

**DEPARTMENT OF ENVIRONMENTAL PROTECTION**  
**Bureau of Clean Water**

**DOCUMENT NUMBER:** 385-2208-003

**TITLE:** Alternate On-lot Sewage Pretreatment Technology Verification Policy (TVP)

**EFFECTIVE DATE:** May 9, 2020

**AUTHORITY:** The Pennsylvania Sewage Facilities Act, 35 P.S. §§ 750.1-750.20, 25 Pa. Code Chapter 73

**POLICY:** The Department of Environmental Protection (DEP) will evaluate new concepts or technologies that are applicable to on-lot sewage systems and components that have been classified as on-lot alternate technologies for use in Pennsylvania. It is necessary that such evaluations be consistently applied and impartially conducted by a DEP-approved qualified independent third-party evaluator.

**PURPOSE:** The purpose of this guidance is to provide scientific, technical, and field testing standards as directed by Act 26 of 2017, upon which evaluation of each on-lot sewage system or component that has been classified as an alternate system and newly proposed on-lot sewage system or component technologies for which approval as an alternate system or component in the Commonwealth of Pennsylvania is being sought. The guidance provides a consistent approach for the submission, review, and approval/disapproval of existing and proposed alternate pretreatment technologies. This guidance replaces the previous *Experimental Onlot Wastewater Technology Verification Program* guidance (381-2208-001).

**APPLICABILITY:** This policy applies to persons and manufacturers seeking approval of new or previously classified alternate on-lot sewage system and component technologies.

**DISCLAIMER:** The policies and procedures outlined in this guidance are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. DEP does not intend to give this guidance that weight or deference. This document establishes the framework, within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

**PAGE LENGTH:** 38 pages

## I. DEFINITIONS AND ACRONYMS

### A. Definitions

*Act* – Pennsylvania Sewage Facilities Act (35 P.S. §§ 750.1-750.20).

*Act 26* – The act of July 20, 2017 (P.L. 321, No. 26), amending the Pennsylvania Sewage Facilities Act.

*Advanced secondary on-lot sewage pretreatment* – Level of pretreatment of sewage that achieves a reduction in the five-day carbonaceous biochemical oxygen demand (CBOD<sub>5</sub>) and Total Suspended Solids (TSS) both to a level at or below 10 mg/L.

*Alternate sewage system* – A method of demonstrated on-lot sewage treatment and disposal not described in 25 Pa. Code Chapter 73.

*Applicant* – A person who applies to the DEP for approval for use in the Commonwealth of Pennsylvania of an on-lot sewage pretreatment system or component.

*BOD<sub>5</sub>* – Five-day biochemical oxygen demand in mg/L – the concentration of dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter during a period of 5 days at a temperature of 20°C.

*CBOD<sub>5</sub>* – Carbonaceous five-day biochemical oxygen demand in mg/L – the concentration of oxygen used by microorganisms in the non-nitrogenous oxidation of organic matter during a period of 5 days at a temperature of 20°C.

*Composite sample* – Two or more samples or subsamples collected from the same point at different times, mixed together in appropriate known proportions (either discretely or continuously), from which the average value of a desired parameter may be obtained.

*Confidence interval* – In statistics, a confidence interval (CI) is a type of interval estimate, computed from the statistics of the observed data, that might contain the true value of an unknown population parameter.

*Conventional sewage system* – A system employing the use of demonstrated on-lot sewage treatment and disposal technology in a manner specifically recognized by 25 Pa. Code Chapter 73. The term does not include alternate or experimental sewage systems.

*Experimental sewage system* – A method of on-lot sewage treatment and disposal not described in 25 Pa. Code Chapter 73 which is proposed for the purpose of testing and observation.

*Fecal coliform* – Fecal coliform bacteria whose concentrations are measured in MPN/100 ml, most probable number of total coliform bacteria per 100 ml.

*Grab sample* – An individual sample taken from an inlet or outlet of an on-lot sewage system or any of its components at a given time and location.

*Manufacturer* – A person or legal entity that manufactures on-lot sewage systems or any component of an on-lot sewage system.

*On-lot sewage system* – An individual or community sewage system, whether public or privately owned, which uses a system of components for collecting, treating, and disposing of sewage into a soil absorption area or spray field or by retention in a retaining tank serving one or more lots.

*On-lot sewage system component* – Any subsection or component of an on-lot sewage system such as building sewer (collection system), treatment tank(s), media filter(s), dosing tank, disinfection system, equalization tank(s), and absorption area(s) or any component necessary for an on-lot sewage system to function properly.

*Sewage* – A substance that contains the waste products or excrement or other discharge from the bodies of human beings or animals and noxious or deleterious substances being harmful or inimical to the public health, or to animal or aquatic life, or to the use of water for domestic water supply or recreation. The term includes any substance which constitutes pollution under The Clean Streams Law.

*Sewage Pretreatment Component* – Any part of an on-lot sewage system that provides treatment of sewage prior to conveyance to a final treatment and dispersal component or reuse; often, this treatment is designed to meet primary, secondary, advanced secondary, and/or fecal coliform and total nitrogen performance standards.

*TSS* – Total suspended solids in mg/L – The pollutant parameter total suspended solids.

*Shallow limiting zone* – A soil horizon or condition in the soil profile or underlying strata which includes one of the following:

1. A seasonal high water table between 10 and 20 inches below the mineral soil surface, whether perched or regional, determined by direct observation of the water table or indicated by redoximorphic features.
2. Rock with open joints, fractures or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments between 16 and 20 inches below the mineral soil surface.
3. A rock formation, other stratum or soil condition which is so slowly permeable that it effectively limits downward passage of effluent between 16 and 20 inches below the mineral soil surface.

## B. Acronyms

DEP – Pennsylvania Department of Environmental Protection

EPA – United States Environmental Protection Agency

OAT – On-lot Alternate Technology

O&M – Operation and Maintenance

SEO – Sewage Enforcement Officer

## II. INTRODUCTION

The Pennsylvania Sewage Facilities Act establishes the framework for the development and implementation of plans for the sanitary disposal of sewage waste. Effective pretreatment and disposal of sewage waste are essential to maintaining the quality of waters of the Commonwealth.<sup>1</sup> Section 5 of the Sewage Facilities Act requires each municipality to submit to the DEP an officially adopted plan for sewage services for areas within its jurisdiction and establishes the framework for review and approval of these official plans by both the municipality and the DEP. On July 20, 2017, the Act was amended by Act 26 to revise the sewage planning process to allow for the consideration of alternate on-lot sewage systems or components during the planning process.

Act 26 amended Section 5 of the Act to require the DEP to “develop scientific, technical and field testing standards upon which an evaluation of each on-lot sewage system that has been classified as an alternate system in accordance with 25 Pa. Code § 73.72 (relating to alternate sewage systems) shall be based.” Act 26 also directed the DEP to develop these standards in consultation with the DEP’s Sewage Advisory Committee (SAC).<sup>2</sup>

The existing regulations, in 25 Pa. Code § 73.72, establish the criteria for evaluation of alternate systems or components on a case-by-case basis. The regulations were developed primarily to address malfunctioning on-lot sewage systems or components on lots that have specific site suitability deficiencies or engineering problems. Prior to Act 26, Sewage Enforcement Officers (SEOs) could only permit on-lot alternate technologies (OATs) as per 25 Pa. Code § 72.23(d).

As provided in 25 Pa. Code § 73.72(b), a person desiring to install an alternate system is required to submit complete preliminary design plans and specifications to the SEO and the DEP for review and comment prior to applying to the local agency for an installation permit of an OAT. The DEP may delegate the review of certain OATs to qualified SEOs within their area of jurisdiction.

Initial evaluations of OATs are based on the criteria in 25 Pa. Code § 73.72(c). The DEP develops general requirements that must be considered by an SEO before issuing a permit for the use of OATs. These general requirements for evaluating OATs will be available for use by SEOs through the OAT guidance document. The local agency is responsible for making a decision on a permit application for the system based on consideration of the DEP comments. Persons seeking to use these approved OATs are not required to submit their proposals to the DEP for further review.

