



National Standards for Decentralized Wastewater Treatment:

An Overview of Methods and Criteria for Demonstrating Product Performance



Today's Agenda

- Brief overview of NSF
- Development of American National Standards
- Current NSF/ANSI Onsite Wastewater Treatment Product Standards
- Standards in Development
- Related International Standards
- Questions

NSF Mission: Protection Of Public Health And Safety

MISSION: NSF International, an independent, not-for-profit non-governmental organization, is dedicated to being the leading global provider of public health and safety-based risk management solutions while serving the interests of all stakeholders.

We make the world safer by improving public health.

NSF.

Live safer.™

About NSF International

NSF's primary business activities are:

- Developing national voluntary consensus standards that enhance public health and safety.
- Providing product certification services to manufacturers of products primarily in the food service, water treatment, plumbing, and wastewater treatment industries.
- Providing management systems registration.
- Providing testing and auditing services.
- Providing training and education services.

NSF Water Related Programs

- Wastewater Treatment Systems and Components
- Beverages and Bottled Water
- Drinking Water Treatment Units
- Mechanical Plumbing System Components
- Plastics Piping System Components
- Pool, Spa, and Recreational Water Products
- Water Treatment and Distribution Systems
- Water Treatment Chemicals
- Water Conservation Technologies

NSF Onsite Wastewater Treatment Unit Program

- Develop American National Standards
 - First standard adopted in 1970
- Provide Third-party Product Certification
 - Product Testing
 - Facility Audits
 - Fulfillment of Service and Maintenance Requirements

Goal: Ensure a national program of product compliance that (1) provides consistent methods and measures of performance, and (2) a reliable third-party source for data and product directories of those products demonstrating compliance.

NSF Consensus Standards Development Process

Consumers
Laboratories
Utilities
Consultants



Federal
State
Local



Live safer.™

NSF Joint Committee

- Consensus body of experts that oversee development of NSF Onsite Wastewater Standards.
- Balanced membership of external stakeholders.
- Responsible for all new standards and maintenance/revision of current.
- Product: **American National Standards**

Goal: provide a uniform method of product evaluation that can be used by:

- product manufacturers to assess their product's performance;
- health officials for specifying product compliance requirements; and
- buyers for greater confidence in product selection.

American National Standards

- Designated as “ANSI”, e.g. NSF/ANSI
 - Only from standards development organizations accredited by the American National Standards Institute (ANSI)
- Only one standard for a given scope
- Represent the standards appropriate for the U.S. market
 - Commonly used and adopted, in total or in part, in many other countries

Current NSF/ANSI Onsite Wastewater Treatment Product Standards

NSF.

Live safer.™

Product and Technology Types

- Complete onsite wastewater treatment systems
 - Combined total wastewater
 - Blackwater only
 - Graywater only
 - Residential and commercial
- Treatment components/modules
 - Disinfection devices
 - Filters
 - Pumps
 - Gravelless trench technologies
 - Tanks
 - Additives

NSF/ANSI (American National Standards) for Onsite Wastewater Treatment Systems

- **NSF/ANSI 41**-2011 *Non-liquid saturated treatment systems* (1978)
- **NSF/ANSI 46**-2010 *Evaluation of components and devices used in wastewater* (1997)
- **NSF/ANSI 240**-2011 *Drainfield trench product sizing for gravity dispersal onsite wastewater treatment and dispersal systems* (2011)
- **NSF/ANSI 40**-2010 *Residential wastewater treatment systems* (1970)
- **NSF/ANSI 245**-2010 *Wastewater treatment systems – nitrogen reduction* (2007)
- **NSF/ANSI 350**-2011 *Onsite residential and commercial water reuse treatment systems* (2011)
- **NSF/ANSI 350-1**-2011 *Onsite residential and commercial graywater treatment systems for subsurface discharge* (2011)
- **NSF/ANSI 360**-2010 *Wastewater treatment systems – field performance verification* (2010)
- Under development; tanks, treatment additives

NSF/ANSI Standard 41

- Standard 41: *Non-Liquid Saturated Treatment Systems (compost toilets)*
 - No size restriction
 - Solid + liquid, or solid only
 - Residential
 - Day-use park
 - Cottage



NSF.

