evaluating wastewater treatment technologies have already been developed. Individual states have also developed and implemented their own evaluation standards or requirements. So far, this has resulted in technologies being re-evaluated under multiple standards, creating inefficiencies and increasing costs. While different standards and evaluation protocols are needed for different test settings (e.g., in-situ vs. test center), are existing national standards for each test setting acceptable or do they need to be amended?

5.5 Addressing Issues with Varying Climate and Geologic Settings

Most alternative treatment technologies are self-contained, and treatment occurs through biological activity prior to dispersal in the drainfield. Therefore, their performance is dependent on temperature rather than soils or local geology, and technologies verified in one state are likely to perform in a similar fashion in a neighboring state (i.e., similar temperature ranges). However, performance of soil-based treatment technologies can be impacted by varying climate and geologic settings, and performance verification for these systems should take into account geography, hydrology, and geology.

While the current focus of this effort is on the Chesapeake Bay watershed states, the data may be used beyond the watershed, and other states may wish to participate in the data sharing effort. For example, the WERF stormwater database requires information on watershed location and precipitation data. Stormwater technology performance is highly dependent on rainfall, and therefore geography, but the same does not hold true for wastewater technology performance. Protocols to address varying climate and geologic settings will need to be incorporated as part of the data collection effort for onsite technologies.

5.6 Accreditation of Testing Facilities and Organizations

Initial research and conversations with some Chesapeake Bay watershed states indicates that states currently allow for a variety of data sources for technology verification, and most do not specify the accreditation process for testing facilities. On the one hand, accreditation provides a clear set of rules that testing facilities and organizations would need to abide by for verification purposes. It provides a mechanism for verifying testing facility credentials upfront before funds are spent by states or manufacturers to collect data. On the other hand, the accreditation process for a testing facility or organization does not currently exist, and until it is fully implemented, the requirement for accreditation would provide a barrier to technology verification.

An accreditation process also requires an implementing entity. NSF provides accreditation for testing centers and facilities. If the NSF accreditation system is not used another approach will need to be developed. If accreditation is implemented at the state level, the validity of the accreditation for other states would need to be confirmed.

The potential need for accreditation should be raised as part of the discussions during the development of the framework, protocols, and agreements for data sharing. Accreditation may, or may not be necessary, and this whitepaper does not provide a recommendation one way or another. Rather, it raises the question of need for discussion purposes.

5.7 Operation, Maintenance, and Monitoring Considerations

Most advanced onsite systems include pumps and other moving parts that require energy, as well as regular operation and maintenance (O&M). In addition, states and local health departments may require some form of monitoring for these advanced systems. Should O&M and monitoring for advanced systems be evaluated as part of the evaluation and verification process? Advanced system manufacturers will typically specify O&M activities and frequencies required for their system, and estimate the costs associated with those activities. They will also specify is back-up power is needed for the system. Should the verification and validation process verify that the O&M recommended for a particular system is appropriate for that system? Should costs be tracked to confirm the estimated of the manufacturer? Confirming O&M activities and costs could help states and consumers compare systems.

6. Leading the Collaboration Effort

Comments received on EPA's draft *Model Program for Onsite System Management in the Chesapeake Bay Watershed*, as well as preliminary conversations with manufacturers and installers of onsite systems have shown widespread support for streamlining state approvals of onsite technologies. In addition, conversations with some Chesapeake Bay watershed state agency representatives indicate willingness on behalf of the states to work together towards streamlining state approvals and data sharing in the Chesapeake Bay. While all relevant parties seem to agree on the benefits of a collaborative effort, a main entity should be identified to lead the effort without any existing or perceived conflict of interest. In addition, communication channels should be identified to ensure participation by states and other stakeholders. This section focuses on identifying potential leading organizations and their responsibilities, as well as other participants in the effort.

