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1 General

1.1 Purpose

This Standard provides evaluation criteria and test methods for wastewater additives to allow for the determination that the product is:

- safe to use, and
- effective in its use as claimed by the manufacturer.

A wastewater additive is a product produced and marketed as a means of measurably supplementing or promoting the natural biological reactions taking place within an on-site wastewater treatment unit treating residential wastewater.

1.2 Scope

This Standard contains requirements for assessing the effectiveness of wastewater additives intended for use in conventional on-site wastewater treatment systems having a capacity of 20,000 Lpd (5000 gpd) or less. Conventional on-site systems, for purposes of this Standard, are septic tank systems.

This standard sets out the criteria and requirements for assessing the environmental and health risks of chemical, micro-organisms or enzyme ingredients commonly found in wastewater additives.

This standard sets out the protocols for testing the effectiveness of additives sold and claimed to supplement or promote the natural biological reactions taking place within an on-site wastewater treatment unit to reduce BOD₅, TSS, Solids and Sludge or FOG, and which have been certified to be safe to use pursuant to NSF/ANSI 409 Safety.

Manufacturers shall exercise due diligence to ensure compliance with all applicable regulatory requirements, but compliance with this Standard in itself does not imply that all regulatory requirements have been met.

2 Normative References

The following documents contain provisions that, through reference, constitute provisions of this NSF/ANSI Standard. At the time this Standard was balloted, the editions listed below were valid. All documents are subject to revision, and parties are encouraged to investigate the possibility of applying the recent editions of the documents indicated below. The most recent published edition of the document shall be used for undated references.

NSF 409 Wastewater Additives Safety
3 Definitions

residential wastewater (wastewater): Human body waste and liquid waste typically generated by the occupants of a residence. It is also found as effluent from small business establishments such as bed and breakfast facilities, highway rest stops, small restaurants.

safe to use: An additive that has been certified to conform to NSF/ANSI 409 Safety

Test Plan: A written document prepared to describe the procedures for conducting a test according to the requirements of this standard at a particular field site. At a minimum, the Test Plan includes detailed instructions for sample and data collection, sample handling and preservation, and quality assurance and quality control requirements relevant to the particular field site. [See: Annex B]

Testing Organization: One or more independent third-party Testing Organizations will be qualified by the Verification Organization to implement technology-specific Test Plans described herein, including documentation and sample reporting to the Verification Organization.

Verification Organization: The organization responsible for oversight of the Testing Organization in preparation and completion of testing, and in preparation, review and completion of the final report. The Verification Organization shall have demonstrated experience in the evaluation of residential wastewater treatment systems, development of product test protocols, quality assurance/quality control practices and procedures, and management of field studies and evaluations.

wastewater additive: a product claimed by the manufacturer or distributor to supplement or promote the natural biological reactions taking place within a wastewater collection, transport, or treatment system.

[Note: do we need to define the abbreviations BOD5, TSS, and FOG?]

4 Verification of Effectiveness

4.1 Additive classification

For the purpose of this Standard, additives are classified according to the claimed intended performance, i.e.:
- BOD5 and TSS reduction,
- Sludge and solids reduction, and
- FOG reduction, or
- combinations thereof.

4.2 General

4.2.1 Scope of sampling, testing and analysis

For the purposes of this Standard all additives to be included in the performance verification will be tested for BOD5 and TSS reduction, Solids and Sludge reduction and/or FOG reduction.

Temperature, pH and dissolved oxygen (DO) shall be recorded at the time of collection.
Additional analyses involving nitrogen species (NO₂⁺NO₃⁻), total-nitrogen, alkalinity, and TKN shall be included on request of the manufacturer.

Additional parameters such as fecal coliform or E. coli may be completed in response to needs of the responsible regulatory agency, or at the request of the manufacturer.

All samples shall be collected in accordance with the criteria set forth in this section (See also Annex A) and the Test Plan. Whether composite samples or grab samples are collected, sampling point, date, and time of sample collection shall be reported for each sample collected.

4.2.2 Methods of Testing

The claimed effectiveness of wastewater additives including their ingredients shall be verified by one of two methods as requested by the manufacturer:

- Method One - Field Testing
- Method Two - Laboratory Site Testing

4.2.3 Analytical Methods

Analysis of samples shall be determined using the appropriate EPA methods or methods in Standard Methods. Appropriate methods are shown in Table 1.

