

# **THE NEED FOR REGIONALIZED STANDARD OPERATING PROCEDURES FOR THE ACCEPTANCE, USE, AND MANAGEMENT OF NUTRIENT-REDUCING SEPTIC SYSTEMS**

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## **ABSTRACT**

As communities across the country work to implement programs requiring the use of nutrient-reducing septic systems to help mitigate the effects of harmful algal blooms (HABs), it is becoming increasingly important to streamline and regionalize the process for acceptance, use, and management of these technologies. In 2015, thanks to work from the EPA, representatives from Delaware, Maryland, Pennsylvania, Virginia, and West Virginia signed a Memorandum of Cooperation to share data related to the performance of nitrogen-reducing septic systems. This approach centered around the Chesapeake Bay Watershed area and allowed for a holistic regional approach to mitigating nutrient pollution from onsite wastewater sources. In addition, it provided regulators with the necessary tools to permit these technologies and prevented delays associated with manufacturers seeking approvals in the five (5) represented states.

In 2016, EPA tried to continue these efforts with the New England/Long Island Data Sharing initiative, but the efforts ultimately stalled. This was in part due to the fact that states like Rhode Island and Massachusetts have long standing regulations would have to be amended in order to implement the data share recommendations. The effort still proved valuable as the recommendations have been adopted on Long Island, which is now the leading market for nitrogen-reducing technologies in the US, where regulators seek to upgrade over 400,000 conventional septic systems and cesspools to nitrogen-reducing technologies. Both Suffolk and Nassau Counties have developed stringent, science-based regulations for the acceptance, use, and management of nitrogen-reducing septic system technologies. These acceptance processes allow manufacturers to submit data from other Jurisdictions and require a statistically significant dataset to prove a technology's nitrogen reduction capabilities.

The cost of meeting separate requirements for each regulatory jurisdiction can prevent a promising technology from investing or being able to afford participation in multiple markets. Revisiting the data sharing initiatives and developing regionalized SOPs for technology approval and vetting will improve the review and submission process without sacrificing the control of local regulatory jurisdictions.

## **INTRODUCTION**

By developing standard operating procedures and better collaboration between permitting jurisdictions the industry will benefit by increasing the number of technologies available, standardized processes for monitoring, more confidence in system capabilities, and more consistent training throughout the US.

Currently the burden is placed on the individual manufacturers to submit data to the individual permitting jurisdiction to review, analyze, and determine if the jurisdictions monitoring and

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performance protocols are met. The process can take years for a technology to receive approval and cost manufacturers hundreds of thousands of dollars in the process. Before discussing potential approaches to regionalization, it is important to understand the current approval process in various proximate jurisdictions.

### Rhode Island

In Rhode Island the Department of Environmental Management (RIDEM) has authority over the approval, use, and permitting of Onsite Wastewater Treatment Systems (OWTS). Nitrogen-Reducing technologies are considered Alternative and Experimental Systems despite being in use since the late 1990's and being at the forefront of the IA industry throughout the mid 2000's. RIDEM's Approval Process consists of three phases: (1) Experimental; (2) Class One; (3) Class Two.

An Experimental Technology may be approved if the applicant demonstrates that the technology shall work in practice and theory, the site needs to be able to accommodate an OWTS, the Applicant must sign a statement agreeing to abandon the experimental technology and revert back to an OWTS permitted under Department Rules if the technology fails to perform as designed, finally, the Applicant must secure a bond or form of financial security to replace the entire OWTS in the event it fails to perform as designed.

The criteria for Class One technology Approval for nitrogen-reduction requires four (4) consecutive years of performance data per installation for no fewer than ten (10) installations with data collected no less frequently than quarterly. The installations must be in Rhode Island, if RI data is not available, the Applicant needs four (4) years of data from three (3) other jurisdictions with no fewer than ten (10) installations with data collected no less frequently than quarterly.