6.1 Potential Leading Agencies or Organizations

A number of organizations could lead this effort. Each organization would have to be approached to gauge their level of interest in leading the collaboration effort, identify any potential conflicts of interest, and determine the type of commitment and resources they can dedicate to the effort. Potential leading organizations include the following:

- The Water Environment Federation (WEF): http://www.wef.org;
- The Water Environment Research Foundation (WERF): http://www.werf.org/;
- The National Onsite Wastewater Recycling Association (NOWRA): www.nowra.org;
- The State Onsite Regulators Alliance (SORA): http://sora-coi.net/; and
- The U.S. EPA Chesapeake Bay Program Office (http://www2.epa.gov/aboutepa/about-chesapeake-bay-program-office) or another EPA entity.

The organizations and entities above were identified because of their current association and expertise with wastewater issues and their involvement either in the Chesapeake Bay watershed, or at the national level. The best leading entity for this effort may include multiple agencies and organizations. For example, WERF's International Stormwater BMP Database effort started as a cooperative effort between the U.S. EPA, and the American Society of Civil Engineers, but is now supported by a much broader coalition of organizations.

6.2 Responsibilities and Characteristics of the Leading Entity

In addition to being committed to the effort, the leading organization, or group of organizations, should maintain its independence from individual stakeholder interests. The leading entity will need to involve all levels of stakeholders in the effort, and ensure participation from all interested parties.

An initial funding source or significant voluntary participation will be needed to start the effort. This would be followed by additional funding needs to sustain the initial effort. The leading entity may need to identify funding sources, and manage them to avoid any existing or perceived conflict of interest.

While the initial focus of the streamlining effort is on the Chesapeake Bay watershed states, and an entity closely tied to the Bay may be the best suited to lead the initial effort, additional states may wish to join in the effort. As previously mentioned, the leading entity may evolve to include additional organizations if the initial effort is successful.

6.3 Communication with States and Other Stakeholders

Initial efforts for streamlining state verification and approval processes will require state agency involvement for states in the Chesapeake Bay watershed. Some states have been more pro-active in addressing nitrogen loads from onsite systems than others, and they may be more involved than other states in the streamlining process. However, communication with all states in the Watershed should continue throughout the process. There will be benefits to the streamlining process beyond water quality in the Chesapeake Bay. States should be informed of the streamlining efforts so they are aware of the availability of shared information, and have the option to review and accept data generated in neighboring states.

Other stakeholders have expressed interest in a more streamlined verification and approval process, particularly the wastewater industry. The initial feedback from the wastewater industry has been overwhelmingly positive, and participation from these and other stakeholders could be very constructive. The wastewater industry may also be able to provide some of the funding and resources to support the effort. Communication with the wastewater industry should continue throughout the process.

In addition, communication channels should also be established with some of the less vocal stakeholders, including local regulatory authorities (e.g., local health departments), homeowners, and the construction industry. The focus of the communication to these stakeholders may be partly educational, but it is important to involve them throughout the process. Local regulatory authorities typically review permit applications for onsite systems, and may fund some of the upgrades to advanced systems. Homeowners usually pay for part, or all of a system upgrade, and have a financial interest in an increased selection of approved wastewater technology. Similarly, the construction industry has a financial interest in the increased selection of approved wastewater technology, and in the education of the general public about wastewater systems. The stakeholders would also benefit from participating in the effort.

7. Steps for Starting the Process

The current focus of this streamlining effort is on Chesapeake Bay watershed states and nitrogen removal technologies. In that context, the first step should be to review verification and approval processes of onsite technologies for states in the watershed, to identify commonalities and constraints, particularly as they relate to nitrogen removal. Broadening the focus and scope of the effort can happen at a later time. Once commonalities and constraints have been identified, they should be presented to the states for verification, and to confirm a common understanding of the processes.

During that time, a leadership group should be established for the effort involving state agency representatives, industry leaders, and other stakeholders. In collaboration with Chesapeake Bay watershed states, the leading entity should draft a memorandum of understanding or agreement for states to participate in the process. An MOA or MOU would demonstrate to manufacturers and other stakeholders that states are committed to this effort, and would encourage participation in the process.

While starting at the local level (i.e., Chesapeake Bay watershed states), the approach could be expanded to a more national application at a later time.