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Units</th>
<th>Reference Methods</th>
<th>Accuracy Percent Recovery</th>
<th>Precision Relative Percent Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>S.U.</td>
<td>150.1</td>
<td>N/A (1)</td>
<td>0-10%</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>SM  2550B (2)</td>
<td>N/A</td>
<td>0-10%</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>mg/L as CaCO₃</td>
<td>EPA 310.1</td>
<td>80-120%</td>
<td>0-10%</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>mg/L</td>
<td>EPA 160.2</td>
<td>N/A</td>
<td>0-10%</td>
</tr>
<tr>
<td>BOD₅</td>
<td>mg/L</td>
<td>EPA 405.1</td>
<td>75-125%</td>
<td>0-20%</td>
</tr>
<tr>
<td>TKN</td>
<td>mg/L as N</td>
<td>EPA 351.2</td>
<td>80-120%</td>
<td>0-10%</td>
</tr>
<tr>
<td>NH₃-N</td>
<td>mg/L as N</td>
<td>EPA 350.1</td>
<td>80-120%</td>
<td>0-10%</td>
</tr>
<tr>
<td>NO₃ &amp; NO₂-N</td>
<td>mg/L as N</td>
<td>EPA 353.2</td>
<td>80-120%</td>
<td>0-10%</td>
</tr>
<tr>
<td>Fecal Coliform</td>
<td>cfu/100mL</td>
<td>SM 9223</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>E. Coli</td>
<td>MPN/100 mL</td>
<td>M9223 B</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

(1) Not applicable.
(2) Standard Methods.

4.3 Method One - Field Testing

4.3.1 Number of systems
Manufacturers seeking to verify the performance of the additive under Method One - Field Testing shall identify a random pool of not less than 20 systems where the additive is used and which are suitable for field performance testing. The random pool of systems should include systems installed only in a single climatic region.

[Note: can we specify a standardized or recognized classification of climatic regions?]

4.3.2 Selection of systems

From the pool of systems submitted by the manufacturer, the Verification Organization shall select a minimum of 5 systems for testing and not less than 2 reserve systems for a total of 7 systems for the specified climatic region. At the request of the manufacturer, additional systems may be selected by the Verification Organization from the pool of 15 prior to initiating sampling under this protocol and be sampled and the data used in the event there is a need to disqualify more than 2 of the initial 15 systems.

In lieu of selecting all systems for test from a random pool of not less than 15 systems, the manufacturer may recommend systems for selection from an existing State or local regulatory agency field performance evaluation program. The recommended systems shall be similarly representative of a random pool, as determined by the Verification Organization.

4.3.3 System Requirements

All systems where the additives are being applied shall be representative of residential or community use as defined in this Standard. Systems shall be screened to verify that the system in which the additive is being used:

- is currently under a valid system maintenance contract;
- undergoes a routine system inspection at least twice per year;
- (if it is a residential systems) has an O&M manual as required in NSF/ANSI 40 or NSF/ANSI 245 as applicable;
- is used in a manner consistent with the system and additive manufacturers’ guidelines;
- the homeowner or the community system operator has granted written permission to collect samples pursuant to this Standard;
- the homeowner or the community system operator certifies that they are not being compensated by the additive manufacturer for being part of the evaluation;
- the homeowner or the community system operator agrees in writing to operate the system in accordance with the owner’s or operator’s manual; and
- the homeowner or the community system operator agrees in writing to keep a valid maintenance contract on the system.

All systems selected for additive evaluation under this Standard shall have operated continuously for at least 6 months prior to the commencement of treatment with the additive. Further, selected systems shall have been covered by a maintenance contract in effect since system start-up (for systems less than
one year old) or one year immediately prior to initiating the field verification (for systems more than one year old). All maintenance contracts shall extend through the period covering the final sample collection.

Residential systems selected for additive evaluation under this field verification shall be occupied by at least two people for the duration of the study. Intermittent periods of time with a lower or higher occupancy such as may occur during a vacation or normal travel shall not be considered as disqualifying, but shall be recorded in the site log and reported in the final report.

Community systems selected for additive evaluation under this field verification shall be inhabited by at least 60% of the normal population of the community throughout the 6 months prior to the commencement of treatment by the additives and throughout the 6 month field performance trial.

Community systems shall not receive industrial (high strength) effluents that constitute more than 5% of the average daily flow.

4.3.4 Field site screening audits

The Verification Organization shall conduct field site audits of systems to be tested under this Standard; the Verification Organization shall audit a minimum of 2 sites and the balance shall be audited by the Testing Organization. The manufacturer shall be notified in writing of the systems to be audited and, at their discretion, the manufacturer, may be present at the time of audit. This audit shall verify that the:

- system where the additive is being applied is currently under a valid maintenance contract;
- system where the additive is being applied has been in operation for at least six consecutive months;
- system where the additive is being applied has been inspected by the maintenance provider within the past six months and a written report is on file with the maintenance provider;
- additive is being applied is being used under residential conditions with occupancy of two or more people or the community conditions of 60% or more of the normal population;
- additive is being applied is being used in conformance with the manufacturer’s recommendations;
- owner or system operator is willing to give permission to the Verification Organization (in writing) to access the property for the purposes of conducting this Standard; and
- site where the additive is being applied has no potentially hazardous or unusual conditions, such as, but not limited to, guard animals, that would make sampling difficult or hazardous to those conducting the sampling.