The criteria for Class Two technology Approval for nitrogen-reduction requires two (2) consecutive years of performance data per installation for no fewer than ten (10) installations with data collected no less frequently than quarterly. The installations must be in Rhode Island, if RI data is not available, the Applicant needs two (2) years of data from another jurisdictions with no fewer than ten (10) installations with data collected no less frequently than quarterly.

### Massachusetts

The Massachusetts Department of Environmental Protection (MASDEP) has the authority over the State's onsite wastewater treatment systems under State Environmental Code Title 5. The approval process consists of three phases: (1) Piloting; (2) Provisional; (3) General Use. Piloting technologies must submit data showing performance similar to that of a conventional septic system and are capped at 15 installations of a technology which need to be sampled quarterly for 18 months. Provisional Approved technologies up to 50 systems may be installed and tested quarterly for three (3) years before General Use Approval can be granted. Massachusetts does not accept reciprocal approvals.

Suffolk County, NY

The Suffolk County Department of Health Services (SCDHS) has the authority under article 19 of the Suffolk County Sanitary Code to approve, regulate and serve as the Responsible Management Entity (RME) of Innovative and Alternative Onsite Wastewater Treatment Systems (IA OWTS) for nitrogen reduction. SCDHS developed a multi-tiered approval process based on the Massachusetts process. However, as later referenced in this paper, SCDHS was the first jurisdiction to adopt recommendations from the now defunct datashare project between coastal New England States and Suffolk County. The main differences between the Suffolk and MA process is that Suffolk based the number of installations and monitoring protocol off the statistical analysis Horsely and Witten Group conducted as part of the EPA datashare project. In addition, Suffolk County adopted stringent enforcement mechanisms such as major and minor violations. A Minor Violation is issued if the technology’s annual 12-month rolling average effluent TN concentration is between 19 mg/L and 30 mg/L requiring manufacturers to develop a remedial action plan to improve performance before the technology is eligible for suspension. A Major Violation is issued if the annual 12-month rolling average effluent TN concentration of a technology’s systems at equilibrium exceed 30 mg/L, allowing SCDHS to immediately suspend the technologies approval. Figure 1 and Table 1 outline the Suffolk County Approval Process.

