

**PENNSYLVANIA 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:** July 29, 2023

**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 methods and minimum levels of pretreatment for demonstrating the performance of on-lot alternate technology systems or components. The scientific methods and minimum levels of pretreatment in this guidance can provide the basis for DEP's evaluation of 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 proposed alternate on-lot pretreatment technologies.

**APPLICABILITY:** This policy applies to persons and manufacturers seeking approval of new 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).

*Advanced secondary on-lot sewage pretreatment* – The use of physical, biological, and chemical operations and processes designed to achieve a five-day carbonaceous biochemical oxygen demand of 10 milligrams per liter (mg/L) or less and total suspended solids of 10 mg/L or less..

*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 5-day measure of the pollutant parameter biochemical oxygen demand.

*CBOD<sub>5</sub>* – Five-day carbonaceous biochemical oxygen demand in mg/L – The 5-day measure of the pollutant parameter carbonaceous biochemical oxygen demand.

*Composite sample* – Two or more samples or subsamples collected from the same point at different times, mixed 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.

*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 for reuse; often, this treatment is designed to meet primary, secondary, advanced secondary, and/or fecal coliform and total nitrogen performance standards.

*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.

*TSS* – Total suspended solids in mg/L – The weight of solids remaining after a well-mixed sample is filtered through a standard glass filter and the suspended portion is dried to a constant weight at 103-105 degrees Celsius.

B. Acronyms

ANSI – American National Standards Institute

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

TGD – Technical Guidance Document

## II. INTRODUCTION

### A. Regulatory Authority

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 (official 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.

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. 25 Pa. Code § 73.72 was developed primarily to address malfunctioning on-lot sewage systems or components on lots that have specific site suitability deficiencies or engineering problems and to address existing lots created prior to the Sewage Facilities Act being enacted.

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 for an on-lot alternate technology (OAT). The DEP may delegate the review of classified OATs to local agency SEOs that have completed approved training for the specific OAT or have successfully been trained by DEP staff on the specific OAT.

Though 25 Pa. Code § 73.72 is intended for site-specific classification of OATs, the regulations do not prohibit the DEP from generally classifying an OAT. By following the required criteria in § 73.72 and established scientific methods, the DEP can develop a general classification for an alternate sewage system or component that will meet the requirements in the regulations and the Sewage Facilities Act. This is accomplished by ensuring that the technology protects public health, safety, and the waters of the Commonwealth, which can be demonstrated by completing the process described in this guidance document.

### B. Approval Process

This guidance outlines the process that manufacturer(s) should follow for the pretreatment system or component to be classified for use in Pennsylvania as an alternate system or component. Upon conditional approval, the classification criteria will be made available to the SEOs through a technical guidance document (TGD) for each generally classified OAT. The successful completion of the on-lot technology performance verification process outlined in this guidance document will ensure the technology performs at a level that will protect public health, safety, and the waters of the Commonwealth, when appropriately installed, operated, and maintained.

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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. ...”)

This guidance includes three elements: (1) NSF/ANSI certification, or other DEP-accepted certification of the technology by an approved certification organization, (2) in situ third-party field testing, and (3) ongoing performance monitoring or performance audits.

1. Certification by an approved organization provides the basis for establishing that a proprietary system or component can meet the minimum levels of pretreatment under a controlled setting. Certified systems or components bearing the certification organization mark verifies the technology meets the American National Standards Institute (ANSI) standard for testing and certification, including ongoing inspection of the manufacturing process by the certification agency. This “mark” provides assurance that the system or component being installed is the technology that was certified and generally classified. An additional statistical analysis of the certification organization data by the DEP will be completed to verify the technology meets the minimum level of pretreatment selected by the manufacturer.
2. In situ third-party field testing provides evidence that the technology can successfully meet the minimum level of pretreatment under variable field conditions and sewage loading. This is necessary because the certification testing is conducted in a controlled setting, whereas field testing shows how the system or component reacts under typical use. The field test data helps establish the level of operation and maintenance (O&M) required to ensure the system or component functions in a manner that achieves the desired minimum level of pretreatment.