When, in the course of verifying field performance, a system where the additive is being applied is discovered that fails to meet these criteria, or is being operated outside the limits established by the system or additives manufacturer, the system may be disqualified from field performance testing by the Verification Organization. Should a system initially identified for testing be found during testing to be unqualified, the results from a reserve system may be substituted for the unqualified system. All data collected shall be reported; however, only the 7 systems identified at the end of the study as the primary systems shall be used to establish the field performance results. The results of the survey (section 4.3.4) shall be made in writing and kept on file by the Verification Organization. Changes in occupancy or
population residency, or the manner of use, which occur over the period the field evaluation occurs, shall be noted. A summary of these data shall be included in the final report.

4.3.5 Sample collection and analysis

4.3.5.1 Duration of sampling

At a minimum, samples shall be collected one time per quarter for four consecutive quarters at each field site.

4.3.5.2 Sample collection

The methods and procedures for collection of samples shall be described in a Test Plan, which shall be developed by the Verification Organization, or their designated representative, in conjunction with the manufacturer. Review of the Test Plan may include participation by regulators or other appropriate entities. Approval of Test Plan, by signature of key personnel for each entity, shall be by the Verification Organization, manufacturer, and the Testing Organization, if other than the Verification Organization. Further definition of the items to be included in the Test Plan is included in Section 4.3.7. The Test Plan shall be included in the Final Report.

4.3.5.2.1 Pre-evaluation samples

Pre-evaluation screening samples shall be collected during field site screening audits (described in section 4.3.4) to characterize the nature of the influent to the system. The samples shall be analyzed for the presence of the relevant parameters for which the additive is intended to improve. Additional analyses, such as ammonia nitrogen (or TKN), may be completed in response to needs of the responsible regulatory agency, or at the request of the manufacturer. A sample of the water supply to the residence or to the community shall be collected at the same time and analyzed for alkalinity and nitrate nitrogen, if appropriate. If the water supply does not meet criteria established by the manufacturer of the treatment system or the constructor of the community system, as stated in the system operation manual, the site may be disqualified as a possible field site.

4.3.5.2.2 Field samples

Field samples shall be collected during the evaluation as described in the approved Test Plan. At a minimum, influent samples shall be collected twice per week during the study, once prior to (or concurrent with) the first effluent sample and one with the final effluent sample. All effluent samples shall be analyzed for the presence of the relevant parameters for which the additive is intended to improve.

4.3.5.2.3 Field observations

At the time of the pre-evaluation field site audits, a record shall be made of the layout of the system on the property and photos shall be taken of the system installation for determining the optimum approach for design of the sampling methods. At this visit, it shall be determined if there are any conditions with the residents that could impact additive performance for residential systems (such as medication use, chemotherapy, etc.) and if there is a means of monitoring water usage at the residence. Similar notes should be used for community systems whenever there may be a community-wide medication program.

At the time of field sampling, note shall be made in a log book of any site conditions that could impact operation of the system or collection of samples, such as the number of residents in the home or community, changes in resident or population conditions that could impact system operation (such as
medications), mechanical or electrical problems with the system, etc. Other critical observations shall be completed as indicated in the approved Test Plan.

4.3.6 Sample collection and handling

4.3.6.1 Minimum parameter set to be obtained and reported

The minimum data set under this standard for treated systems shall include the following results for effluent quality for which the additive is claimed to improve and DO, pH, and temperature. In addition, the ambient air temperature shall be recorded. Where appropriate nitrogen species and alkalinity shall also be reported.

In addition, data shall be recorded on the time, manner, frequency and rate of additive application.

4.3.6.2 Sample collection

The method of collecting samples will be dictated by site conditions, including location of the system on the site (accessibility), power availability, inlet and outlet piping arrangements, depth of cover over the system and availability of sampling equipment. The sample collection methods must be clearly described in detail in the approved Test Plan and each manufacturer shall be responsible for training the person collecting the samples in the proper method of sample collection as described in the Test Plan. Guidance for design of the sample collection plan is provided in Annex A.

The analytical laboratory completing analysis of the collected samples should provide the sample bottles required for the various analyses. The bottles should come with preservative in the bottles and labeled by analysis type. Samples will be placed in coolers with ice to maintain temperature as close to 39.2 °F (4 °C) as possible, and shall be delivered to the laboratory the day of sample collection.

4.3.6.3 Sample handling

Chain of custody shall be maintained for all samples collected during the verification test. The individual, as trained by the manufacturer, responsible for sample collection will fill out a chain of custody form. The form will be signed and dated for each set of samples delivered to the analytical laboratory. The receiving technician will acknowledge receipt of the samples by signing the chain of custody form and providing a copy of the form to the sample delivery person. Copies of the completed chain of custody forms will be included with all laboratory reports transmitting final analytical results.