Figure 1: Approval Tiers for Residential Systems in Suffolk County, NY

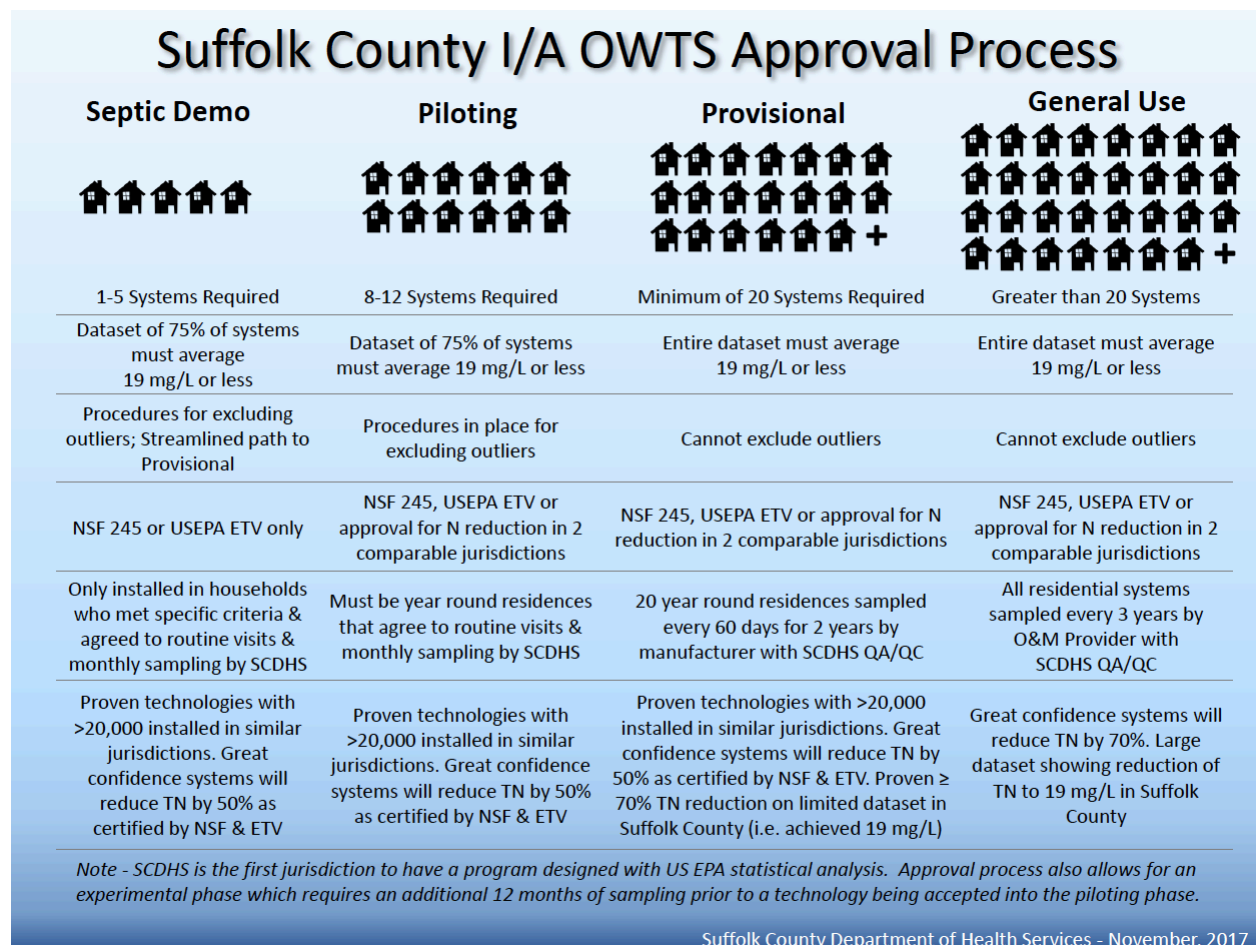


Table 1. Approval Chart for Residential Systems in Suffolk County, NY

| <b>TABLE 19-104.1: Approval Chart for Residential Systems</b> |   |  |  |
|---|---|--|--|
| <b>Approval Phase</b>   | <b># of Systems</b>   | <b>Sampling Frequency</b>  | <b>Performance Requirement</b>   |
| Experimental*   | 2 – 5 year-round  | Monthly Sampling<br>12 months rolling average  | For instances where 2 - 3 experimental systems are installed, each system must maintain an individual TN average of 19 mg/L or less. For instances where 4 - 5 experimental systems are installed, all systems must be sampled monthly. The department may omit the data from one of the installed systems. Each of the remaining systems must maintain an average effluent TN of 19 mg/L or less for a period of 12-monthly consecutive samples |
| Piloting*   | 8 – 12 year-round   | Monthly Sampling<br>12 months rolling average  | The total dataset of 75% of the systems must have a combined average of 19 mg/L or less TN   |
| Provisional 1   | First 20 year-round   | Bi-Monthly Sampling for 24 months rolling average<br>Minimum 12 samples.   | The dataset of all the 20 systems must have a combined average of 19 mg/L or less TN   |
| Provisional 2   | All Residential Systems installed during Provisional Use Approval | Samples must be taken within 36 Months from date of installation, and at a minimum of every 36 months thereafter | The annual dataset must maintain a combined average of 19 mg/L or less TN in order to remain in the Provisional phase **   |
| General Use   | All Residential Systems   | Samples must be taken within 36 Months from date of installation, and at a minimum of every 36 months thereafter | The dataset must maintain an average of 19 mg/L or less in order to remain in General Use phase **   |