Once it is established that a technology is capable of meeting the minimum level of pretreatment through both the statistical analysis and in situ evaluation, the manufacturer will choose which protocol they will follow to verify performance – either ongoing performance monitoring or a performance audit. Once that choice is made, the DEP, in consultation with the manufacturer, will complete the final step in the approval process – development of, and public review and comment on, the draft OAT TGD. After successful completion of the final step in the approval process, the technology is generally classified, and it is approved for use as an OAT in Pennsylvania.

3. After general classification of the OAT, the manufacturer will verify ongoing performance of their OAT based on the protocol chosen – ongoing performance monitoring or a performance audit. Only the data collected during the performance audit may be used to justify the termination of the performance audit protocol.

### III. SCOPE

This policy provides guidance for how to test and verify the performance of on-lot alternate sewage system and component technologies for manufacturers seeking general classification as an OAT. 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 on-lot sewage systems or components, and a delay in making proven alternate systems or components available for general use.

This policy extends to all commercially ready, proprietary, and non-proprietary systems and components that are reproducible from one location to another, and for which the manufacturer requests to be classified as an OAT. This includes systems or components applicable to individual and community on-lot systems or components designed to treat sewage from residential, commercial, or institutional establishments as listed in 25 Pa. Code § 73.17 (relating to sewage flows) but excluding industrial waste.

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 – An organization that oversees the development of voluntary consensus standards and conformity assessment systems for products and systems. The certification organization should be accredited by either ANSI, the Standards Council of Canada (SCC), or other international organization approved by the DEP as an independent third-party organization and should demonstrate to the satisfaction of the DEP that the organization can adequately verify the performance of the technology pursuant to this guidance document. Examples of acceptable ANSI certification organizations can be found at [www.ansi.org/Accreditation/product-certification/Directory](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 independent third-party entity that implements the technology-specific field test plan and/or performance audit, including documentation of testing conditions and procedures, sample collection, and data reporting to the DEP. An independent third-party, is a person or body that is independent of the person or organization that sells the on-lot sewage pretreatment component or system, independent of the technology manufacturer, and independent of the consumer of the on-lot sewage pretreatment component or system. 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 and performance audit review.
- C. Service Provider – An individual, company, or other entity who is trained to provide operation of, and maintenance to, a specific component, components, or a system.
- D. The DEP – The Pennsylvania state agency responsible for, among other duties, implementing the provisions of the Sewage Facilities Act and this policy. The DEP develops and maintains the on-lot sewage pretreatment technology minimum levels of

pretreatment, technology verification application process, and review methodology. The DEP reviews technology verification applications to verify on-lot sewage technology performance and approves or disapproves the general classification of on-lot technologies as alternate technologies for use in Pennsylvania.

## V. TECHNOLOGY APPROVAL PROCESS

The technology approval process consists of three steps: (1) administrative review; (2) technical review; and (3) OAT TGD development and conditional approval. This process is designed to: confirm that the submitted information is acceptable and adequate for evaluation; validate the test results; demonstrate attainment of the minimum level of pretreatment for the general classification desired; and incorporate the technology into a comprehensive OAT TGD.

### A. Step One – Administrative Review of Application

1. The DEP will review the information provided by the manufacturer to verify all the requested documents were submitted to determine if the application is administratively complete. For a list of administrative completeness see *Appendix B: Documentation for the Review of the TVP Application*.
  - a. 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. Applications should include all necessary information to confirm that the technology performs at the pretreatment level specified in the application.
  - b. All proprietary technologies should have the most recent third-party certification reports included with the application. The certification should be valid throughout the TVP process. See *Appendix C: Relevant Certifications*.
  - c. Non-proprietary pretreatment systems or components do not need a third-party certification. These technologies will be technically and scientifically evaluated by the DEP to ensure conformance with minimum levels of pretreatment and engineering principles.
  - d. 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.

### B. Step Two – Technical Review of the Application

1. Analysis of Third-Party Certification Organization Data – The DEP will perform a statistical analysis of the data provided by the certification organization to verify

the technology meets the minimum level of pretreatment listed in *Appendix A1: On-lot Sewage Pretreatment Levels*.