4.3.6.4 Sample analysis

Analysis of samples shall be determined using the appropriate EPA methods or methods in Standard Methods. Appropriate methods are shown in Table 1.

4.3.7 Test Plan

Prior to the initiation of any sampling and analysis, a Test Plan must be prepared in accordance with Annex B. The Test Plan must be reviewed and accepted by all of the participating parties (Verification Organization, Testing Organization and manufacturer, and system owner or operator as the case may be). The plan may be drafted by the Testing Organization, and will be reviewed for technical and QA/QC acceptability by the Verification Organization.

4.3.8 Application of the Additive
The additive shall be inserted in the influent flow at the frequency and in the quantity recommended by the manufacturer.

4.3.9 Duration of the test

The test period shall commence when the pre-conditioning period is concluded. The test shall be conducted over a period of 6 months.

4.4 Method Two - Laboratory Site Testing

4.4.1 Test facility

The test facility shall comprise four 3,785 L (1,000 gallons) concrete two-chambered septic tanks conforming to ASTM C1227 - 12 Standard Specification for Precast Concrete Septic Tanks.

The first chamber shall be 2/3 and 1/3 chamber conforming to applicable standards.

All septic tanks shall be installed in parallel and be fed from the same source of challenge water.

Backup pumps shall be readily available to minimize the impact of pump failures.

4.4.2 Design loading

The system shall be dosed 7 days a week with 500 gpd wastewater volume of the system. The following schedule shall be adhered to for dosing:

<table>
<thead>
<tr>
<th>Time frame</th>
<th>% rated daily hydraulic capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 a.m. to 9:00 a.m.</td>
<td>approximately 35</td>
</tr>
<tr>
<td>11:00 a.m. to 2:00 p.m.</td>
<td>approximately 25</td>
</tr>
<tr>
<td>5:00 p.m. to 8:00 p.m.</td>
<td>approximately 40</td>
</tr>
</tbody>
</table>

NOTE – The individual dosage shall be no more than 10 gallons per dose, unless the dosage system is based on a continuous flow, and be uniformly applied over the dosing periods.

4.4.3 Pre-conditioning

Prior to commencing a test series, the four tanks shall be cleaned and purged following a previous test, and then pre-conditioned using the challenge water set out in 4.4.4.

Beginning after the first month of septic tank pre-conditioning, tank sludge and scum accumulations shall be measured through the tank riser closest to the introduction of the challenge water.

The septic tank pre-conditioning period shall last until a 5 cm (2 in) sludge layer and 2.5 cm (1 in) scum layer is developed in all tanks or six months, whichever occurs first.

[Comment: this implies that the test procedure could extend for up to 12 months if the test procedure itself is for 6 months after pre-conditioning.]
Influent BOD₅, TSS and FOG samples shall be collected once every two weeks during septic tank preconditioning. The purpose of these samples is to ensure that the supply provides challenge water that in the aggregate meets the BOD₅, TSS and FOG requirements of this standard.

4.4.4 Challenge water

Wastewater availability should be of sufficiently high volume so that studies are carried out year-round.

The challenge water shall have the following physical, chemical and organic qualities:

1) The 30-d average BOD₅ concentration of the wastewater delivered to the system shall be between 100 mg/L and 300 mg/L.

2) The 30-d average TSS concentration of the wastewater delivered to the system shall be between 100 mg/L and 350 mg/L.

3) The challenge water shall be supplemented with an infusion of municipal or residential sludge from a treatment facility at the rate of 3kg/1000L.

[Note: quality 3) is just a suggestion as to the amount of sludge infusion]

[Questions: Can we mimic sludge with some other product - soya paste is used in WaterSense toilet testing?]

4) The challenge water shall be supplemented with infusions of olive oil and animal fats, the average presence of fats, oils or greases deliver to the system shall be between 5 mg/L and 10 mg/L.

[Note: quality 4) is just a suggestion as a FOG contaminant quality]

Any holding tank or wet well providing challenge water to these tanks shall be thoroughly mixed immediately prior to each dosing of the septic tanks in order to prevent the basin itself from acting as a primary clarifier.

4.4.5 Test procedure

At least one of the tanks shall be randomly used as a "control" tank. The control tank shall be fed with the challenge water identically to the other tanks, but shall never receive an additive dose.

The challenge water shall be dosed via sewage-handling pump to all septic tanks equally. The discharge from these tanks shall be routed through a sampling device and then into a sewer downstream from the challenge water supply source.

Effluent BOD₅, TSS and FOG shall be collected once every two weeks during the test via a 24-hour time composite sampler. The purpose of these samples is to ensure that a significant difference between the three treated tanks (to each other) and the control tanks for any parameter is not significant at a p=0.05 using ANOVA or nonparametric methods as appropriate.