Prior to issuance of the DEP’s previous *Experimental Onlot Wastewater Technology Verification Program* guidance (381-2208-001) in July 2004, monitoring, observation, and testing requirements for experimental on-lot sewage technologies were established on an individual

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<sup>1</sup> 35 P.S. § 750.3 (Declaration of policy) (“It is hereby declared to be the policy of the Commonwealth of Pennsylvania through this act: (1) To protect the public health, safety and welfare of its citizens through the development and implementation of plans for the sanitary disposal of sewage waste. ...”)

<sup>2</sup> 35 P.S. § 750.5(c.2)(1) (“...the department shall, in consultation with the advisory committee, develop scientific, technical and field testing standards upon which an evaluation of each on-lot sewage system that has been classified as an alternate system in accordance with 25 Pa. Code § 73.72 (relating to alternate sewage systems) shall be based.”)

manufacturer basis and resulted in inconsistencies, inappropriate use of experimental on-lot sewage technologies, and a delay in making promising technologies available for general use.

The process that the DEP has used to approve alternate on-lot sewage systems or components had also gone this same route. This guidance document complies with the provisions of Act 26 and formalizes the alternate on-lot sewage system approval process. Given the advancements in on-lot pretreatment technologies and the enactment of Act 26, the DEP must establish processes used to approve, site, and maintain alternate pretreatment system components. The development of the scientific, technical, and field testing standards, as required by Act 26, provides a more consistent and robust process for on-lot alternate system or component review and determination. In accordance with the Act, the process set forth herein ensures that the best management practices being employed for pretreatment and disposal of sewage on the most challenging sites will be protective of the waters of the Commonwealth, water supplies, and property values.

This guidance outlines the process that the manufacturer of each existing and new alternate pretreatment component and experimental system should follow for the system or component to be approved for use in Pennsylvania. Given that it is difficult for the existing alternate systems or components to meet requirements that had not previously been established, the DEP has provided some flexibility in the process for the existing alternate pretreatment system components without compromising the integrity of the review process.

This guidance includes three elements: (1) certification by an approved certification organization, (2) in-situ performance of the technology through field testing, and (3) ongoing performance monitoring of the technology through annual testing or performance audits.

- (1) The certification provides a basis for establishing whether a proprietary pretreatment system can meet the performance standards under a controlled setting. The certification data can be used to determine if the pretreatment system meets the performance criteria for the various parameters in the pretreatment standards. An additional statistical analysis of the certification data provides evidence that the pretreatment system meets the standards.
- (2) Successful field testing provides the assurance that the technology performs under field conditions and variable sewage loading. This is important since the certification testing is conducted in a controlled setting, while field testing shows how the system reacts under “typical” use. Field data will also help to establish the level of operation and maintenance (O&M) required to ensure the system operates in a manner that maintains compliance with the effluent performance standards.

Once it is established that a technology is capable of meeting the performance standards and the approval process is completed, the technology is approved for use as an alternate technology in the Commonwealth of Pennsylvania.

- (3) Once the technology is approved for use as an alternate technology, the manufacturer may opt to enter the performance audit process. Manufacturers who do not choose to enter the performance audit process will, for the life of the system, monitor performance through annual testing of every installed system by a manufacturer-approved service provider(s). Annual performance monitoring of installed systems provides assurance that

the technology continues to meet the approved performance standards for the technology, and ensures systems or components are being operated and maintained appropriately.

Manufacturers who choose to have their technology enter the last element of the technology verification process – the performance audit – are no longer required to have all installed systems tested annually. The performance audits, through random selection of installed systems, provide assurance that the technology continues to meet the approved performance standards for the technology, and ensures systems or components are being operated and maintained appropriately. Once a technology has shown, through the data collected during the performance audit process, that the technology consistently meets the performance standards for which it was approved, the DEP may classify the technology as a conventional component and/or system. Classification as a conventional component and/or system requires an update to the regulations which is beyond the scope of this technical guidance document.

### **III. SCOPE**

This policy is intended to provide guidelines for testing and verifying the performance of experimental on-lot sewage system and component technologies and alternate on-lot sewage system and component technologies for on-lot sewage pretreatment and disposal. The prior practice of classifying systems or components on a case-by-case basis resulted in inconsistencies in classifications, improper use and management of alternate and experimental on-lot sewage systems or components, and a delay in making proven alternate and experimental systems or components available for general use.

This policy extends to all commercially ready, proprietary and non-proprietary pretreatment systems or components of an experimental or alternate on-lot sewage system that are reproducible from one location to another. This includes systems or components applicable to individual and community on-lot systems or components designed to treat no more than 10,000 gallons per day of sewage from residential, commercial, or institutional establishments as listed in 25 Pa. Code § 73.17, but excluding industrial waste.

This policy will not affect any system/component testing or approval as currently described in 25 Pa. Code Chapter 73 or alternate technology systems/components permitted and installed prior to finalization of this technical guidance document. On-lot sewage systems or components not described in 25 Pa. Code Chapter 73 are the focus of this policy. The technology performance verification information gathered under this policy will also be appropriate for use in making small flow treatment facility design, permit, and operation decisions.

### **IV. ROLES AND RESPONSIBILITIES**

- A. Certification Organization – One or more certification organizations acceptable to the DEP will be selected by the technology manufacturer to oversee the technology verification process through test center verification. To be acceptable to the DEP, a certification organization should be accredited by either the American National Standards Institute (ANSI) or the Standards Council of Canada (SCC) as an independent third-party organization and should demonstrate to the satisfaction of the DEP that the organization can implement the certification elements of this guidance. Examples of acceptable ANSI certification organizations can be found at [www.ansi.org/Accreditation/product-](http://www.ansi.org/Accreditation/product-)

[certification/Directory](#), and SCC certification organizations can be found at [www.scc.ca/en/search/accredited\\_bodies](http://www.scc.ca/en/search/accredited_bodies).

- B. Testing Organization – An entity that implements the technology-specific field test plan and/or performance audit, including documentation and sample reporting to the DEP. The testing organization should be an independent third-party: a person or body that is recognized as being independent of the person or organization that sells the pretreatment unit, and independent from the manufacturer and user of the pretreatment unit. An individual – such as a professional engineer, geologist, university professor, or other qualified professional – can also act as a testing organization. The qualifications of the testing organization should be provided to, and will be subject to review and approval by, the DEP as part of the field test verification application review.
- C. Technology Manufacturer – A person or legal entity that manufactures on-lot sewage systems or components. This person or entity may obtain product certification from the DEP. When the on-lot sewage system consists of components made by other manufacturers, a primary manufacturer should be designated for the purposes of obtaining product certification. All the other manufacturers will be deemed affiliates of the primary manufacturer (hereinafter referred to as “the manufacturer”) for DEP purposes.
- D. Service Provider – An individual, company, or other entity who is certified by the manufacturer to provide O&M for a specific component, specific components, or a system. By being affiliated with the manufacturer, a service provider will not be independent and thus not able to act as a testing organization for the manufactured product.
- E. The DEP – Develops and maintains the on-lot sewage pretreatment technology performance standards, technology verification application process, and review methodology. Reviews the technology verification applications to verify the on-lot sewage technology performance and approves or disapproves on-lot technologies classified as alternate technologies for use in Pennsylvania.

## V. **Technology Application Review Process**

- A. The Technology Application Review Process consists of the following steps:
  - 1. Step One – Administrative review of the application
  - 2. Step Two – Technical review of the application
  - 3. Step Three – Final Approval Process
- B. Step One – Administrative Review of Application
  - 1. The DEP will perform an administrative review of the information provided by the manufacturer to verify all the requested documents were submitted.
    - a. All applications for on-lot technology verification must be submitted to the DEP. Applications should include all necessary information to confirm that the technology performs at the pretreatment level specified in

the application. The DEP will review the application to determine if it is administratively and technically complete. The applicant will submit two (2) hard copies and one (1) electronic copy of the application to the DEP; all calculations and testing data will be provided in an electronic format that is acceptable to the DEP. See *Appendix B: Application Administrative Requirements* for the administrative completeness items.