*Note: The number of required systems is a cumulative number. The minimum of 20 systems for Provisional Use includes the number of systems installed as part of Experimental and Piloting processes.*

Nassau County, NY

The Nassau County Soil and Water Conservation District has the authority over the administration and management of the Septic Environmental Program to Improve Cleanliness (S.E.P.T.I.C.) and as such has developed, procedures for the Acceptance, Use and Management, of Nitrogen-Reducing Technologies participating in the S.E.P.T.I.C. grant program. The guidelines are similar and based on the Suffolk County model, Nassau County requires a multi-tiered acceptance process. The intent of the acceptance process is to allow new and promising technologies into the marketplace on a restricted basis while providing technologies with a long history of meeting performance standards a streamlined path to more favorable acceptance. As with Suffolk County, Nassau required various levels of monitoring depending on the acceptance stage and has adopted the same major and minor violation definitions as Suffolk County. Nassau added an additional layer of enforcement in that their guidelines include a claw back provision for all grant funded installations, where the County can require the property owner to repay grant funds if they do not maintain the system in accordance with their Grant Agreement. Nassau also built in reciprocity for Suffolk County and Massachusetts approvals. Table 2 indicates what is required to enter the Nassau market for each acceptance stage, where Table 3 shows the requirements, manufacturers must meet to maintain their acceptance status.

Table 2. Acceptance Criteria for Technologies to Enter Nassau S.E.P.T.I.C.

| Acceptance Phase         | Minimum Required Dataset to Enter Acceptance Phase | Required Minimum # of Samples      | Required Minimum Performance Verification Needed for Initial Acceptance   | Eligible for Grant Funds            |
|--------------------------|--|------------------------------------|---|-------------------------------------|
| Experimental             | third-party verification report                    | As specified in third-party report | Must submit a third-party evaluation report that demonstrates that the technology is technically capable of reducing TN concentrations to 30 mg/L or less.  | Yes, with restrictions <sup>4</sup> |
| Piloting <sup>1</sup>    | 2 installations                                    | 12 consecutive <sup>3</sup>        | NSF 245, equivalent, or third-party entity evaluation for systems installed in any US jurisdiction where the 12-month rolling average TN concentration results are between ≤ 19 and 30 mg/L AND a 50 percent actual reduction in TN concentration (see Memo #2 for details) | Yes, with restrictions <sup>5</sup> |
| Provisional <sup>1</sup> | 12 installations                                   | 12 consecutive <sup>3</sup>        | Average TN of 19 mg/L or less for systems installed in a jurisdiction where the technology is approved for nitrogen removal and the temperature conditions are comparable to, or colder than, those in Nassau County, NY.   | Yes                                 |
| General Use <sup>2</sup> | 20 installations                                   | 12 consecutive <sup>3</sup>        | Average TN concentration of 19 mg/L or less for all systems installed in Suffolk or Nassau Counties on Long Island;   | Yes                                 |

<sup>1</sup>The District honors Piloting and Provisional Approvals from Suffolk County Department of Health Services and State of Massachusetts, provided those technologies are averaging between 19 – 30 mg/L at the time of submission.

<sup>2</sup>The District honors General Approvals from Suffolk County Department of Health Services and State of Massachusetts, provided those technologies are averaging 19 mg/L or less at the time of submission.

<sup>3</sup>Consecutive samples may be submitted in monthly, bi-monthly, or quarterly intervals.

<sup>4</sup>Experimental Acceptance allows for the use of grant funds if the Manufacturer/ Designer of the technology sign a statement agreeing to repair, replace, or modify the Experimental Technology, including to install an OWTS permitted under the County’s Approved Alternative Technology List, if the District determines that the proposed Technology fails to perform as designed. The signed statement must clearly state who is responsible for the cost of repairing, replacing, or modifying the OWTS, and the method for ensuring funds to complete this work - whether through a bond or other form of financial security, posted by the Manufacturer or Design Professional, that is acceptable to the District. In addition, the Property Owner must attest and sign a statement that they understand that the Technology does not yet have any data on Long Island installations.