Live safer.™

NSF/ANSI Standard 41

- Laboratory controlled test:
 - Minimum 6 month treatment test
 - Stress events; vacation, 200% overload, 500% party
 - Various structural tests; impact, load, water tightness, burn resistance
- Mature system test
 - Minimum three existing installations
- Criteria:
 - No odor
 - Liquid containment
 - <200 MPN/100 mL

NSF/ANSI Standard 46

- Standard 46: *Evaluation of Components and Devices Used in Wastewater Treatment Systems*
 - Septic tank effluent filters
 - Grinder pumps
 - Disinfection devices

NSF/ANSI Standard 46

- Septic tank effluent filters
 - Gravity flow filters
 - Outlet path of residential septic tank systems
 - 400 to 1500 gpd
 - Scope of evaluation structural, retention of physical particles
 - Not reduction of TSS or BOD₅

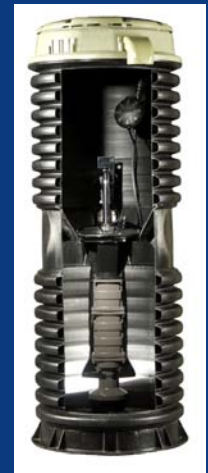
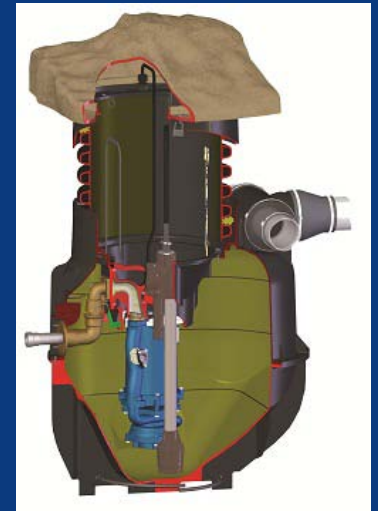


NSF/ANSI Standard 46

- **Septic tank effluent filters** (following order)
 - Flow test for clean filters; 11 gpm
 - Flow test for 85% clogged filter
 - Maximum 2 inch head rise
 - Structural integrity; dry and wet conditions for inserting and removing filter; 100% clogged with 12 inches of head for 48 hours
 - Solids retention; 11 gpm 8 hrs/day for 7 days
 - Bypass protection; 100% clogged, 4 inches of head with upward force applied
 - Zero spheres passing
 - Filter shall not become dislodged

NSF/ANSI Standard 46

- Grinder Pumps
 - Pump delivery performance
 - Evaluation of change in pump curve before and after testing
 - Household items loading test; 6 weeks
 - Shut off test
 - Negative head test
 - No clogging, jamming or mechanical failure
 - Maximum 20% increase in gap between stationary and rotating cutting elements
 - Maximum change in curve $\pm 5\%$



NSF/ANSI Standard 46

- Disinfection Devices
 - Up to 1500 gallons per day
 - Chlorination
 - Dispenser; disinfectant dispensing only
 - Disinfection device; disinfectant and contact chamber both
 - Ultraviolet disinfection
 - Ozone disinfection Residential applications
 - Test conditions:
 - Challenge water; 25 mg/L BOD₅/30 mg/L TSS, and 10⁴-10⁶/100 mL FC
 - Duration of 30 to 90 days
 - Material resistance testing
 - Fecal coliform reduction; ≤200 MPN/100mL

NSF/ANSI Standard 240; Drainfield Products

- Alternatives to conventional course aggregate dispersal systems
 - Comparison to aggregate
- Hydraulic performance



NSF.

Live safer.™

Drainfield Product Testing; Two Options

- Long Term Acceptance Rate (LTAR)
 - Newer technologies
 - Test site evaluation
- or
- Field Performance Assessment (FPA)
 - Products in general use for 10 years or more
 - Expert panel review of field studies

Long Term Acceptance Rate

- Equal number of aggregate control versus trench product; six of each
- All of equal length; 12 foot minimum
- Width can be varied; 1-4 feet
- Loaded with residential wastewater
 - Same as Standard 40 for strength
 - Septic tank effluent
- Minimum 36 week test
 - Accelerated loading to achieve ponding
- Assessment of hydraulic performance; measured gpd acceptance rates for both the control and the product
- Provides unit of measure for comparison purposes as GPD/ft² of bottom area.