- b. All proprietary pretreatment technologies should have the appropriate certification unless the proprietary pretreatment technology is technologically incapable of being tested by a certification organization. See *Appendix C: Acceptable Certifications* for currently acceptable certifications. The appropriate certification should be provided with the application to be considered administratively complete. If a technology is incapable of being certified, a statement provided by a qualified certification organization stating why the technology cannot be tested using the approved certification protocol should be provided with the application.
  - c. An exception to the certification requirement may be granted for classified pretreatment OATs that were classified prior to September 18, 2017, and for which certification testing has not been performed. Manufacturers of these alternate systems or components may submit field testing data in lieu of certification data. The field testing data should meet the standards set forth in the field testing verification protocol referenced in *Appendix E: Field Testing Verification Protocol*.
  - d. Non-proprietary pretreatment systems or components need not have a certification. These technologies will be technically and scientifically evaluated by the DEP to ensure conformance with performance standards.
  - e. Alternate on-lot sewage system components that provide distribution of effluent should equally distribute effluent over the absorption area with the goal of maximizing the renovative and dispersal capability of the infiltrative surface. Evidence of equal distribution should be provided to the DEP for alternate component approval.
  - f. The DEP may require additional information, when applicable, to determine the performance of a technology.
2. Once the application is considered administratively complete, the DEP will begin a technical review.

C. Step Two – Technical Review of the Application

1. Verification of Third-Party Certification – A statistical analysis of the certification data to verify the technology meets the performance standards in *Appendix A1: On-lot Pretreatment Technology Performance Standards*.
  - a. As authorized under 25 Pa. Code § 73.72(c)(8), certification testing must have occurred in a climate which is similar to or colder than the climate in Pennsylvania. Pretreatment technology performance will be categorized based upon the level of pretreatment achieved.
  - b. The DEP will proceed to Step C.2 below, Verification of Field Testing Data, for proprietary technologies that are incapable of being tested by a certification organization and for non-proprietary technologies.
  - c. The DEP will statistically evaluate proprietary technologies with certification data to determine if they meet the performance standard(s) for the approval being requested.
    - i. Except for fecal coliform, all applicable sample data will be evaluated to determine the sample mean and the sample standard deviation. See *Appendix D: Statistical Equations*.
    - ii. Using the sum of the sample mean plus one sample standard deviation, the DEP will determine whether the data supports the conclusion that the technology meets the applicable performance standard.
    - iii. For applications that request fecal coliform pretreatment performance approval, using the sum of the sample geometric mean plus two standard deviations, the DEP will determine whether the data supports the conclusion that the technology meets the applicable performance standard.
    - iv. If the statistical analysis does not verify that the technology meets the DEP's applicable performance standard(s), DEP will disapprove the technology. If disapproved, the applicant may retest the technology with an approved certification organization and restart the application process after testing is complete.
    - v. If the statistical analysis verifies the technology meets the DEP's applicable performance standard(s), the technical review will proceed to Verification of Field Testing Data.

2. Verification of Field Testing Data – This subsection outlines the process the DEP will follow for the statistical analysis of the field testing data to verify the technology’s performance in the field.
  - a. The DEP will verify the field testing data under *Appendix E: Field Testing Verification Protocol*. Any existing performance verification data that the manufacturer wishes to be considered to supplement or supplant requested testing must be submitted along with the verification application in a format acceptable to the DEP.
  - b. DEP will determine acceptance of previously completed field testing data on a case-by-case basis. All testing data (influent, effluent, and process control samples) collected for the technology will be provided to the DEP regardless of whether the samples meet the DEP’s minimum requirements. The DEP will primarily use field testing data that meets the minimum requirements as stated below in verifying the performance of the technology. The DEP may use field data that does not meet these requirements, but the data may hold less weight in the decision-making process.
    - i. Field testing sites must either be in Pennsylvania or at a site where the climate is similar to or colder than the climate in Pennsylvania. One method of determining whether a field testing location is climatologically comparable to Pennsylvania would be to use the Plant Hardiness Zone Map produced by the United States Department of Agriculture; however, other methods may be acceptable.
    - ii. Testing must have been completed by a DEP-approved testing organization and must have followed at a minimum the protocols stated in *Appendix E: Field Testing Verification Protocol*.
    - iii. Testing should have occurred over 12 or more consecutive months.
  - c. All the DEP-acceptable field testing data will be statistically evaluated to determine whether at least a 90% confidence interval for the sample data meets the performance standard for each parameter for which approval is being requested.
  - d. If a 90% confidence interval for the acceptable field testing data does not meet the applicable performance standard for one or more parameters, field testing verification may continue with prior approval by the DEP. Otherwise, the DEP may disapprove the technology for use in Pennsylvania.
  - e. If a 90% confidence interval for the acceptable field testing data does meet the applicable performance standard for all applicable parameters, the DEP will proceed to the Final Approval Process in the technical review, outlined in Subsection D, below.

D. Step Three – Final Approval Process

1. Design considerations will provide the basis for a designer to design the OAT.
  - a. OATs should be designed with a physical treatment barrier or a fail-safe mechanism to ensure that untreated or partially treated sewage will not be discharged to the absorption area.
  - b. Manufacturers of pretreatment components or systems who request pretreatment performance approval that will allow for effluent discharge to mineral soils less than 20 inches thick should incorporate time and pressure dosing of the absorption area into the system design, or another method that is demonstrated to achieve similar or better performance.
2. Siting and installation requirements will provide the basis for a designer to be able to site and for a contractor to successfully install the OAT.
3. O&M requirements will be reviewed to determine whether they meet or conform to industry standards relating to O&M requirements for the electrical and mechanical components of an on-lot pretreatment system, the minimum pumping requirements for the tanks, the minimum inspection requirements for the system, the minimum administrative requirements, and anything else necessary to ensure that the OATs will provide long-term sewage disposal.
4. The DEP, in consultation with the manufacturer, will then develop the OAT guidance document. The technology guidance document will include a minimum of the following:
  - a. Rated performance standard for the technology, if applicable
  - b. Source of technology; proprietary or generic
  - c. Type of technology; secondary, advanced secondary, or combined pretreatment and distribution
  - d. Planning requirements
  - e. Permitting requirements
  - f. Design considerations
  - g. Siting and installation requirements
  - h. O&M requirements
  - i. Inspection and testing requirements

5. The DEP will publish a notice of the availability of the OAT guidance document and the DEP's basis for making the decision to approve the technology in the *Pennsylvania Bulletin* for a 30-day comment period.
6. After reviewing and addressing public comments, the DEP may issue a final approval letter to the applicant for the OAT. The DEP will then upload the OAT guidance document and comment/response document to the DEP's OAT webpage.

## **VI. Performance Audit**

- A. The performance audit is a voluntary process for manufacturers who wish to pursue classification of their approved alternate technology as a conventional component or system. The performance audit verifies ongoing field performance of an OAT, while collecting performance data that the DEP can use to determine if the alternate technology may be classified as a conventional. Classification as a conventional component or system may only be accomplished with an update to the regulations, which is beyond the scope of this technical guidance document. The process for the performance audit is as follows.
  1. General
    - a. The manufacturer should provide the DEP with a list of all the manufacturer's OATs installed in Pennsylvania following approval under the process established under this guidance document. This list should be updated every six (6) months except when otherwise requested by the DEP.
    - b. As per the OAT guidance document, all necessary agreements with the owner of the installation site for the testing organization to complete the performance audit should be finalized and in place. The OAT guidance document and the permit for installation will detail the necessity for a third-party testing organization to enter the property as part of the performance audit.
    - c. As will be described in the OAT guidance document, installation sites should be operated under a valid maintenance agreement or contract. All maintenance on the component, components, and/or the system will be documented.
    - d. The manufacturer should provide the DEP with the manufacturer's choice for the independent third-party testing organization to complete the performance audit. The DEP will review the qualifications of the testing organization to verify the testing organization's independence and the DEP will indicate approval or disapproval.