4.4.6 Hydraulic and design loading

4.4.6.1 Hydraulic loading and schedules
The performance of the system shall be evaluated for 26 consecutive weeks. During the testing and evaluation period, the system shall be subjected to 16 weeks of design loading, followed by 7.5 weeks (52 days) of stress loading, and then an additional 2.5 weeks (18 days) of design loading.

### 4.4.6.2 Design loading

The system shall be dosed 7 days a week with a wastewater volume equivalent to the daily hydraulic capacity of the system. The following schedule shall be adhered to for dosing:

<table>
<thead>
<tr>
<th>Time frame</th>
<th>% rated daily hydraulic capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 a.m. to 9:00 a.m.</td>
<td>approximately 35</td>
</tr>
<tr>
<td>11:00 a.m. to 2:00 p.m.</td>
<td>approximately 25</td>
</tr>
<tr>
<td>5:00 p.m. to 8:00 p.m.</td>
<td>approximately 40</td>
</tr>
</tbody>
</table>

NOTE – The individual dosage shall be no more than 10 gallons per dose, unless the dosage system is based on a continuous flow, and be uniformly applied over the dosing periods.

[Comment – adjust total number of weeks since removed power failure test]

### 4.4.6.3 Stress loading

Stress loading is designed to evaluate a system’s performance under four non-ideal conditions. Systems shall be subjected to each stress condition once during the 6-month testing and evaluation period, and each of the four stress conditions shall be separated by 7 days of design loading (see 4.3.5.2).

#### 4.4.6.4 Wash-day stress

The wash day stress shall consist of 3 wash days in a 5-day period. Each wash day shall be separated by a 24-h period. During a wash-day, the system shall be loaded at times and capacities similar to those delivered during design loading (see 4.3.5.2), however during the first two dosing periods per day, the design loading shall include 3 wash loads (3 wash cycles and 6 rinse cycles).

#### 4.4.6.5 Working-parent stress

For 5 consecutive days, the system shall be subjected to a working-parent stress. During this stress, the system shall be dosed with 40% of its daily hydraulic capacity between 6:00 a.m. and 9:00 a.m. Between 5:00 p.m. and 8:00 p.m., the system shall be dosed with the remaining 60% of its daily hydraulic capacity, which shall include 1 wash load (1 wash cycle and 2 rinse cycles).

#### 4.4.6.6 Vacation stress

On the day that the vacation stress is initiated, the system shall be dosed at 35% of its daily hydraulic capacity between 6:00 a.m. and 9:00 a.m. and at 25% between 11:00 a.m. and 2:00 p.m. Dosing shall then be discontinued for 8 consecutive days (power shall continue to be supplied to the system). Between 5:00 p.m. and 8:00 p.m. of the ninth day, the system shall be dosed with 60% of its daily hydraulic capacity, which shall include 3 wash loads (3 wash cycles and 6 rinse cycles).

### 4.4.7 Dosing volumes
The 30-d average volume of the wastewater delivered to the system shall be within 100% ± 10% of the system’s rated hydraulic capacity.

NOTE – All dosing days, except those with dosing requirements less than the daily hydraulic capacity, shall be included in the 30-d average calculation.

The performance of the system shall be evaluated for 26 consecutive weeks. During the testing and evaluation period, the system shall be subjected to 16 weeks of design loading, followed by 7.5 weeks (52 days) of stress loading, and then an additional 2.5 weeks (18 days) of design loading.

4.4.8 Application of the Additive

The additive shall be inserted in the influent flow at the frequency and in the quantity recommended by the manufacturer.

4.4.9 Duration of the test

The test period shall commence when the pre-conditioning period is concluded. The test shall be conducted over a period of 6 months.

4.4.10 Quality Assurance

Quality assurance practices conforming to Annex C shall be followed.

5 Assessment of additive effectiveness for BOD and TSS

5.1 Effluent quality

The quality of the water shall be sampled daily (grab samples) in the injection pipe, in the first tank, the second tank and at the discharge point. The samples shall be 25 hours apart such that all sampling occurs during normal business hours.

The effluent quality of the effluent shall be compared to the challenge water quality.

The 30-d average BOD₅ concentration of the wastewater effluent from the system shall be less than that of the challenge water.

The 30-d average TSS concentration of the wastewater effluent from the system shall be less than that of the challenge water.

6 Assessment of effectiveness for solids and sludge reduction

6.1 Solids and Sludge depth

On completion of the preconditioning period the depth of the solids and sludges in the first and second chambers shall be measured.

The depth of the solids and sludges shall be measured on the seventh day following the preconditioning period and every seventh day thereafter.
The average depth of the solids and sludges as calculated weekly shall show a consistent decline over the remainder of the test period.

7 Assessment of effectiveness for FOG reduction

7.1 Scum depth

On completion of the preconditioning period the depth of the scum in the first and second chambers shall be measured.