- a. Additional third-party testing may be necessary to establish a technology's performance if the original testing was not conducted in a climate similar to or colder than Pennsylvania.
- b. Evidence of equal effluent distribution should be included for components that provide distribution of effluent to an absorption area.
- c. For non-proprietary technologies, the DEP will develop an appropriate protocol for the verification of the technology. The DEP may use elements of this guidance document to help develop the protocol.
- d. For proprietary technologies with certification data, the DEP will statistically evaluate the data to determine if the technologies meet the minimum level of pretreatment requested.
  - i. The sample data will be statistically evaluated to determine the mean and standard deviation. See *Appendix D: Statistical Equations*.
  - ii. Using the sum of the sample mean plus one standard deviation, the DEP will determine whether the data supports the conclusion that the technology meets the applicable minimum level of pretreatment.
  - iii. For applications that request fecal coliform pretreatment 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 minimum level of pretreatment. The technology is not required to have third-party certification data for fecal coliform to request fecal coliform approval. Data collected through field testing will provide the basis for approval if no certification data is available.
- e. If the statistical analysis does not verify that the technology meets the applicable minimum level of pretreatment, the DEP may disapprove classification of the technology. The manufacturer may choose to proceed with the TVP process, but the DEP reserves the right to request test locations and/or samples in addition to the TVP requirements in *Appendix E (Field Testing Verification Protocol)*. If disapproved, the applicant may retest the technology with a certification organization and restart the application process after retesting is complete.
- f. If the statistical analysis verifies the technology meets the applicable minimum level of pretreatment, the technical review will proceed to Verification and Analysis of Third-Party Field Test Data.



- g. The same third-party certification should be maintained throughout the TVP application process and after general classification of the OAT.
- 2. Verification and Analysis of Third-Party Field Test Data – The DEP will perform a statistical analysis of the data provided by the testing organization to verify the technology meets the minimum level of pretreatment listed in *Appendix A1: On-lot Sewage Pretreatment Levels*. This subsection outlines the process used for the statistical analysis of the field test data to verify the technology’s performance in the field.
  - a. The DEP will verify the field testing data using the methodology presented in *Appendix E: Field Testing Verification Protocol*. Any existing performance verification data, and supporting documentation, from field testing that the technology manufacturer wishes to be considered to supplement the data collected during field testing should be submitted along with the verification application in an electronic format acceptable to the DEP.
  - b. The DEP will determine if data collected during previously completed field testing is acceptable on a case-by-case basis. All test data (e.g., influent, effluent, and process control samples) collected for evaluation of a technology should be provided to the DEP regardless of whether the sample results meet the DEP’s minimum requirements.
    - i. Field testing sites should 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 testing location is climatologically comparable to Pennsylvania is to compare the numerical zone designation of the proposed field test site to those assigned to Pennsylvania in the Plant Hardiness Zone Map produced by the United States Department of Agriculture; however, use of other climatological data comparison methods may be acceptable.
    - ii. Field testing should have been completed by a DEP-approved testing organization following, at a minimum, the protocols stated in *Appendix E: Field Testing Verification Protocol*.
    - iii. Field testing should have occurred over 12 or more consecutive months.
    - iv. At least half of the data to be evaluated in this step should have been collected between November and March.
  - c. All the DEP-acceptable field test data will be statistically evaluated to determine whether at least a 90% confidence interval for the sample data meets the minimum level of pretreatment for each parameter for which approval is being requested.

- d. If a 90% confidence interval for the accepted field test data does not meet the applicable minimum level of pretreatment for one or more parameters, field testing verification may continue with prior approval by the DEP. Otherwise, the DEP may disapprove classification of the technology for use in Pennsylvania.
- e. If a 90% confidence interval for the accepted field test data does meet the applicable minimum level of pretreatment for all parameters, the DEP will proceed to Step Three in the approval process; this final step in the technology approval process is outlined immediately below.