2. Site selection

- a. Once a calendar year, or as the DEP otherwise determines at the end of a five-year (5-year) performance audit cycle, the DEP will refer to the manufacturer's list of systems or components installed in Pennsylvania to randomly select sites to be audited from among each OAT installed in the state. If an OAT is installed at five (5) or fewer sites in Pennsylvania, all these sites should be included in the audit. If an OAT is installed at more than five (5) sites in Pennsylvania, five (5) or five percent (5%) of these sites - whichever is the greater number - should be included in the audit, up to a maximum of ten (10) sites. Performance audit samples will be collected at each site.

To provide clarity on the number of sites for performance auditing, here are some example situations.

A manufacturer has completed the approval process for an on-lot sewage treatment system to be classified as an OAT and the manufacturer wishes to proceed with the performance audit to have the technology become a conventional on-lot system in Pennsylvania.

- i. In the first year after OAT classification, the system is installed at four (4) sites in Pennsylvania. All four (4) sites will need to be included in the performance audit.
- ii. In the second year after OAT classification, the system is installed at an additional 51 sites in Pennsylvania, bringing the total number of systems installed in the state to 55. Since five percent (5%) of the total number of systems installed in the state (i.e.,  $0.05 \times 55 = 2.75$ ) is less than five (5), five (5) sites will need to be included in the performance audit.
- iii. In the third year after OAT classification, the system is installed at another 105 sites in Pennsylvania, bringing the total number of systems installed in the state to 160. Since five percent (5%) of the total number of systems installed in the state (i.e.,  $0.05 \times 160 = 8$ ) is more than the minimum of five (5), five percent (5%) - which in this case is eight (8) - of the systems will need to be included in the performance audit.
- iv. In the fourth year after OAT classification, the system is installed at another 140 sites in Pennsylvania, bringing the total number of systems installed in the state to 300. Since five percent (5%) of the total number of systems installed in the state (i.e.,  $0.05 \times 300 = 15$ ) exceeds the maximum of ten (10) sites, ten (10) systems will need to be included in the performance audit.
- b. The DEP will contact the approved testing organization, provide the testing organization with the locations, and determine the dates and times

for the performance audit sampling in consultation with the testing organization. The testing organization should not inform the manufacturer of the locations and dates of the performance audit sampling unless specifically agreed to with the DEP. The manufacturer and/or a representative of the manufacturer may accompany the testing organization to one or more of the audit locations on the scheduled date of the performance audit sampling.

- c. All OATs selected for inclusion in the performance audit should have operated continuously for at least 60 days, or as agreed to between the manufacturer and the DEP. Further, OATs selected should serve buildings or residences occupied by at least two (2) people and should be producing effluent at the time of the performance audit sampling.

### 3. Sampling plan requirements

- a. The DEP will provide the testing organization with the required inspection elements and sampling parameters that will be used during the performance audit sampling. All samples must be analyzed by a laboratory accredited by the DEP Laboratory Accreditation Program or the National Environmental Laboratory Accreditation Program (NELAP). The performance audit sampling form and a copy of the DEP or NELAP certified lab results should be provided to the DEP and the manufacturer.
- b. The testing organization should provide the DEP with the performance audit sampling plan for completing the audit. The sampling plan, at a minimum, should ensure conformance with the sampling protocols as noted in Section 5 of *Appendix E: Field Testing Verification Protocol*, **except** for the requirement in Section 5.2, bullet four that “[s]amples will be collected once every 60 days for 12 consecutive months at each field site.” Instead, samples for the performance audit should be collected once per year per site unless results require additional sampling of a site.
- c. During the performance audit sampling, the testing organization should first ensure that the OAT is producing effluent. If the OAT is not producing effluent, the testing organization should make note and inform the DEP and the manufacturer that the OAT was not producing effluent. If the component and/or system is not functioning correctly, the testing organization should advise the owner and the DEP in writing. Other than routine maintenance specified in the system’s O&M manual, maintenance should not be performed on the system for the 10 days prior to the audit sampling, including prior to sampling on the day of the audit sampling. Any routine maintenance conducted on the unit should not be done on the same day as sampling prior to sampling.

### 4. Action level

- a. Effluent samples from each location inspected should be less than or equal to two times the performance standard level of pretreatment as set forth in

the manufacturer's OAT guidance document. For example, the action levels for TSS and CBOD<sub>5</sub> would both be 20 mg/L for the advanced secondary level of pretreatment. See *Appendix A1: On-lot Pretreatment Technology Performance Standards*.

- b. If during the performance audit sampling, the testing organization and/or the manufacturer representative observe untreated or partially treated sewage on the surface of the ground, entering a surface water of the Commonwealth, backing up from the absorption area into any components of the OAT, or backing up into a structure, the testing organization should notify the local agency's SEO.
  - c. The DEP will provide the manufacturer with the results of the performance audit. When a case of nonconformity of a component or system is detected, the manufacturer should provide the DEP a Corrective Action Plan (CAP) explaining the case(s) of nonconformity and specifying the action(s) to be taken to establish or return to conformity with the applicable requirements.
  - d. Upon approval of the CAP, the manufacturer should implement the CAP and advise the DEP in writing upon completion. Some cases of nonconformity may require an additional audit visit and sampling following the instructions specified in Section VI.A.3.
  - e. During the next audit cycle, the manufacturer should include in the sampling plan, any sites that obtained substandard results in addition to the sites randomly selected in accordance with Section VI.A.2.a.
  - f. The DEP may suspend the planning and permitting of new installations of an OAT, either from the moment a case of nonconformity is detected or following the close of a period to correct the situation, depending on the type of nonconformity involved. If at the end of the period of suspension, the case(s) of nonconformity has not been corrected, the DEP may suspend the OAT approval.
5. Performance audit report
- a. A performance audit report must be provided to the DEP. At a minimum, the performance audit report should include:
    - i. Current property owner name
    - ii. Verification that the model installed is the model approved for use in Pennsylvania
    - iii. Date and time of the audit
    - iv. Weather conditions at time of audit

- v. Detailed description of the site
- vi. Specifications for the tested system
- vii. Geographic location of system with GPS coordinates
- viii. List of individuals involved in the audit of the system
- ix. Inspection report if generated
- x. All O&M performed on the system during the previous 365 days
- xi. List of any physical or process control changes to the system in the previous 365 days
- xii. Complete description of sampling and analytical methods
- xiii. All testing results, including all sample data and analyses or other data summaries or evaluations
- xiv. Rationale for exclusion of data or removal of the system from the audit

b. The testing organization should provide this information on a form provided by the DEP.

B. The DEP will review the performance audit data every five (5) years – the performance audit cycle – for each technology to determine the new 90% confidence interval upper limits for each parameter, calculated using data from the verification of field testing data during the review and approval process, and the data collected during the performance audits. The new 90% confidence interval upper limits will be used to evaluate whether the OAT continues to meet the standards for the approved level of pretreatment, as shown in *Appendix A1: On-lot Pretreatment Technology Performance Standards*. Based on the data collected over the performance audit cycle, and the statistical analysis, the DEP will determine if the manufacturer’s technology should:

- 1. discontinue the performance audit,
- 2. continue with the performance audit at the same time frequency and with the same amount of systems,
- 3. continue with a performance audit at a different time frequency,
- 4. continue with a performance audit with a different amount of installed systems,
- 5. be reevaluated at a lower pretreatment standard(s) due to the inability of the technology to meet the currently approved pretreatment standard(s), or

6. be removed from the OAT guidance document due to the inability of the technology to meet the currently approved pretreatment standard(s) or any lower pretreatment standard(s).