The depth of the scum shall be measured on the seventh day following the preconditioning period and every seventh day thereafter.

The average depth of the scum as calculated weekly shall show:
- a consistent decline over the remainder of the test period, or
- shall be reduced from the pre-conditioning level by 2.5 cm (1 in).

8 Product control

8.1 Formulation control

The manufacturer shall have practices in place to ensure that the product is manufactured according to the approved formulation, and to ensure that no changes in the manufacturing processes, product composition, or raw materials occur without prior authorization by the certification body. The practices shall ensure that no contamination is introduced by product packaging, transfer and storage equipment, or dilution water. Containers shall either be dedicated to one category of chemical, or written records of cleaning (e.g., wash tickets) shall be available for review. Documentation of these practices shall be available for review.

8.2 Product traceability

The manufacturer shall establish and maintain practices that ensure all products are uniquely labeled according to 9.1. These practices shall provide traceability from raw materials to finished products.

9 Labeling and literature

9.1 Labels

Product labels shall declare the identity of the active ingredients within wastewater additive included in the product. Labels of products other than proprietary ingredients shall declare the quantity of each ingredient and/or constituent (i.e., percentage of total). The amount of active or desired ingredient shall be listed in addition to the total amount of the ingredient. Labels shall comply with appropriate regulatory requirements.

The Standard name and numeric designation to which the product has been certified shall be included on the label.
9.2 Literature

1) Product literature should also include information set out in 9.1.

2) The product literature shall specify recommended dosages and frequency of application.

3) Where applicable, the manufacturer shall specify any special precautions for proper handling, appropriate storage and intended use.

4) The manufacturer’s name, mailing address, contact information including phone number and email shall be included for complaint purposes.
Annex A

(Informational)

Guidance for Design of Sampling Plan

A.1 Purpose/Objective
   A.1.1 Purpose
   A.1.2 Objectives

A.2 Site Evaluation
   A.2.1 General Site Description
   A.2.1.1 Individual Site Description
   A.2.1.2 Access to system
   A.2.1.3 Access to inlet and outlet
   A.2.1.4 Power availability
   A.2.1.5 Security
   A.2.1.6 Site drawings and photos
   A.2.1.7 Installation instructions
   A.2.2 Treatment System Description
   A.2.3 Installation Details

A.3 Selection of Sampling Location
   A.3.1 General
   A.3.2 Influent Sampling
   A.3.3 Effluent Sampling

A.4 Selection of Sampling Method
   A.4.1 General
   A.4.2 Composite Samples
   A.4.3 Grab Samples

A.5 Other Considerations
Annex B
(normative)

Test Plan

At a minimum, the Test Plan (section 4.3.7) shall include the following:

Section 1 Title page / approval by project participants

Section 2 Project description and objectives

2.1 The Test Plan shall provide an overview of the testing to be performed, the test objectives (i.e., what capabilities are being verified), and a description of the test site(s).

2.2 Identification of critical measurements, data quality objectives, data quality indicator goals, the schedule for completing testing, and milestones shall be addressed.

Section 3 Project organization

3.1 The Test Plan shall identify the Verification Organization, Testing Organization and manufacturer, and key contacts for each party.

3.2 The Test Plan shall include contact information for each residence or community site included in the project, including any stipulations on access to the treatment system at each location.

3.3 Copies of the signed homeowner’s or operator’s permission to enter their property shall be included in the Test Plan.

Section 4 Experimental approach

4.1 Sampling/monitoring points for all measurements, including locations and access points.

4.2 The frequency of sampling/monitoring events, as well as the number of each sample type and/or location, including QC and reserve samples.

4.3 The sampling strategy and procedures shall be included and evidence must be presented to demonstrate that the strategy is appropriate for meeting verification objectives (i.e., a description of the rationale used to select sample sites, types, and frequencies shall be provided in the Test Plan).

4.4 All measurements (i.e., analytical, physical, and process) shall be identified for each sample type, and test-specific target analytes shall be listed and classified as critical or noncritical in the Test Plan.

4.5 The planned approach (statistical and/or non-statistical) for evaluating data, including formulas, units, and definitions of terms, shall be included in the Test Plan.

4.6 The Test Plan shall include or reference safety and hygiene plans for the relevant Testing Organization and laboratory.
Section 5 Sampling procedures

5.1 Known site-specific factors that may affect sampling/monitoring procedures shall be described in the Test Plan.

5.2 Any site preparation needed prior to sampling/monitoring shall be described in the Test Plan.

5.3 Each sampling/monitoring procedure to be used shall be discussed or referenced in the Test Plan. If compositing or splitting samples, these procedures shall be described.

5.4 The Test Plan shall include discussion of the procedures to be used to assure that representative samples are collected.