<sup>5</sup>Piloting Acceptance allows for Grant funded installations if the Property Owner attests to understanding the Technology does not yet have a statistical dataset of system performance on Long Island.

Table 3. Performance Verification Criteria for Technologies Enrolled in Nassau S.E.P.T.I.C.

| Acceptance Phase | Maximum # of Systems Allowed to be Installed | Required Treatment Threshold  | Minimum Sampling Frequency During Acceptance Phase  | Maintenance and Reporting Requirements |
|------------------|--|-------------------------------|---|--|
| Experimental     | Up to 5                                      | Average TN of 19 mg/L or less | Monthly Sampling<br>12 months rolling average   | Yes                                    |
| Piloting         | Up to 12                                     | Average TN of 19 mg/L or less | Monthly Sampling<br>12 months rolling average   | Yes                                    |
| Provisional      | No Limit                                     | Average TN of 19 mg/L or less | Bi-Monthly (every 60 days) Consecutive Sampling for 24 months<br>Rolling average of a minimum of 12 samples for the first 20 residential systems need to be monitored | Yes                                    |
| General Use      | No Limit                                     | Average TN of 19 mg/L or less | Sampling must be done within 36 months from date of installation, and every 36 months thereafter  | Yes                                    |



As you can see these varying processes can lead to significantly different technologies approved for use in neighboring jurisdictions with limited communication between jurisdictions. Orenco's AX-20 is the predominate system installed for nitrogen reduction in Rhode Island with over 7,500 installations (RIDEM February 2023) whereas the BioMicrobics FAST system is the predominate system tracked in Barnstable County's database with 1,680 systems installed (Barnstable County 2023). FujiClean and Hydro-Action are the predominate systems on Long Island with over 2,000 of each technology installed (SCDHS & NCSWCD 2023). FujiClean was approved for use in Suffolk County NY in 2017 but did not receive favorable (Category 1) approval in Rhode Island until 2021. Hydro-Action's RI approval is pending a manufacturer resubmission and neither Hydro-Action nor FujiClean have high tiered approvals in Massachusetts, despite having a statistically significant dataset of less than 15 mg/L TN on Long Island (SCDHS 2021).

If a universal protocol were adopted for residential field verification it would ease the burden on both manufacturers and regulators while providing cost savings to manufacturers and consumers. For example, it would provide Massachusetts with valuable 3<sup>rd</sup> party verification data need to approve systems that have accumulated thousands of data samples on Long Island. The process would expedite the approval and deployment of these technologies in jurisdictions where demand is at an all-time high, while ensuring a greater level of confidence in the technologies ability to reduce TN. Finally, the process would enhance and not impede on the independence of the individual permitting jurisdictions as nothing would prevent jurisdictions from implementing more stringent approvals but at least the standardized protocol would normalize regional monitoring and ease enforcement efforts.

## **MATERIALS AND METHODS**

In 2016, following the successful implementation of the Chesapeake Bay Watershed Memorandum of Cooperation between Delaware, Maryland, Pennsylvania, Virginia, and West Virginia to share data related to the performance of nitrogen-reducing septic systems. EPA tried to continue these efforts with a similar MOC among the New England Coastal States and Long Island. The purpose was to provide written commitments from Maine, Massachusetts, New Hampshire, Rhode Island, and Suffolk County, NY to participate in the sharing of field and laboratory data and streamlined process to provide consistent document on the performance of advanced nitrogen-reducing septic systems.

The EPA assembled an expert panel consisting of EPA staff, consultants, and regulators and educators from all involved jurisdictions. The collaborative process produced two useful documents which have gone on to help structure the approval and monitoring processes on Long Island. The first was a statistical analysis of Barnstable County's IA database by Horsley Witten Group, Inc and the second was a Test Plan Application Template.