C. Step Three – OAT TGD Development and Conditional Approval

- 1. Design considerations described in the TGD will provide the OAT's design basis.
  - 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 instructions will provide the basis for a designer to be able to site and for a contractor to successfully install the OAT.
- 3. O&M guidelines will be reviewed by the DEP to ensure that the OATs will provide long-term sewage disposal.
- 4. The manufacturer should provide, as part of the conditional approval, an SEO training course that is consistent with the approved OAT TGD that teaches the local agency SEO how to review the siting, design, construction, operation, and maintenance requirements of the OAT. The course will be approved by the DEP for SEO continuing education credits.
- 5. The DEP, in consultation with the manufacturer, will then develop the OAT TGD. The OAT TGD will include a minimum of the following:
  - a. Rated minimum level of pretreatment for the technology, if applicable
  - b. The name of the manufacturer of the proprietary technology
  - c. Type of technology; secondary, advanced secondary, nitrogen reduction, disinfection, or combined pretreatment and distribution
  - d. Planning requirements, if applicable

- e. Permitting requirements
  - f. Design considerations
  - g. Siting and installation instructions
  - h. O&M guidelines
  - i. Inspection frequency
  - j. Ongoing performance monitoring testing protocols or performance audit
6. The manufacturer will choose the type of ongoing performance monitoring protocol or performance audit they wish to use for their technology. This choice will be noted along with the monitoring requirements in the OAT TGD.
  7. The DEP will publish a notice of the availability of the OAT TGD and the DEP's basis for making the decision to approve the technology in the *Pennsylvania Bulletin* for a 30-day comment period.
  8. After reviewing and addressing public comments, the DEP may issue a conditional approval letter to the applicant for the OAT. The DEP will then upload the OAT TGD and public comment and response document to the DEP's OAT TGD webpages and publish notice of the final OAT TGD and comment and response document in the *Pennsylvania Bulletin*.

## **VI. PERFORMANCE MONITORING PROTOCOLS**

- A. Ongoing Performance Monitoring Protocol – Manufacturers who choose to not participate in the performance audit should monitor all installed OATs annually to verify the OATs are meeting the minimum level of pretreatment under which the OAT was generally classified. Ongoing performance monitoring activities will be described in the OAT TGD and will include sampling of the effluent by a service provider based on the parameters under which the technology was generally classified. For example, if the technology is generally classified as an advanced secondary treatment system or component and for fecal coliform reduction and nitrogen reduction, the effluent for each OAT system installed should be sampled for pH, dissolved oxygen, water temperature, ambient air temperature, alkalinity, nitrate (as N), nitrite (as N), total Kjeldahl nitrogen (as N), ammonia (as N), CBOD<sub>5</sub>, TSS, and fecal coliform.
- B. Performance Audit Protocol – The performance audit protocol is a voluntary process for manufacturers who do not wish to complete the ongoing performance monitoring protocol. The performance audit protocol verifies ongoing field performance of an OAT, while collecting performance data that the DEP can use to determine if the alternate technology meets the minimum level of pretreatment under which the technology was generally classified. The process for the performance audit protocol is as follows.

1. General

- a. The manufacturer should provide the DEP with a list of all the installed OAT components and systems in Pennsylvania after the conditional approval; this list should also include the Pennsylvania field testing sites. This list should be updated at least every six (6) months except when otherwise requested by the DEP. The list should include, at a minimum:
  - i. Physical address of the property
  - ii. Date of installation
  - iii. Permit number of for original installation
  - iv. Summary of any repairs or modifications to each component or system requiring a permit and the permit numbers associated with each
  - v. Property use – residential, commercial, or institutional
    - 1) If residential, seasonal or year-round occupancy and number of residents
    - 2) If commercial or institutional, type of establishment and number of employees
  - vi. Geographic coordinates of the system or components and of the soil absorption area.
- b. 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 prior to testing. Such agreements are necessary for a third-party testing organization to enter the property as part of the performance audit.
- c. Installation sites should be operated under a valid maintenance agreement or contract. All maintenance on the component, components, and/or the system should be documented and provided to the DEP when submitting the performance audit report.
- d. The manufacturer should provide the DEP with the manufacturer's choice for the independent third-party testing organization who will complete the performance audit. The DEP will review the qualifications of the testing organization to verify the testing organization's independence and 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 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. The DEP may request additional sites to be tested when performance of the installed systems or components are not meeting the requirements in the OAT TGD. 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.