Appendix B: Technical Requirements to Enter Advanced Onsite Wastewater Treatment Practices into Scenario Builder and the Phase 5.3.2 Watershed Model
Presented to Wastewater Treatment Workgroup (WTWG) for Review and Approval: May, 2014

Background: In June, 2013 the Water Quality Goal Implementation Team (WQGIT) agreed that each BMP expert panel would work with CBPO staff and the Watershed Technical Workgroup (WTWG) to develop a technical appendix for each expert panel report. The purpose of this technical appendix is to describe how the Onsite Wastewater Treatment Expert Panel's recommendations will be integrated into the modeling tools including NEIEN, Scenario Builder and the Watershed Model.

Q1. What are the efficiency reductions a jurisdiction can claim for the advanced on-site waste treatment systems (advanced septic systems) in the Phase 5.3.2 Watershed Model?

A1. The panel's recommendations include 20 distinct combinations of in situ and ex situ practices that reduce septic nitrogen loads beyond a conventional septic system. The information in the table below was taken from Table ES-1-3 in the expert panel report (p. 11). The qualifying technologies for each ex situ and in situ practice are described in Answer 2 below.

Table 1. Percent Nitrogen Reductions for New Septic System Treatment BMPs

NEIEN BMP Name	Scenario Builder BMP Name	Percent Nitrogen Reduction
Septic Effluent with Shallow Pressure	Septic Effluent with Enhanced In Situ	38%
Septic Effluent with Elevated Mound	Septic Effluent with Enhanced In Situ	38%
NSF 40	Secondary Treatment with Conventional In Situ	20%
NSF 40 with Shallow Pressure	Secondary Treatment with Enhanced In Situ	50%
NSF 40 with Elevated Mound	Secondary Treatment with Enhanced In Situ	50%
IMF	Secondary Treatment with Conventional In Situ	20%
IMF with Shallow Pressure	Secondary Treatment with Enhanced In Situ	50%
IMF with Elevated Mound	Secondary Treatment with Enhanced In Situ	50%
Constructed Wetland	Secondary Treatment with Conventional In Situ	20%

Constructed Wetland with Shallow Pressure	Secondary Treatment with Enhanced In Situ	50%
Constructed Wetland with Elevated Mound	Secondary Treatment with Enhanced In Situ	50%
RMF	50% Denitrification Unit with Conventional In Situ	50%
RMF with Shallow Pressure	50% Denitrification Unit with Enhanced In Situ	69%
RMF with Elevated Mound	50% Denitrificaiton Unit with Enhanced In Situ	69%
IFAS	50% Dentrification Unit with conventional In Situ	50%
IFAS with Shallow Pressure	50% Denitrification Unit with Enhanced In Situ	69%
IFAS with Elevated Mound	50% Denitrification Unit with Enhanced In Situ	69%
Proprietary Ex Situ	50% Dentrification Unit with Conventional In Situ	50%
Proprietary Ex Situ with Shallow Pressure	50% Denitrification Unit with Enhanced In Situ	69%
Proprietary Ex Situ with Elevated Mound	50% Denitrification Unit with Enhanced In Situ	69%

Q2. What technologies qualify for the reductions listed in the table above?

A2. Qualifying technologies are listed below.

Secondary Treatment– Pre-treatment practices are those occurring prior to dispersing effluent into the soil treatment unit. Secondary ex situ systems include: certified, NFS 40 Class I or equivalent systems; intermittent media filters (IMF); and constructed wetlands (p. 29-30). Additional details about these systems are provided in the expert panel report.

50% Denitrification Units– Pre-treatment practices are those occurring prior to dispersing effluent into the soil treatment unit. 50% Denitrification ex situ systems include: recirculating media filters (RMF); Anne Arundel County Integrated Fixed-Film Activated Sludge (IFAS). Many proprietary treatment systems also exist that offer 50% denitrification (p. 30). The proprietary treatment systems that fall into this category will generally be verified through a two step process that includes a controlled test condition and then a field test condition. Additional details about these systems are provided in the expert panel report.