5.5 For samples requiring a split sample for either QA/QC purposes or for shipment to a different laboratory, the Test Plan shall identify who is responsible for splitting samples, and where the splitting is performed (i.e., field versus laboratory).

5.6 A list of sample volumes to be collected, and the amount of sample required for each analysis, including QC sample analysis, shall be specified in the Test Plan.

5.7 Sample containers and preservation methods (i.e., refrigeration, acidification, etc.), including specific reagents, equipment, and supplies required for sample preservation shall be described in the Test Plan.

5.8 Hold time requirements shall be specified in the Test Plan.

5.9 Procedures for transporting samples shall be described in the Test Plan.

5.10 Sample archiving requirements for each relevant organization shall be provided in the Test Plan.

Section 6 Analytical procedures

6.1 Each measurement method to be used shall be described in detail or referenced in the Test Plan. Where appropriate, modifications to EPA approved or similarly validated methods shall be specified.

6.2 Methods shall be appropriate to the matrix/analyte being tested.

6.3 For measurements requiring a calibrated system, the Test Plan shall include specific calibration procedures applicable to each target 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 7 Quality Assurance Project Plan (QAPP)

7.1 Procedures to maintain chain-of-custody (e.g., custody seals, records) during sample transfer from the field to the laboratory, in the laboratory, and among contractors and subcontractors shall be described in the QAPP to ensure that sample integrity is maintained.
7.2 The QAPP shall 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.

7.3 Any additional test-specific QA objectives shall be presented in the QAPP, including acceptance criteria. This includes items such as mass balance requirements.

7.4 The specific procedures used to assess all identified QA objectives shall be fully described in the QAPP.

7.5 The QAPP shall list and define all other QC checks and/or procedures (e.g., blanks, surrogates, controls, etc.) used for the verification testing, both field and laboratory.

7.6 For each specified QC check or procedure, required frequencies, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met shall be included in the QAPP.

7.7 The QAPP shall describe how the sampling equipment is calibrated and the frequency of calibration.

7.8 The QAPP shall describe how cross-contamination between samples is avoided.

7.9 All QA Managers and their relationship in the organizations (i.e., location within each organization) shall be identified in the QAPP with evidence that the QA Manager is independent of project management.

7.10 Responsibilities of all other project participants shall be identified in the QAPP, meaning that organizations responsible for planning, coordination, sample collection, sample custody, measurements (i.e., chemical, physical, and process), data reduction, data validation, and report preparation shall be clearly identified in the QAPP.

Section 8 Data reporting, data reduction, and data validation

8.1 The reporting requirements (e.g., units, method) for each measurement and matrix shall be identified in the Test Plan.

8.2 The deliverables expected from each organization responsible for field and laboratory activities shall be listed in the Test Plan.

8.3 Data reduction (per Section 9 of this Standard) specific to the verification testing, and also specific to each organization, shall be summarized in the Test Plan.

8.4 Data storage requirements for each organization shall be provided in the Test Plan.

Section 9 Assessments

9.1 The Test Plan shall identify all audits (i.e., both internal systems audits and internal performance audits, where applicable) to be performed, who will perform these audits, and who will receive the audit reports. Additional inspections may be conducted but shall be supervised.

9.2 The Test Plan shall provide procedures to be followed to ensure that necessary corrective actions will be performed in response to audit findings.
9.3 The responsible party(s) for implementing corrective actions shall be identified.

Section 10 References

10.1 References shall be provided in the Test Plan either in the body of the text as footnotes or in a separate section.
Annex C  
(normative)  
Quality Assurance/Quality Control  

C.1 Verification test data – Data Quality Indicators (DQI)  
Several data quality indicators (DQIs) have been identified as key factors in assessing the quality of the data and in supporting the verification process. These indicators are:  
- Precision;  
- Accuracy;  
- Representativeness;  
- Comparability; and  
- Completeness.  

Each DQI is described below and the goals for each DQI are specified. Performance measurements will be verified using statistical analysis of the data for the quantitative DQI’s of precision and accuracy. If any QA objective is not met during the tests, an investigation of the causes will be initiated. Corrective action will be taken as needed to resolve the difficulties. Data failing to meet any of the QA objectives shall be flagged in the Final Report, and a full discussion of the issues impacting the QA objectives will be presented.  

C.2 Precision  
Precision refers to the degree of mutual agreement among individual measurement and provides an estimate of random error. Analytical precision is a measurement of how far an individual measurement may deviate from a mean of replicate measurements. Precision is evaluated from analysis of field and laboratory duplicates and spiked duplicates. The standard deviation (SD), relative standard deviation (RSD) and/or relative percent difference (RPD) recorded from sample analyses are methods used to quantify precision. RPD is calculated by the following formula:  

$$ RPD = \left\{ \frac{\text{abs}[C1 – C2]}{(C1 + C2)/2} \right\} \times 100\% $$  

Where:  
C1 = Concentration of the compound or element in the sample  
C2 = Concentration of the compound or element in the duplicate  

Field duplicates of both influent and effluent samples will be randomly collected at a frequency equal to 10% of field samples. The laboratory will run duplicate samples as part of the laboratory QA program. Laboratory duplicates are analyzed on a frequency of one duplicate for every ten samples analyzed. The data quality objective for precision is based on the type of analysis performed. Table 1 shows the laboratory precision that has been established for each analytical method. The data quality objective varies from a relative percent difference of ± 10% to ± 30%.  