- 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 be randomly selected and 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 be randomly selected and 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 be randomly selected and included in the performance audit.
- b. The DEP will contact the approved testing organization, provide the testing organization with the site locations selected, 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 in advance 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 installed on-lot sewage systems or components 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, systems or components selected should serve buildings or residences occupied by at least two (2) people and should be producing effluent at the time of the sampling. Non-residential on-lot sewage systems or components may be included in the audit with prior approval from the DEP.

### 3. Sampling plan elements

- a. The DEP will provide the testing organization with the inspection elements and sampling parameters to be used during sampling. Samples are analyzed by a laboratory accredited by the DEP's Laboratory Accreditation Program or the National Environmental Laboratory Accreditation Program (NELAP). The performance audit sampling form and a copy of the results from a DEP-certified lab or NELAP-certified lab should be provided to the DEP and the manufacturer.
- b. The testing organization should provide the DEP with the performance audit sampling plan for approval before 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 which states, "[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 sampling, the testing organization should first ensure that the OAT system or component is producing effluent. If the system or component is not producing effluent, the testing organization should make note and inform the DEP and the manufacturer that the system or component was not producing effluent. If the component 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 O&M manual for the system or component, maintenance should not be performed on the system or component during the ten days prior to sampling. Any routine maintenance conducted on the unit should not be done on the same day as sampling. Maintenance of the system or component after sampling is allowed and should be noted.

4. Action level

- a. Effluent sample results from each location inspected should be less than or equal to two times the minimum level of pretreatment as set forth in the OAT TGD. Results in excess of that amount may be considered action levels. For example, the action levels for advanced secondary treatment TSS and CBOD<sub>5</sub> would both be 20 mg/L (i.e., two times 10 mg/L).
- b. If during the 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 component of the OAT, or backing up into a structure, the testing organization should immediately 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.B.3 of this guidance document.
- 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.B.2.a of this guidance document.
- 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 should be provided to the DEP and the municipality within thirty (30) days of the completion of the audit report. At a minimum, the performance audit report should include for each audited site:
  - i. Current property owner name

- ii. OAT identification number and 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 – to determine the new 90% confidence interval upper limits for each parameter. This is calculated using the original data from the verification of field testing analyzed 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 minimum level of pretreatment under which the technology was generally classified. 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 level due to the inability of the technology to meet the currently approved minimum level of pretreatment, or
6. be declassified as an approved OAT due to the inability of the technology to meet the currently approved minimum level of pretreatment or any less stringent levels of pretreatment.

## VII. MINIMUM LEVELS OF PRETREATMENT ON SOILS WITH SHALLOW LIMITING ZONES

- A. The minimum level of pretreatment in *Appendix A1: On-lot Sewage Pretreatment Levels* are based on two factors: depth to limiting zone and soil infiltration loading rates, as described by Tyler et al. (2000).<sup>2</sup>
- B. *Appendix A2: Minimum Level of Pretreatment on Soils with Shallow Limiting Zones* provides clarification on the pretreatment levels for 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 should meet Advanced Secondary Level of Pretreatment for CBOD<sub>5</sub> and TSS, and the FC-2 Fecal Coliform Level of Pretreatment.
    - b. with a soil infiltration loading rate  $> 1.0$  gal/ft<sup>2</sup>/day, the technology should meet Advanced Secondary Level of Pretreatment for CBOD<sub>5</sub> and TSS, and the FC-3 Fecal Coliform Level of Pretreatment.
  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 should meet the Advanced Secondary Level of Pretreatment for CBOD<sub>5</sub> and TSS, and the FC-3 Fecal Coliform Level of Pretreatment.
    - b. with a soil infiltration loading rate  $> 1.0$  gal/ft<sup>2</sup>/day the technology should meet the Advanced Secondary Level of Pretreatment for CBOD<sub>5</sub> and TSS, and the FC-4 Fecal Coliform Level of Pretreatment.