Field Performance Assessment

- Expert panel
 - Seven national experts
 - Independent of applicant
- Review of existing data sets;
 - Minimum 10 years and 1,000 systems, 600 at 5 yrs or more
 - More than 50 installations in 5 or more US states or Canadian provinces
- Judged by study type and data quality attributes; scoring system
 - Type; third-party vs. manufacturer led, and if compared against control, trench product only, permit data only
 - Data quality; performance, age of systems, soil condition, climate, peer review

FPA Study Type Weighting

FPA Study Type and Description	Weighting of study: Independent 3rd Party Lead	Weighting of study: 2nd Party Lead	Weighting of study: Manufacturer lead
Type 1: Product compared to control installed in the field	1.0	0.60	0.25
Type 2: Product compared to existing reference data set or benchmark maximum allowable failure rate	0.90	0.54	0.23
Type 3: Survey of permit data and all other studies not meeting type 1 or 2¹	0.80	0.48	0.20

Data Quality Attribute	Sub Attribute	Total Group Score = 100	Sub group Value
Performance	Statistical measure of sample size mean failure rates and statistical confidence levels	40	
	a. Means and test of significance or confidence intervals are reported at 95% level or greater		40
	a. Means and test of significance or confidence intervals are reported at 90 to 94% level		20
	a. Means and sample size per treatment but no significance test or confidence intervals are reported. Minimum sample size of 20 per treatment.		10
Age of systems		30	
	a. 50% of sites installed more than 20 years earlier		30
	a. 50% of sites installed between 5 and 20 years earlier		25
	a. 50% of sites installed less than 5 years earlier		20
	a. 50% of sites installed less than 2 years earlier		10
Soil condition		10	
	a. Study includes slow, medium and fast draining soils, and does report the affects of soil type on failure rate		10
	a. Study includes slow, medium and fast draining soils, but does not report the affects of soil type on failure rate		8
	a. Study includes two of the three soil infiltration classifications: slow, medium and/or fast.		4
	a. Study includes one of the three soil infiltration classifications: slow, medium and/or fast.		2
Climate		10	
	a. Study includes sites in different major climate types for temperature and reports the affects of climate on total and relative failure rate.		10

Example FPA Score

Example Individual FPA Scoring - 3rd Party Lead, Perfect Execution and Results			
Data Quality Attribute	Ranking of FPA (From Table 3)	DQA Score (From Table 4)	Total Score
Performance Assessment	1.00	30	30.00
Age of Systems	1.00	25	25.00
Soil Conditions	1.00	10	10.00
Climate	1.00	3	3.00
Peer Review	1.00	5	5.00
Individual Study Score			73.00

Residential Wastewater Treatment Systems

NSF/ANSI 40 *Residential wastewater
treatment systems*

and

NSF/ANSI 245 *Wastewater treatment
systems – nitrogen reduction*

NSF.

Live safer.™

NSF/ANSI Standards 40 and 245

- Any residential system with a treatment capacity of 400-1500 gal/day (1514 L/day-5678 L/day).
 - Standard 40: CBOD₅ and TSS reduction
 - Standard 245: Nitrogen reduction (plus meet Standard 40)
 - Both: pH
- Performance evaluation:
 - No restriction for seasons
 - No service or maintenance during entire six month test
 - All test data reported
 - No allowance for discard of any data, except if test facility fails to provide an acceptable test



NSF/ANSI Standard 40 and 245

- Infiltration and exfiltration resistance.
- Noise level; 60 dbA at 6m.
- Mechanical components; no periodic maintenance or adjustment.
- Electrical compliance.
- Ground level access ports for routine maintenance, sampling and examination.
- Failure sensing and signaling; audible and visual, detection of malfunctions.
- Manuals.

NSF/ANSI Standard 40 and 245

- Design loading of wastewater
 - 6:00 am to 9:00 am; 35%
 - 11:00 am to 2:00 pm; 25%
 - 5:00 pm to 8:00 pm; 40%

Example: 500 gpd; Total of 80 doses over 24 hours, divided equally among three dosing periods (80 x 6.25 gallons)



NSF/ANSI Standard 40 and 245

- Sampling
 - 24 hour composite
 - Standard 40: five days/week; 118 sample points
 - Standard 245: three days/week; 70 sample points
- 26 Week Minimum Evaluation Period
 - 16 weeks design loading;
 - 7.5 weeks stress/design loading;
 - wash-day
 - working-parent
 - power/equipment failure
 - Vacation
 - 2.5 weeks design loading