## VII. Levels of Pretreatment on Soils with Shallow Limiting Zones

- A. The performance standards in *Appendix A1: On-lot Pretreatment Technology Performance Standards* are based on two factors: depth to limiting zone and soil infiltration loading rates, as described by Tyler et al. (2000).<sup>3</sup>
- B. *Appendix A2: Level of Pretreatment on Soils with Shallow Limiting Zones* provides clarification on the levels of pretreatment required on soils with shallow limiting zones.
  1. For soils with a depth to seasonal high water  $\geq 12$  inches and  $< 20$  inches, and a depth to rock  $\geq 16$  inches and  $< 20$  inches, and
    - a. with a soil infiltration loading rate between 0.2 and 1.0 gal/ft<sup>2</sup>/day, the technology must meet the Advanced Secondary Pretreatment Standards for CBOD<sub>5</sub> and TSS, and the FC-2 fecal coliform standard.
    - b. with a soil infiltration loading rate  $> 1.0$  gal/ft<sup>2</sup>/day, the technology must meet the Advanced Secondary Pretreatment Standards for CBOD<sub>5</sub> and TSS, and the FC-3 fecal coliform standard.
  2. For soils with a depth to seasonal high water  $\geq 10$  inches and  $< 12$  inches, and a depth to rock  $\geq 16$  inches, and
    - a. with a soil infiltration loading rate between 0.2 and 1.0 gal/ft<sup>2</sup>/day, the technology must meet the Advanced Secondary Pretreatment Standards for CBOD<sub>5</sub> and TSS, and the FC-3 fecal coliform standard.
    - b. with a soil infiltration loading rate  $> 1.0$  gal/ft<sup>2</sup>/day the technology must meet the Advanced Secondary Pretreatment Standards for CBOD<sub>5</sub> and TSS, and the FC-4 fecal coliform standard.

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<sup>3</sup> Tyler, E. J. and L. Kramer Kuns. (2000). "Designing with Soil: Development and Use of a Wastewater Hydraulic Linear and Infiltration Loading Rate Table." NOWRA 2000 Conference Proceedings. Grand Rapids, MI. [http://soils.wisc.edu/sswmp/SSWMP\\_4.42.pdf](http://soils.wisc.edu/sswmp/SSWMP_4.42.pdf).

**APPENDIX A1:**

**ON-LOT PRETREATMENT TECHNOLOGY PERFORMANCE STANDARDS**

<b>On-lot Sewage System Basic Performance Standards Table</b>		
<b>Level of Pretreatment</b>	<b>CBOD<sub>5</sub> mg/L</b>	<b>TSS mg/L</b>
Primary	≤125	≤80
Secondary	≤25	≤30
Advanced Secondary	≤10	≤10

<b>On-lot Sewage System Fecal Coliform (FC) Performance Standards Table</b>	
<b>Level of Pretreatment</b>	<b>MPN/100ml</b>
FC-1	≤50,000
FC-2	≤1000
FC-3	≤200
FC-4	≤1

<b>On-lot Sewage System Total Nitrogen (TN) Reduction Performance Standards Table</b>	
<b>Level of Pretreatment</b>	<b>mg/L</b>
TN-1	≥50% reduction or ≤20
TN-2	≤10

**APPENDIX A2:**

**LEVEL OF PRETREATMENT ON SOILS WITH SHALLOW LIMITING ZONES**

<b>Level of Pretreatment Required</b>	<b>Depth to Seasonal High Water</b>	<b>Depth to Rock</b>	<b>Soil Infiltration Loading Rate gal/ft<sup>2</sup>/day</b>
Advanced Secondary Pretreatment with Fecal Coliform to ≤1,000 MPN/100 ml (FC-2)	≥12” and <20”	≥16” and <20”	0.2-1.0
Advanced Secondary Pretreatment with Fecal Coliform to ≤200 MPN/100 ml (FC-3)	≥10” and <12”	≥16”	0.2-1.0
Advanced Secondary Pretreatment with Fecal Coliform to ≤200 MPN/100 ml (FC-3)	≥12” and <20”	≥16” and <20”	>1.0
Advanced Secondary Pretreatment with Fecal Coliform to ≤1 MPN/100 ml (FC-4)	≥10” and <12”	≥16”	>1.0

## **APPENDIX B:**

### **APPLICATION ADMINISTRATIVE REQUIREMENTS**

- 1) Manufacturer's name, mailing address, street address, and phone number.
- 2) Contact individual's name, mailing address, street address, phone number, and email address.
- 3) Statement from the manufacturer that the contact represents the company in this matter.
- 4) Name, including specific brand and model, of the pretreatment product.
- 5) All criteria under 25 Pa Code § 73.72 (c)(1-4), including: product description; engineering basis of the design of the process; process flow drawings and schematics; materials and characteristics; component design specifications; volumes and flow assumptions and calculations; components; dimensional drawings; and photographs.
- 6) Siting and installation requirements.
- 7) Technical and scientific documents referenced in the application, provided in their entirety.
- 8) Detailed description, procedure, and schedule of routine service and system maintenance events.
- 9) All field testing data: influent samples, effluent samples, process control samples, and the like.
- 10) Identification of information subject to confidential trade secrets.
- 11) Copies of product brochures and manuals.
- 12) List of states and/or Canadian provinces where the technology is registered/approved for use.
- 13) Description of any additional requirements outside the standard design imposed by the states and/or Canadian provinces and the reason for them. This includes a description of requirements such as, but not limited to, sizing of components and appurtenances, O&M, siting of system, and distribution requirements.
- 14) Copy of the technology approval and the official technology use documentation for each state/province.
- 15) List of states and/or Canadian provinces where the technology was not approved for use.
- 16) All documentation provided by the state/province stating why it was not approved.
- 17) Final certification report from the certification organization or a statement from a qualified certification organization stating that the technology is unable to be tested.

**APPENDIX C:**

**ACCEPTABLE CERTIFICATIONS**

<b>Certifications</b>				
<b>Certification</b>	<b>CBOD<sub>5</sub></b>	<b>TSS</b>	<b>TN</b>	<b>Fecal Coliform</b>
NSF/ANSI 40 Residential Wastewater Treatment Systems	Yes	Yes	No	No
NSF/ANSI 46 Components and Devices	No	No	No	Yes
NSF/ANSI 245 Nitrogen Reduction	Yes	Yes	Yes	No
NSF/ANSI 350 Onsite Residential and Commercial Water Reuse Treatment Systems	Yes	Yes	Yes	Yes
CAN/BNQ 3680-600 Onsite Residential Wastewater Treatment Technologies	Yes	Yes	Yes	Yes
NSF/ANSI 41 Non-Liquid Saturated Treatment Systems	NA	NA	NA	NA
NSF Protocol P157 Electrical Incinerating Toilets-Health and Sanitation	NA	NA	NA	NA

**APPENDIX D:**  
**STATISTICAL EQUATIONS**

Number of samples = n

$$\text{Sample Mean } \bar{x} = \frac{\sum x}{n}$$

$$\text{Sample Standard Deviation } s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x - \bar{x})^2}$$

$$\text{t-test } t = (\text{Performance Standard} - \bar{x}) * \left(\frac{\sqrt{n}}{s}\right)$$

$$\text{Confidence Interval} = \bar{x} \pm t \left(\frac{s}{\sqrt{n}}\right)$$

## **APPENDIX E:**

### **FIELD TESTING VERIFICATION PROTOCOL**

#### **Section 1. Purpose**

This Appendix E (Appendix E or protocol) is a protocol to be used by applicants seeking approval of alternate on-lot pretreatment units to be used in the Commonwealth of Pennsylvania. Field verification of alternate on-lot pretreatment systems or components is an important and required step in the process for approving alternate sewage systems or components for use in the Commonwealth. This protocol is only for field verification of pretreatment systems or components with rated capacities between 400 and 1,500 gallons/day.

The manufacturer will submit a Test Plan, based on this protocol. The sampling procedure outlined in this Appendix E is for field verification testing. This field testing protocol assumes that for proprietary technologies, third-party certification has been completed, and the DEP's statistical analysis of the certification testing data satisfies the DEP's requirements.

The Test Plan will be reviewed by the DEP, which will either: (1) approve the Test Plan and allow field verification testing to begin; (2) request changes to the Test Plan prior to approval, or (3) deny the request for field verification if the Test Plan does not meet the requirements to move forward.

This Appendix E is designed to clearly describe the data collection requirements to be included in the field verification Test Plan. It is the responsibility of the applicant to complete the requirements in accordance with this Appendix E.

Applicants seeking approval for use as a nitrogen reduction technology should use the Chesapeake Bay Test Plan Application Template<sup>4</sup> instead of this Appendix E.