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<sup>2</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 SEWAGE PRETREATMENT LEVELS

Minimum Levels of Pretreatment		
Level of Pretreatment	CBOD <sub>5</sub> mg/L	TSS mg/L
Primary	≤125	≤80
Secondary	≤25	≤30
Advanced Secondary	≤10	≤10

Fecal Coliform (FC) Minimum Levels of Pretreatment	
Level of Pretreatment	MPN/100ml
FC-1	≤50,000
FC-2	≤1000
FC-3	≤200
FC-4	≤1

Total Nitrogen (TN) Reduction Minimum Level of Pretreatment	
Level of Pretreatment	mg/L
TN-1	≥50% reduction
TN-2	≤20
TN-3	≤10

## APPENDIX A2:

### MINIMUM LEVEL OF PRETREATMENT ON SOILS WITH SHALLOW LIMITING ZONES

Minimum Level of Pretreatment	Depth to Seasonal High Water	Depth to Rock	Soil Infiltration Loading Rate gal/ft <sup>2</sup> /day
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:**

### **DOCUMENTATION FOR THE REVIEW OF THE TVP APPLICATION**

- 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 data from field testing: 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.
- 18) Technical course material, such as links to videos or presentations, on-line training classes, etc. Training material should cover installation information.

**APPENDIX C:**

**RELEVANT 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 385 Disinfection Mechanics	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

**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.

#### **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.

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 245 – 2022: Residential Wastewater Treatment Systems – Nitrogen Reduction.

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

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

NSF/ANSI 385 – 2021: Disinfection Mechanics

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 should 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 should 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. The DEP may require additional test sites in colder parts

of the Commonwealth for those systems or components with limited or no cold weather data.

- The DEP does not require field testing locations until the Test Plan is approved. The applicant should submit field testing locations prior to sampling. Field testing locations are subject to approval by the DEP. The field-testing location submittal should 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 connected to a residential dwelling which discharges domestic-strength sewage and should meet the following conditions:
  - 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 receiving the system or component and installation at cost 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 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 – except for total Kjeldahl nitrogen, nitrite-nitrogen, and nitrate-nitrogen – 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 should 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 DEP may require additional samples in colder parts of the Commonwealth for those systems or components with limited or no cold weather data. 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

- Identify all measurements 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, dissolved oxygen, pH, and alkalinity. Additionally, analyze the sample for fecal coliform when the applicant is requesting approval under the fecal coliform minimum level of pretreatment. Record effluent temperature and ambient air temperature.
- 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 should 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 minimum level of pretreatment 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 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's 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 should 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 should 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.

Report all data. The Department will use all acceptable reported data to establish the field performance results. Changes in occupancy or the manner of use, which occur over the period of field evaluation, should 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's minimum level of pretreatment 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 should be conducted according to the applicant's specifications and include any additional steps identified by the DEP to support the long-term performance of the technology. 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 should 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 a description of the technique for visual evaluation of the system allowing identification of the problem, a sequential method for identifying failure of components, and a 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>3</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).

## 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

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<sup>3</sup> [www.standardmethods.org](http://www.standardmethods.org)

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 should 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 should 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 should 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>4</sup>**

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

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<sup>4</sup> Twenty sites should 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
Total Kjeldahl Nitrogen	24-h composite	Laboratory
Nitrite (NO <sub>2</sub> -N)	24-h composite	Laboratory
Nitrate (NO <sub>3</sub> -N)	24-h composite	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
Total Kjeldahl Nitrogen	24-h composite	Laboratory
Nitrite (NO <sub>2</sub> -N)	24-h composite	Laboratory
Nitrate (NO <sub>3</sub> -N)	24-h composite	Laboratory

**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 245 Certification
- ☐ NSF/ANSI 350 Certification
- ☐ NSF/ANSI 360 Certification
- ☐ NSF/ANSI 385 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** \_\_\_\_\_