C.3 Accuracy  
Accuracy is defined for water quality analyses as the difference between the measured value or calculated sample value and the true value of the sample. Spiking a sample matrix with a known amount of a constituent and measuring the recovery obtained in the analysis is a method of determining
accuracy. Using laboratory performance samples with a known concentration in a specific matrix can also monitor the accuracy of an analytical method for measuring a constituent in a given matrix. Accuracy is usually expressed as the percent recovery of a compound from a sample. The following equation will be used to calculate percent recovery:

\[
\text{Percent Recovery} = \left(\frac{AT - Ai}{As}\right) \times 100\%
\]

Where:

- \(AT\) = Total amount measured in the spiked sample
- \(Ai\) = Amount measured in the un-spiked sample
- \(As\) = Spiked amount added to the sample

During the verification test, the laboratory will run matrix spike samples at a frequency of one spiked sample for every 10 samples analyzed. The laboratory will also analyze liquid samples of known concentration as lab control samples. The accuracy objectives by parameter or method are shown in Table 1.

C.4 Comparability

Comparability will be achieved by using consistent and standardized sampling and analytical methods. All analyses will be performed using methods listed in Table 1. Any deviations from these methods will be fully described and reported as part of the QA report for the data. Comparability will also be achieved by using National Institute of Standards (NIST) traceable standards including the use of traceable measuring devices for volume and weight. All standards used in the analytical testing will be traceable to verified standards through the purchase of verifiable standards, and maintaining a standards logbook for all dilutions and preparation of working standards. Comparability will be monitored through QA/QC audits and review of the test procedures used and the traceability of all reference materials used in the laboratory.

C.5 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic population, parameter at a sampling point, a process condition, or an environmental condition. The Test Plan design will describe grab and composite samples of influent and effluent to be collected and then analyzed. The sampling locations for the samples will be designed for easy access to help ensure that a representative sample of the flow is obtained in each grab or composite sample bottle. The sample handling procedure includes a thorough mixing of composite containers prior to pouring the samples into the individual containers. The laboratory will follow set procedures (in accordance with good laboratory practice) for thorough mixing of any samples prior to sub-sampling in order to ensure that samples are homogenous and representative of the whole sample.

Representativeness will be monitored through QA/QC audits (both field and laboratory), including review of the laboratory procedures for sample handling and storage, review and observation of the sample collection, and review of the operating logs maintained at the test site. At least one field and one lab audit will be performed during the testing by the Verification Organization or their representative.

C.6 Completeness

Completeness is a measure of the number of valid samples and measurements that are obtained during a test period. Completeness will be measured by tracking the number of valid data results against the
specified requirements in the Test Plan. The goal for this data quality objective will be to obtain a minimum of 80 valid samples.

Table C1  Summary of Analytical Accuracy and Precision Limit Goals

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Units</th>
<th>Reference Methods</th>
<th>Accuracy Percent Recovery</th>
<th>Precision Relative Percent Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>S.U.</td>
<td>150.1</td>
<td>N/A (1)</td>
<td>0-10%</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>SM 2550B (2)</td>
<td>N/A</td>
<td>0-10%</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>mg/L as CaCO₃</td>
<td>EPA 310.1</td>
<td>80-120%</td>
<td>0-10%</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>mg/L</td>
<td>EPA 160.2</td>
<td>N/A</td>
<td>0-10%</td>
</tr>
<tr>
<td>CBOD₅</td>
<td>mg/L</td>
<td>EPA 405.1</td>
<td>75-125%</td>
<td>0-20%</td>
</tr>
<tr>
<td>TKN</td>
<td>mg/L as N</td>
<td>EPA 351.2</td>
<td>80-120</td>
<td>0-10</td>
</tr>
<tr>
<td>NH₃-N</td>
<td>mg/L as N</td>
<td>EPA 350.1</td>
<td>80-120</td>
<td>0-10</td>
</tr>
<tr>
<td>NO₃ &amp; NO₂-N</td>
<td>mg/L as N</td>
<td>EPA 353.2</td>
<td>80-120</td>
<td>0-10</td>
</tr>
<tr>
<td>Fecal Coliform</td>
<td>cfu/100mL</td>
<td>SM 9223</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>E. Coli</td>
<td>MPN/100 mL</td>
<td>M9223 B</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

(1) Not applicable.
(2) Standard Methods.