#### **Section 2. Protocol Description and Objectives**

The Test Plan should include a description of the project, an overview of the testing to be performed, and the test objectives. The Test Plan should consist of four main parts: Project Description, Sampling Plan, O&M, and Assessment.

The Project Description should include an overview of the project, the identification of the model(s) that will be used in the test population, the associated design flow(s), and information for all models for which approval is sought, including engineering diagrams. The manufacturer is to include expected product field performance based on previous data collection, including but not limited to data collected for compliance purposes.

The Sampling Plan should include an identification of critical measurements, data quality objectives, data quality indicator goals, the schedule for completing testing, milestones, and a detailed sampling program.

The O&M should include the installation manual, the owner's manual, the use and maintenance manual, the field logbook, and the troubleshooting and repair manual.

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<sup>4</sup> <https://federalleadership.chesapeakebay.net/file.axd?file=2015%2f4%2fTest+Plan+Application+Template.pdf>

The Assessment should include a quality assurance project plan, audits, and procedure for assessments.

### **Section 3. References**

NSF/ANSI 40 - 2013: Residential Wastewater Treatment Systems.

NSF/ANSI 350 - 2017: Onsite Residential and Commercial Water Reuse Treatment Systems.

NSF/ANSI 360 - 2014: Wastewater Treatment Systems - Field Performance Verification.

EPA ETV: EPA Environmental Technology Verification Program (1) Protocol for the Verification of Residential Wastewater Treatment Technologies for Nutrient Reduction, ETV program, November 2000  
(2) Verification Protocol for Secondary Effluent and Water Reuse Disinfection Applications, ETV program, October 2002.

NQ 3680-600/2009: Onsite Residential Wastewater Treatment Technologies, BNQ.

NQ 3680-910/2000: Wastewater Treatment – Stand-Alone Wastewater Treatment Systems for Isolated Dwellings, BNQ.

NQ 3680-915/2000: Wastewater Treatment – Stand-Alone Wastewater Treatment Systems for Isolated Dwellings – Certification Protocol, BNQ.

### **Section 4. Project Organization**

#### **4.1 Key Project Contacts**

In addition to the manufacturer, who is the entity that develops, designs, and produces on-lot sewage systems or components, there is one other important entity in this process to ensure that the product undergoes third-party testing: the testing organization (Section IV.B). Third-party testing is testing conducted by an independent party under contract to the manufacturer to test a product under an approved Test Plan, with an obligation to report all results. The information contained in Table 1 of this Appendix E and the qualifications of the testing organization must be provided in the Project Description part of the Test Plan. Only one testing organization should be used for all systems or components tested under this protocol. The testing organization will be subject to review and approval as part of the Test Plan application review.

The DEP will conduct its own independent review and verification of the data collected during the field test verification process.

#### **4.2 Location of Installed Units**

Table 2 and Table 3 are to be used by the applicant to submit the locations for the units to be tested during field verification as follows:

- 20 Pennsylvania sites must be submitted by the applicant for review and approval by the DEP.

- 15 sites will be selected, with a minimum of 12 sites to be tested and three sites to remain as reserves. More sampling and reserve sites can be approved if the manufacturer has a reason to test additional sites. Note, for nitrogen reducing technologies, six additional testing sites may be needed in other states to meet the minimum requirement in the Chesapeake Bay Data Sharing Agreement.<sup>5</sup>
- The DEP does not require field test locations until the Test Plan is approved. The applicant should submit field test locations prior to sampling. Field test locations are subject to approval by the DEP. The field test location submittal must include the following information:
  - Site location (street address, town, county, state, GPS coordinates)
  - Occupancy
  - Property owner contact information
  - Any stipulations on access to the pretreatment system or component
  - Copies of all signed homeowner permissions to enter the property should be attached to this plan. This information is required to be submitted after the Test Plan is approved and prior to sampling. Due to the potential complications of finding appropriate locations, the list provided in Table 3 can be reviewed and updated as needed.
- All systems should be representative of domestic-strength sewage and should meet the following requirements:
  - The system is used in a manner consistent with the manufacturer’s guidelines; and
  - The homeowner certifies that they are not being compensated with direct remuneration by the manufacturer for being part of the evaluation. Exceptions to compensation may include a reduced cost for the installation of the system being tested or the offer of an extended warranty or service contract.

## **Section 5. Sampling Plan**

### **5.1 Sampling Points**

Describe the sampling and monitoring points for all measurements, including locations and access points.

### **5.2 Frequency and Number of Samples**

The Sampling Plan should include the frequency of sampling and monitoring events, as well as the number of each sample type and/or location, including quality control (QC) and reserve samples. The sampling strategy and procedures should be included, and evidence should be

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<sup>5</sup> <https://federalleadership.chesapeakebay.net/file.axd?file=2015%2f4%2fTest+Plan+Application+Template.pdf>

presented to demonstrate that the strategy is appropriate for meeting verification objectives. Sampling on an individual unit should not begin until the unit has operated continuously for at least 60 consecutive days or as agreed to between the DEP and the manufacturer.

Sampling should include, at a minimum:

- Effluent samples, except for fecal coliform, will be 24-hour time composite samples using the same sampling method for all sites being tested. The applicant should describe how the composite sample will be collected and how it represents an accurate composite of the 24-hour flow through the system.
- Effluent fecal coliform samples will be grab samples using the same sampling method for all sites being tested. The samples will occur during the 24-hour time composite effluent samples. The applicant should describe how the grab sample will be collected.
- Influent samples will be a grab sample using the same sampling method for all sites being tested. The samples will occur during the 24-hour time composite effluent samples. The applicant must describe how the grab sample will be collected.
- Samples will be collected a minimum of once every 60 days for 12 consecutive months at each field site. The applicant has a maximum of 24 months from the Test Plan approval date to complete the testing program and submit all required deliverables.
- The samples should be taken on days that are representative of the variation in temperature and precipitation (i.e., rain) at the field test site.

### 5.3 Data Measurements

- All measurements shall be identified for each sample type, and test-specific target analytes should be listed in the Sampling Plan.
- Measurements to be conducted on influent samples include BOD<sub>5</sub>, pH, and alkalinity.
- Measurements to be conducted on effluent samples include CBOD<sub>5</sub>, TSS, DO, pH, and alkalinity. Additionally, fecal coliform measurements shall also be conducted when the applicant is requesting approval under the fecal coliform standard. Effluent temperature and ambient air temperature must also be recorded.
- Additionally, an estimate of influent flow should be included based on the site's water bill. If no water bill is available, the pump event counter or telemetry system can be used to estimate the flow. If no counter is available through the system, an assumed occupancy flow estimate of 45 gallons/person/day should be used.
- Effluent flows should be estimated based upon the rated flow rate of the effluent pump and the operational period of the effluent pump.

- The samples collected should be analyzed as shown in Table 4 and Table 5. The testing organization shall certify in its report that samples were taken by a qualified person and that sampling standards, methods, and preservation deadlines were all met.

#### 5.4 Data Evaluation

A statistical analysis of the data for each parameter should be provided and include at a minimum:

- Median;
- Mean;
- Standard Deviation; and
- Confidence Interval.

The effluent data will be evaluated based on the requested performance standard for system approval. If the system is determined not to be performing as expected, the DEP may request additional testing or disapprove the technology.

A confidence interval is a basic statistical concept that provides information about the range in which the “true mean” lies for a specified confidence level. The most commonly used confidence levels are 90%, 95%, and 99%. In general, the more confident you want to be that the “true mean” lies within the range you select, the wider the range becomes. *See Section 5.16: Calculating Confidence Intervals.*

Further, the testing organization should inform the DEP when tests cannot be completed. For example, the testing organization should inform the DEP if the OAT is not producing effluent at the time of sampling.

#### 5.5 Safety and Hygiene Plans

The Sampling Plan should include or reference safety and hygiene plans for the relevant testing organization and laboratory.

#### 5.6 Site Evaluation and Factors

Site evaluation includes general site description, such as access to the system, access to outlet, power availability, security, site drawings and photos, and installation instructions and details. The Sampling Plan should identify known site-specific factors that may affect sampling or monitoring procedures.