Effluent Quality Criteria

- CBOD₅: 25 mg/L 30-day average
40 mg/L 7-day average
- TSS: 30 mg/L 30-day average
45 mg/L 7-day average
- Nitrogen: minimum 50% reduction
- pH: 6.0 – 9.0

Water Reuse Standards

NSF 350 Onsite residential and commercial reuse treatment systems

and

NSF 350-1 Onsite residential and commercial graywater treatment systems for subsurface discharge

Comparison of NSF 350 and 350-1

Standard 350

- Residential and commercial treatment systems.
- Sources: graywater and combined wastewater.
 - Graywater: laundry, bathing or both.
 - Combined residential: black and gray.
 - Combined commercial: all potential sources.
- Effluent application.
 - Indoor; toilet and urinal flushing.
 - Outdoor; surface and subsurface irrigation.
 - Other comparable non-potable applications.

Standard 350-1

- Residential and commercial treatment systems.
- Sources: graywater only; laundry, bathing or both.
- Effluent application: subsurface only

System Sizes

- Residential wastewater; Up to 1500 gpd
 - Laboratory testing with actual wastewater.
- Graywater; Up to 1500 gpd
 - Laboratory testing with synthetic wastewater; bathing, laundry, or both
 - Exception; commercial laundry water
- Systems exceeding 1500 gpd, and commercial laundry
 - Field evaluation using actual building wastewater.

Performance Evaluation: Complete Residential Wastewater

- Residential wastewater treatment system (combined wastewater); same as Standard 40/245.
 - Standard 40 Class I as prerequisite.
 - Same basic influent requirements.
 - Six month evaluation, stress testing, composite sampling
- Simultaneous testing to three standards
 - Standard 40: CBOD₅, TSS, pH
 - Standard 245: Total Nitrogen
 - Standard 350: Turbidity, E. coli

Performance Evaluation: Graywater

- Tested with synthetic challenge water:
 - 53% Laundry; liquid detergent and softener, dirt.
 - 47% Bathing; shampoo, conditioner, deodorant, toothpaste, soap, sun tan lotion, shaving foam, cleaner.
 - Secondary treated residential wastewater; source of total coliforms and E. coli



Graywater Influent Characteristics

Parameter	Required range
TSS	80-160 mg/L
CBOD ₅	130-180 mg/L
Temperature	25-35°C
pH	6.5-8.0
Turbidity	50-100 NTU
Total phosphorous	1.0-3.0 mg/L
Total nitrogen	3.0-5.0 mg/L
Total coliforms	10 ³ -10 ⁴ CFU/100mL
E. coli	10 ² -10 ³ CFU/100mL

Graywater Dosing Schedule: Standard 350

System design	Design loading					Stress tests				
	First 16 weeks	First 20 weeks	Last 4 weeks	Last 3.5 weeks	Last 2.5 weeks	Wash-day surge	Power/equipment failure	Vacation	Water Efficiency	Cleaning solution
R-Bathing only	x			x			x	x	x	
R-Laundry only	x				x	x	x	x	x	
R-Combined	x				x	x	x	x	x	
C-Bathing only		x	x				x	x		
C-Laundry only		x	x				x	x		
C-Combined		x	x				x	x		x

Commercial Facilities

“Businesses such as lodging establishments, business parks and campuses, shopping facilities, places of public assembly where no manufacturing, assembly, industrial or food processing is involved, and laundering facilities for hospitals, hotels, rental uniforms, and other facilities likely to handle high amounts of soiling or high strength commercial cleaners.”

Evaluated in the field at an actual installation, but following similar sampling and duration

Standard 350 Effluent Criteria

Parameter	Class R	Class C
CBOD ₅	10 mg/L (25)	10 mg/L (25)
TSS	10 mg/L (30)	10 mg/L (30)
Turbidity	5 NTU (10)	2 NTU (5)
E. coli	14 MPN/100 mL (240)	2.2 MPN/100 mL (200)
pH	6.5-8.5	6.5-8.5

Standard 350-1 Effluent Criteria

Parameter	Criteria
CBOD ₅	25 mg/L
TSS	30 mg/L

NSF/ANSI 360 Wastewater treatment systems – Field Performance Verification

- Same systems as covered under Standards 40/245
- Goal: Bridging lab versus field performance



NSF.