The statistical analysis by the Horsley Witten Group, Inc (HW). analyzed field sampling data for over 2,000 advanced treatment systems. The analysis sought to answer two questions: (1) How many samples are needed to understand the performance of an individual onsite system? (2) How many systems need to be sampled to evaluate the overall performance of an advanced technology?

The analysis looked at 208 systems across 12 technologies which encompassed over 4,000 sample points. HW utilized a one-tail. T-test method to estimate the number of sampled need to be withing

a 20% range of the true mean and a 90% confidence level. Using bootstrapping in Excel to continuously resample the same population distribution for each technology.

The Test Plan application provided standard operating procedures for sample collection and contained the following:

- Key project contacts
- Regulatory Jurisdiction Contact Information
- Details on the frequency and number of samples needed for each jurisdiction.
- Required sampling parameters for each jurisdiction.
- Site preparation and sampling procedures
- Provisions for split samples, audits, and data reporting
- Details on System Operation, Maintenance, and Inspection

## **RESULTS**

The Statistical Analysis found that by field sampling between eight (8) and twenty (20) systems of a technology, with 12 samples collected on each system, would be sufficient to assess the performance of the technology within a 90% confidence level. This data ultimately went on to shape the Long Island Approval and Acceptance Processes. Suffolk County also implemented a revised and shortened version of the proposed Test Plan Template. However, in regards to the MOC the efforts ultimately stalled in part due to the fact that states like Rhode Island and Massachusetts have long standing regulations would have to be amended in order to implement the data share recommendations. Both Suffolk and Nassau Counties have developed stringent, science-based regulations for the acceptance, use, and management of nitrogen-reducing septic system technologies. These acceptance processes allow manufacturers to submit data from other Jurisdictions and require a statistically significant dataset to prove a technology's nitrogen reduction capabilities.

## **DISCUSSION**

The intended purpose of this now defunct Memorandum of Cooperation (MOC) was to provide a written commitment between the New England Coastal region states and Suffolk County, NY to participate and share field and laboratory data, and unify sampling protocol to provide a consistent approval process for advanced denitrification systems across multiple permitting jurisdictions. This would have allowed for the simplification and expedition for approval of these technologies in each jurisdiction, as well as to eliminate repetitive testing, ultimately lowering costs to the manufacturers and property owners. However, due to the difficulty in getting all permitting jurisdictions to adopt the test plan protocol and agree to implement the MOC, the attempt ultimately fell apart in early 2017.

In retrospect, the more effective way to reach the same result would be the establishment of procedures and protocols that could be used by a third-party entity to evaluate, and field verify technologies for nitrogen removal, similar to how NSF and ETV provides certification in a test

center environment. The following recommended next steps could be taken to further spark discussion and build the foundation for such a concept:

1. Assemble an expert panel to revisit the Test Plan Application and develop a sample submission template.
2. The statistical analysis could be routinely revisited to include an ever-increasing dataset. This process could even be automated.
3. Third party entities such as MASSTC, NSF, BNQ, and ETV could look into a certification process for field verification that regulators can use similar to NSF 40 and 245 certifications.
4. Jurisdictions with existing approval processes could investigate adopting reciprocity clauses in their regulations.
5. Exceptions could be made to systems being installed through publicly funded demonstration projects as done in Rhode Island in the late 1990's and early 2000's.
6. Information collected under standardized procedures could be vetted and posted publicly online for access for consumers, industry professionals, and regulators.

In 2023, with new regulations for nitrogen-reducing technologies being passed or proposed in markets like Hawaii, Florida, Long Island, and Cape Cod, it is important to not artificially diminish supply to further inflate the cost of installations. If the cost of advanced treatment continues to exceed \$50,000 per installation, it will ultimately diminish the onsite industry in favor of large sewerage projects. The onsite industry needs to come together and unite to streamline and simplify processes across jurisdictions for the larger public good.



## **ACKNOWLEDGEMENTS**

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