#### 5.7 Site Preparation

Any site preparation needed prior to sampling or monitoring should be described in the Sampling Plan.

## 5.8 Sampling Procedure

Each sampling and monitoring procedure to be used should be discussed or referenced in the Sampling Plan. Any components added to the system to facilitate sampling that would not otherwise be a part of the system installation should be identified in the Sampling Plan.

## 5.9 Representative Samples

The Sampling Plan should include a discussion of the procedures to be used to assure that representative samples are collected.

## 5.10 Sample Volumes

A list of sample volumes to be collected and the amount of sample required for each analysis, including QC sample analysis, should be specified in the Sampling Plan. Information on sample volumes should be provided in a table.

## 5.11 Split Samples

For samples requiring a split sample for either Quality Assurance (QA) or QC purposes or for shipment to a different laboratory, the Sampling Plan should identify who is responsible for splitting samples and where the splitting is performed.

## 5.12 Sample Containers and Preservation Methods

Sample containers and preservation methods (such as refrigeration, acidification, and the like), including specific reagents, equipment, and supplies required for sample preservation, should be described in the Test Plan. Information on sample preservation should be provided in a table.

## 5.13 Hold Time Requirements

Hold time requirements should be specified in the Sampling Plan and provided in a table.

## 5.14 Sample Transportation

Procedures for transporting samples should be described in the Sampling Plan.

## 5.15 Sample Archiving

Sample archiving requirements, or sample retention policies, for the organizations conducting the sampling and analysis should be provided in the Sampling Plan.

## 5.16 Calculating Confidence Intervals

In analyzing data, it is first essential to recognize that the data collected represents only a “sample” of the actual range of effluent quality produced by a system over time. Therefore, a mean value – or other statistical values – calculated from sample data (including CBOD<sub>5</sub>, TSS, fecal coliform, and other parameters) may not accurately represent the “true mean.” Instead, the sample mean represents an estimate of the “true mean” that one would find if the system were

monitored continuously. As you take more samples, the closer you will be to finding the “true mean” that the system produces over the range of actual operating conditions experienced in the field. The confidence level indicates how sure one can be that the estimated mean (calculated from the sample data collected) is near the “true mean.”

The above concept is translated into statistics by calculating a confidence interval at a desired level of certainty by assuming the population being sampled is normally distributed around the mean. In the case of a mean CBOD<sub>5</sub> or TSS value, and many of the other parameters analyzed for on-site sewage systems or components, this is often a tenable assumption. However, for some parameters analyzed for on-site sewage systems or components – most notably bacterial parameters like total coliform or fecal coliform – the data are often not normally distributed. For data that are not normally distributed, calculating confidence intervals based on normal distributions requires mathematically transforming the data into a form that is normally distributed. For bacterial data, the transformation that often proves most effective is the natural logarithmic transformation. Once transformed, confidence intervals based on normal distributions can be calculated, and these confidence intervals can then be mathematically transformed back into the original scale of the data.

In this protocol, the DEP is considering a one-sided confidence interval because the purpose is to evaluate compliance with upper limits. The tail area probability chart can be found in any standard statistical text. The formula for the upper confidence limit is:

$$Upper\ CI = \bar{x} + (t_{0.10}) \left( \frac{s}{\sqrt{n}} \right)$$

Where:

Upper CI = Upper limit of the confidence interval

$\bar{x}$  = Sample Mean

$t_{0.10}$  = t-value at 90% confidence interval. A value based on the number of samples and degree of certainty desired and obtained from any statistical reference text.

s = standard deviation of sample calculated

n = number of samples

### 5.17 Sample Analysis

All samples shall be analyzed by a laboratory accredited under the DEP Laboratory Accreditation Program or the National Environmental Laboratory Accreditation Program (NELAP).

## Section 6. System Operation and Maintenance

The Test Plan should address the system O&M program and shall include: the installation manual, the owner’s manual, the use and maintenance manual, the field logbook, and the troubleshooting and repair manual.

## 6.1 System Installation

The installation manual shall include at a minimum: identification number, photos, and diagram of all the components; specification for design, construction and materials for each component; electrical diagram; instructions for delivery and unpacking operations, safety instructions, identification of fragile components and steps to prevent damages; synoptic diagram of each component and all functions of the systems after assembled and connected; other requirements such as plumbing, electricity, ventilation, protection of air intake, burying of system, protection against hydrostatic displacement, waterproofing, slope and various fittings and accessories; energy source and amount of energy; sequential procedure for components; instructions for replacement or repair in case of defects; and other procedures.

## 6.2 System Operation

Each unit will be operated under residential use and serving a residence occupied by at least two people for the duration of the study. Intermittent periods of time with a lower to no occupancy will not be considered as disqualifying but should be recorded in the field logbook and reported in the final report.

All data collected shall be reported shall be used to establish the field performance results. Changes in occupancy or the manner of use, which occur over the period of field evaluation, shall be noted.

The owner's manual should include: model description and identification number; hydraulic capacity in gallons per day; level or levels (or classes) to which the system applies based on the DEP performance standard requirements; description of the system operation, flow-path, and electrical diagram; instruction for starting and operating the system; user and manufacturer responsibilities; list of the household products not allowed in the system; list of reagents, chemical composition, microbiological properties, and concentration level; warranty and limitations; requirements of period removal of system residue; list of actions when the system is intermittently used or not used for an extended period of time; explanation of methods and criteria for detecting problems and malfunctions with the components of the system; description of warning signs in case of problems; and service provider's name and contacts in case of problems.

## 6.3 System Maintenance

All units should be operated under a valid maintenance agreement or contract, and in accordance with the system O&M manual. The maintenance agreement or contract should extend through the period covering the final sample collection. System inspections shall be conducted according to both the applicant specifications and the DEP requirements. At a minimum, inspections by the testing organization will occur during each sampling day. No maintenance will be performed on the unit outside of routine maintenance, as specified in the system O&M manual. Any maintenance conducted on the unit cannot be done on the same day as sampling. The system maintenance service provider shall be independent of the testing organization.

The O&M manual should include a component-specific maintenance program; method for removing and eliminating solid residue; procedure for visual inspection; description of visual and

olfactory techniques for evaluating effluent and mixed liquid; method for collecting samples; and quality of effluent produced accounting to the DEP.

#### 6.4 Field Logbook

A log should be kept detailing any observations during the field testing, including information on site conditions or factors specified in Section 5.6 of this Appendix E. All maintenance performed on the unit will be recorded in the field logbook and submitted along with the other deliverables (see Section 9.2 of this Appendix E).

Additionally, any changes in operation or disruptions to sampling should be described in the logbook. Notes should be made in the field logbook to record any site conditions that could impact operation of the system or collection of samples, such as the number of residents in the home, changes in resident conditions that could impact system operation (such as medications), mechanical or electrical problems with the system, and the like.

#### 6.5 Troubleshooting and Repair

The troubleshooting and repair manual should include: description of the technique for visual evaluation of the system allowing identification of the problem; sequential method for identifying failure of components; and step-by-step procedure for repair and replacement.

### **Section 7. Analytical Procedures**

Sample analysis will be conducted using an appropriate EPA method (40 CFR Part 136) or a method in *Standard Methods for the Examination of Water and Wastewater*.<sup>6</sup>

#### 7.1 Measurement Methods

Each measurement method to be used should be described in detail or referenced in the Sampling Plan. Where appropriate, modifications to EPA-approved or similarly validated methods should be specified. Methods should be appropriate to the matrix and analyte being tested. Details on the sample methods, and accuracy and precision criteria for the analytical methods, should be provided.

#### 7.2 Calibration Procedures

For measurements requiring a calibrated system, the Sampling Plan should include specific calibration procedures applicable to each analyte, and the procedures for verifying both initial and continuing calibrations (including frequency and acceptance criteria, and corrective actions to be performed if acceptance criteria are not met).