Enhanced In Situ – In situ processes are those occurring after ex situ treatment, within the soil treatment unit. These practices include shallow-placed, pressure-dosed dispersal units and elevated sand mounds with pressure-dosed dispersal (p. 31). Additional details about these systems are provided in the expert panel report.

***Proprietary Systems* –**Proprietary technologies exhibiting a reduction of total nitrogen greater than 50% will be assigned a total nitrogen reduction credit of 50% in the watershed model. It is up to each jurisdiction to determine which systems exhibit a reduction of 50% or greater based upon third party monitoring. Additional details about third party monitoring protocols can be found in Section 3.2.1.

Q3. How do these new BMPs interact with the existing reductions for disconnections, septic pumpouts and de-nitrification systems?

A3. The septic disconnection (sewer connection) BMP will be simulated prior to any existing or new septic BMPs. The panel recommended that the 5% credit for septic pumpouts for conventional septic systems should remain within the modeling tools. The panel recommended this credit should only be reported once every five years for any given system, and the credit should only apply in the model for the year reported. Additionally, the panel recommended septic pumpout credits should not be available for systems claiming a credit through a BMP above p. 29).

The septic de-nitrification BMP currently in the model will be replaced by the new practices listed in Table 1. Jurisdictions should no longer report the de-nitrification BMP for progress or planning purposes. Existing de-nitrification systems in the model will remain in the model until NEIEN data is updated by jurisdictions to reflect the type of ex situ and in situ practices being used. Septic pumpouts will still be available on historically reported systems with de-nitrification.

Q4. What do jurisdictions need to report in NEIEN in order to receive credit for the new onsite treatment practices in the modeling tools?

A4. Jurisdictions should report the NEIEN BMP names listed in Table 1 above, as well as the location of the systems and the date the systems were installed.

Q5. How will the reductions be applied to septic systems in the current modeling tools?

A5. The efficiency reductions listed in Table 1 above will be applied to conventional septic systems within the modeling tools. These reductions will result in lower edge-of-stream nitrogen loads from the modeled, conventional septic systems. Please note that each of the system types is mutually exclusive meaning that a jurisdiction should only report one practice type per septic system. Please also note that septic pumpouts and the current septic de-nitrification practices are also mutually exclusive with each of the system types and should not be reported in conjunction with these new BMPs.

Q6. In what order will Scenario Builder credit all of the septic BMPs?

A6. Table 2 below lists the unique Scenario Builder BMP names that will now be associated with septic systems, and places these names in the order in which Scenario Builder will credit the BMPs.

Table 2. Order of Credit for Septic System BMPs in Scenario Builder

Scenario Builder BMP Name	Percent Nitrogen Reduction
Septic Disconnections (Existing)*	N/A
50% Denitrification Units with Enhanced In Situ	69%
Secondary Treatment with Enhanced In Situ	50%
50% Denitrification Units with Conventional In Situ	50%
Septic Effluent with Enhanced In Situ	38%
Secondary Treatment with Conventional InSitu	20%
Septic De-Nitrification (Existing)**	50%
Septic Pumpouts (Existing)**	5%

*The existing Septic Disconnection BMP is simulated prior to any other septic BMPs.
**The existing Septic Pumpout and Septic De-Nitrification BMPs cannot be submitted along with any of the new systems treatment practices described in this document.

Q7: Can a jurisdiction receive credit for a proprietary system?

A7: Yes. The panel recommended that proprietary, ex situ systems with NSF Standard 245 certification or similar and field testing to verify performance could receive a default 50% reduction in nitrogen (p.27). The panel also stated that technologies exhibiting a reduction of total nitrogen greater than 50% will be assigned a total nitrogen reduction credit of 50% in the watershed model (p. 28). It is up to each jurisdiction to determine which systems exhibit a reduction of 50% or greater based upon third party monitoring. Additional details about third party monitoring protocols can be found in Section 3.2.1.

Q8: Can a jurisdiction request a nitrogen reduction efficiency of greater than 50% for a system?

A8: Yes. A jurisdiction may request a reduction efficiency of greater than 50% for a particular type of system based upon third party monitoring. The jurisdiction must submit the results of third party monitoring data and design specifications to the Wastewater Treatment Workgroup for consideration. Per the CBP's BMP Protocol, the Wastewater Treatment Workgroup will then have the discretion to determine if a system should receive greater than 50% reduction in the modeling tools. Additional details about third party monitoring protocols can be found in Section 3.2.1.

Q9: Can jurisdictions receive credit for non-proprietary or non-conforming systems?

A9: Jurisdictions may receive credit for non-proprietary systems that have similar specifications and reductions as one of the BMP types listed above. It is up to each jurisdiction to determine which systems exhibit characteristics and reductions described above based upon third party monitoring (p. 28). Additional details about third party monitoring protocols can be found in Section 3.2.1.

A jurisdiction may request a reduction efficiency review for any non-conforming (proprietary or non-proprietary) system based upon results of third party monitoring. The jurisdiction will need to submit the results of third party monitoring data and design specifications to the Wastewater Treatment Workgroup for consideration as a new BMP (p.28). Per the CBP's BMP Protocol, the Wastewater Treatment Workgroup will then have the discretion to determine if a system should be assigned a different reduction efficiency. Additional details about third party monitoring protocols can be found in Section 3.2.1.

Appendix C: Recommendations of the Onsite Wastewater Treatment Systems Nitrogen Reduction Technology Expert Review Panel

The Onsite Wastewater Treatment Systems Nitrogen Reduction Technology Expert Review Panel (OWTS Expert Panel) was tasked with identifying and recommending on-site wastewater treatment technologies or modifications to existing wastewater treatment systems that would reduce total nitrogen (TN) loads to the Chesapeake Bay watershed. The OWTS Expert Panel was instructed not to address the issue of nitrogen attenuation in the native soils between the edge of the treatment system (drainfield) and the edge of the stream, since the Chesapeake Bay Program Office (CBPO) and a future Expert Panel will review and address this issue. The OWTS Expert Panel also reviewed the existing scientific research and provided recommendations for TN reduction credits that can be assigned for specific OWTS technologies and system modifications. To the extent possible, the associated TN reduction credits were linked to the planning, design, installation, and operational elements of OWTS. Recommendations were also made regarding verification of best management practice (BMP) performance. This report is intended to be an internal technical document for the CBP to use to adapt the existing CBWM and BMP crediting program. A number of other valuable resources are available to assist regulators, designers, and owners in making decisions about the type of systems to install based on the benefits, drawback, costs, and other characteristics of specific systems.

Note: This is an excerpt from the final Onsite Wastewater Treatment Systems Nitrogen Reduction Technology Expert Review Panel report. To see the full 112-page report, please visit the following link:
http://www.chesapeakebay.net/channel_files/21245/owts_expert_panel_final_report_02-17-14.pdf

Appendix D: Workshop Agenda

In My Backyard: An Innovative Look at the Advances of Onsite Decentralized Wastewater Treatment

Scientific and Technical Advisory Committee
December 17 and 18, 2013
NAHB, 1201 15th Street, NW, Washington, DC 20005
Workshop Agenda

Workshop Goal: Report on new technologies and alternative strategies available for the Chesapeake Bay states to address nutrient reduction from onsite septic systems in order to meet load allocations in the Chesapeake Bay TMDL. Identify obstacles to implementing new technologies and alternative strategies and develop strategies to address those obstacles. If research is needed, identify the research needs.