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<sup>6</sup> [www.standardmethods.org](http://www.standardmethods.org)

## Section 8. Quality Assurance Project Plan (QAPP)

The applicant is responsible for submitting a QAPP that follows the guidelines in NSF/ANSI 360 *Section 6: Quality Assurance/Quality Control*. The QAPP should be attached to the Test Plan and address the following points:

- Procedures to maintain chain-of-custody (such as custody seals and records, for example) during sample transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors. The procedures to maintain chain-of-custody should be described in the QAPP to ensure that sample integrity is maintained.
- The QAPP should include quantitative acceptance criteria for QA objectives associated with accuracy, precision, detection limits, and completeness for critical measurements (process, physical, and analytical, as applicable) for each matrix.
- Any additional test-specific QA objectives should be included in the QAPP, including acceptance criteria. This includes items such as mass balance requirements.
- The specific procedures used to assess all identified QA objectives shall be fully described in the QAPP.
- The QAPP should list and define all other QC checks and procedures (including blanks, surrogates, controls, and other QC checks and procedures) used for the verification testing, both field and laboratory.
- For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met, should be included in the QAPP.
- The QAPP should describe how the sampling equipment is calibrated and the frequency of calibration.
- The QAPP should describe how cross-contamination between samples is avoided.
- All QA Managers and their relationship within the organizations (in other words, their location within each organization) should be identified in the QAPP with evidence that the QA Manager is independent of project management.
- Responsibilities of all other project participants should be identified in the QAPP, meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (specifically, chemical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified in the QAPP.
- Any change in sampling procedure from the approved plan should be approved in advance by the DEP.
- All components being sampled should be designed, installed, and configured as approved in the NSF/ANSI certification.

- The applicant should provide a list of the aggregate(s) used in the installation of the system or component that have been verified or tested. This list should include information on whether the aggregate(s) comply, or fail to comply, with the appropriate verifications and tests.

## **Section 9. Data Reporting and Data Reduction**

### 9.1 Data Reporting

The reporting requirements (for example, units and method) for each measurement and matrix should be identified in the Test Plan.

### 9.2 Expected Deliverables

The deliverables expected from each organization responsible for field and laboratory activities should be listed in the Test Plan. The data should be provided in Microsoft Excel format. Data may also be submitted using the template in Table 6 of this Appendix E.

### 9.3 Documents

The Test Plan should include the following documents at a minimum:

- Project Description
- Table 3 of this Appendix E (Location of Installed On-lot Sewage Systems or Components Template), including: description of site selection; specifications for the tested system; description of typical installation; and geographic location of systems or components tested
- List of key participants
- Sampling Plan (complete description of sampling and analytical methods)
- All testing results including all sample data and any statistical analyses or other data summaries or evaluations
- Rationale for exclusion of data or removal of a system from statistical analysis
- Field Logbook
- Table 6 of this Appendix E (Database Submission Template)
- Table 7 of this Appendix E (Verification Statement Template)
- O&M manuals (see Section 6 of this Appendix E)
- QAPP
- Final Report (a summary of the Test Plan)

## **Section 10. Assessments**

### 10.1 Audits

The Test Plan should identify all audits (specifically, both internal systems or components audits and internal performance audits, where applicable) to be performed, who will perform these audits, and who will receive the audit reports. Additional supervised inspections may be conducted.

### 10.2 Procedures for Corrective Actions

The Test Plan should provide procedures to be followed to ensure that necessary corrective actions will be performed in response to audit findings. The responsible party/parties for implementing corrective actions should be identified.

## **Section 11. Complementary Documents**

References should be provided in the Test Plan either in the body of the text as footnotes or in a separate section. The DEP may request a copy of the references.

## **Section 12. Changes to Systems or Components Already Classified as a Conventional or Alternate On-lot Sewage System or Component**

If the design specifications for an approved model are altered, the DEP may require the altered component or system to complete the on-lot sewage pretreatment system approval process, including the field verification; the approval process may be adjusted at the discretion of the DEP depending upon the extent of the design changes.

If the manufacturer wishes to add new models of the on-lot sewage systems or components that are already classified, then a request for approval should be submitted to the DEP. The applicant should include the following:

- A copy of the classification of the original system or component.
- Each model presented by the manufacturer for which the applicant is seeking classification. Each model must include the manufacturer's trademark and its specific number, the type of technology and the hydraulic capacity (a model of the on-lot sewage systems or components may have different hydraulic capacities).
- A complete description of the new design and technical specifications, including detailed plans and components list, all the testing, assessment and certification of the systems or components.
- The reasons for the request to add a new model.

If the changes that affect the system or components are considered crucial to the performance of the system or component, the DEP will request the applicant to proceed with a new application for the full approval process.

When it has been established that the new model or altered component or system meets the provisions of this guidance, the DEP may amend the original classification.

**Table 1: Project Contacts**

<b>Testing Organization</b>	Name:
Contact Person	Phone Number: Address:  Email Address:
<b>Applicant</b>	Name:
Contact Person	Phone Number: Address:  Email Address:

**Table 2: Field Verification Test Plan**

**System Name:** \_\_\_\_\_

**System Model(s):** \_\_\_\_\_

**System Model(s) Number:** \_\_\_\_\_

_____	_____
<b>Testing Organization – Representative Name</b>	<b>Title</b>
_____	_____
<b>Testing Organization Representative – Signature</b>	<b>Date</b>
_____	_____
<b>Applicant – Representative Name</b>	<b>Title</b>
_____	_____
<b>Applicant – Signature</b>	<b>Date</b>

**Table 3: Location of Installed On-lot Sewage Systems or Components Template<sup>7</sup>**

Site ID	Street Address	Town/County	State	Occupancy	Intended Use	Contact Name	Contact Phone	Stipulations on Access
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								
16.								
17.								
18.								
19.								
20.								

<sup>7</sup> Twenty sites must be submitted by the applicant for review and approval. Fifteen sites will be selected, with a minimum of 12 units to be tested and three sites to remain as reserves. If the applicant would like to test more than 12 units, then additional sites should be proposed for selection as sampling and reserve sites.

**Table 4: Influent Parameter Analysis**

<b>Influent Parameter</b>	<b>Sample Type</b>	<b>Testing Location</b>
BOD <sub>5</sub>	Grab	Laboratory
pH	Grab	Test site
Alkalinity (mg/L as CaCO <sub>3</sub> )	Grab	Laboratory

**Table 5: Effluent Parameter Analysis**

<b>Effluent Parameter</b>	<b>Sample Type</b>	<b>Testing Location</b>
CBOD <sub>5</sub> (mg/L)	24-h composite	Laboratory
Total suspended solids (mg/L)	24-h composite	Laboratory
Dissolved Oxygen (mg/L)	Grab	Test site
pH	Grab	Test site
Alkalinity (mg/L as CaCO <sub>3</sub> )	24-h composite	Laboratory
Fecal Coliform (MPN/100 ml)	Grab	Laboratory
Temperature, sewage (°F)	Grab	Test site
Temperature, ambient air (°F)	Grab	Test site

**Table 6: Database Submission Template**

**A. Model Information**

<b>Model Name</b>		<b>Model Number</b>	
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**B. Manufacturer Information**

<b>Name</b>	
<b>Address</b>	
<b>Phone</b>	
<b>Email</b>	

**C. Local Distributor Information**

<b>Name</b>	
<b>Address</b>	
<b>Contact</b>	
<b>Phone</b>	
<b>Email</b>	

**D. Existing Certifications** Please check all that apply.

- Third-Party Certification: \_\_\_\_\_
- NSF/ANSI 40 Certification
- NSF/ANSI 350 Certification
- EPA ETV Certification
- Canadian BNQ Certification
- Other: \_\_\_\_\_

**WATER QUALITY DATA**

<b>Model Name</b>		
<b>Manufacturer Name</b>		
<b>Sample Location</b>	<b>Sample Date</b>	<b>Sample Parameter</b>

**Table 7: Verification Statement Template**

As a recognized third-party testing organization, I certify that the data submitted herein accurately represents the system.

**Testing Organization** \_\_\_\_\_

**Name** \_\_\_\_\_

**Signature** \_\_\_\_\_

**Date** \_\_\_\_\_