December 17, Morning Session

Webinar:
https://chesapeakeresearch.webex.com/chesapeakeresearch/j.php?ED=276843852&UID=1750564152&PW=NNTVlZTM3ODc1&RT=MiMxMQ%3D%3D
Meeting Password: nahb2013
Toll-Free Number: 1-877-668-4493
Meeting Number: 734 017 406

8:00 am Breakfast (provided)

9:00 am Welcome, Introductions, Overview of Workshop, and Objectives – Glynn Rountree, NAHB

9:15 am Overview of EPA's Recent Efforts Regarding Onsite Systems: A State Model Program and a Proposal to Share Third Party Technical Data Among States – Joyce Hudson, EPA Office of Wastewater Management; Presentation: http://www.chesapeake.org/stac/presentations/224_1JHudson%20and%20Nelson Presentation%2012-17-13.pdf

9:45 am Participants Discussion with EPA*

10:15 am Break

10:30 am Panel Discussion: How the States are Addressing Septic Loads and Related Septic Matters – Jay Prager, Maryland Department of the Environment; Marcia Degen, Virginia Department of Health; Derrick Caruthers, Delaware Department of Natural Resources & Environmental Control; Presentation:

http://www.chesapeake.org/stac/presentations/224_2DCaruthersPanel%20Presentation.pdf

11:30 am Panel Discussion: Decision-making to Address the Septic Needs in new Residential Developments – Katie Maloney, Maloney and Associates; Ellen Frketic, MD Environmental Service; Amy Hart, Howard County, MD; and Dave Clark, Rural Community Assistance Partnership

12:30 pm Lunch (provided)

Afternoon Session

1:30 pm Participants Discussion of the Morning Sessions*

2:00 pm Overview of Best Available Technologies for Onsite Septic Systems and Management Considerations – Dr. Albert Rubin, North Carolina State University; Presentation: http://www.chesapeake.org/stac/presentations/224_3BRubin_Overview%20of%20Best%20Available%20Technologies%20for%20Onsite%20Septic.pdf

2:30 pm EPA's Expert Review Panel Report on Onsite Nitrogen Reduction Technology – Victor D'Amato, Tetra Tech, Inc.; Presentation: http://www.chesapeake.org/stac/presentations/224_DAmato%20Presentation%2012-10-13.pdf

3:00 pm Break

3:15 pm No-mix Toilets and Other Eco-toilet Technologies - Matt Patrick, Westport River Watershed Alliance; Presentation: http://www.chesapeake.org/stac/presentations/224_5MPatrick%20ECO-TOILET%20DEMONSTRATION.pdf

3:45 pm Participants Discussion of the Afternoon Session*

4:15 pm Workshop Steering Committee Wrap-up

4:30 pm Adjourn for the day

December 18, Morning Session

Webinar:
https://chesapeakeresearch.webex.com/chesapeakeresearch/j.php?ED=276844262&UID=1750567292&PW=NMTdiNjYzNmYx&RT=MiMxMQ%3D%3D
Meeting Password: nahb2013
Toll-Free Number: 1-877-668-4493
Meeting Number: 738 370 905

8:00 am Breakfast (provided)

9:00 am Florida's Study of Nitrogen Reduction Strategies for Onsite Septic Systems – Damann Anderson, Hazen and Sawyer; Presentation: http://www.chesapeake.org/stac/presentations/224_6DAnderson_Onsite_Workshop_12-10-13.pdf

9:30 am What Cluster Systems can Offer – Anish Jantrania, NCS Wastewater Solutions; Presentation: http://www.chesapeake.org/stac/presentations/224_7AJantrania%20presentation%2012-18-13.pdf

10:00 am Beyond Nitrogen – Rich Piluk, Anne Arundel County Health Department; Presentation:
Part 1 - http://www.chesapeake.org/stac/presentations/224_beyondnitrogenNAHB_pg1-31.pdf;
Part 2 - http://www.chesapeake.org/stac/presentations/224_beyondnitrogenNAHB_pg32-62.pdf;
Part 3 - http://www.chesapeake.org/stac/presentations/224_beyondnitrogenNAHB_pg63-77.pdf;
Part 4 - http://www.chesapeake.org/stac/presentations/224_beyondnitrogenNAHB_pg78-93.pdf

10:30 am Break

10:45 am Participants Discussion of the Morning Session*

11:15 am Workshop Steering Committee Wrap-up

11:30 am Workshop Adjourns

*Dr. Denice Wardrop of Penn State University will facilitate the discussion sessions of the workshop.

Appendix E: Workshop Participants

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