Live safer.™

Why the Need for a Standard?

- Concerns for performance of certified systems in the field.
 - Many past studies had poor design and invalid data leading to improper conclusions.
- States requiring field evaluations of certified systems.
 - Additional measure of approval.
 - Potential for multiple studies.

NSF 360 Field Performance Verification

- Field evaluation of 20 systems minimum
 - Selected from a minimum pool of 100.
 - Minimum of six months in operation.
 - Sampled quarterly for one year; 80 sample points.
 - Sampled for CBOD₅ and TSS, and other parameters as requested.
 - Suggested sampling across a diversity of geographical locations, but no mandate.
 - All oversight, sampling and analysis managed by a third-party organization, such as NSF.

NSF 360 Field Performance Verification

- Not a requirement of 40/245 certification.
- Not a pass/fail evaluation, but detailed report will be produced.
- Only systems having already met the requirements of NSF/ANSI Standard 40, Class I (Standard 245 if sampling TN).

NSF Onsite Wastewater Treatment Product Standards in Development

NSF.

Live safer.™

Onsite Wastewater Treatment Tanks

- Draft NSF 349 “Procedure for the Quality Control of On-site Wastewater Tanks”
 - Minimum documentation requirements for materials, design, construction and water tightness
- Basic product requirements
 - Data plate, service label, manuals, drawings
- Manufacturing quality assurance plan
 - Policies, procedures
 - Water tightness testing, structural integrity
- Compliance with local and state regulatory requirements
 - Targeted at large number of concrete tank producers
- Projected completion 2012

Onsite Wastewater Treatment Additives

- NSF/ANSI Standard 60 for drinking water treatment chemicals
 - Approx. 1,000 companies and 41,000 certified products
 - Formulation review only; no performance
- Draft NSF 409; potentially three components
 - 409-1; formulation/ingredient review for toxicity
 - 409-2; performance for residential and small community (<5,000 gpd); BOD₅, TSS, FOG, Sludge
 - 409-3; performance for commercial/municipal (>5,000 gpd)
- Range of additive types
 - Microorganisms, enzymes, chemicals
- Strict labeling requirements

Related International Onsite Wastewater Treatment Product Standards

NSF.

Live safer.™

Canada

- CAN/BNQ 3680-600/2009 *Onsite Residential Wastewater Treatment Technologies*
- Aligned with NSF/ANSI Standard 40 for base treatment evaluation
- Uniqueness:
 - Minimum overall average influent of 200 mg/L BOD₅/TSS
 - Three temperature options
 - Non-controlled
 - Controlled; 11°C and 17°C
 - Four types of treatment and 11 classes
 - Seasonal reliability test; 12 months in Canada Plant Hardiness Zone 3 or 4

Canada

Type	Basic (B)		Disinfection (D)	Phosphorous (P)	Nitrogen (N)
	TSS	CBOD ₅	Fecal C	Total P	Total N
B-I	100	150			
B-II	30	25			
B-III	15	15			
B-IV	10	10			
D-I			50,000		
D-II			200		
D-III			ND		
P-I				1.0	
P-II				0.30	
N-I					50%
N-II					75%

Hardiness Zones



Australia

- AS/NZS 1546.3:2008 *On-site domestic wastewater treatment units; Part 3 aerated systems*
- Comparable to NSF/ANSI Standard 40
 - 26 week test; influent strengths; loading
- Uniqueness
 - Maximum system size of 14,000L/wk (530 gpd)
 - Sampling only in weeks 8, 16 and 26; 4 days with 4 grab samples/day at 30 minute intervals; BOD₅, TSS, *E. coli*
 - Maintenance allowed in weeks 12 and 24
 - Effluent criteria:
 - BOD₅: 90% ≤ 20 mg/L, no sample > 30 mg/L
 - TSS: 90% ≤ 30 mg/L, no sample > 45 mg/L
 - *E. coli*: median of 10/100 mL, 80% <20, none >100

European Norm

- EN 12566-3:2005 *Small wastewater treatment systems for up to 50 PT*
- Somewhat similar to NSF/ANSI Standard 40
- Uniqueness
 - No lower flow limit, upper approximately 2,000 gallons
 - Influent: BOD₅ 150-500 mg/L, TSS 200-700 mg/L
 - 38 week test; includes under loading (50%; 2x2 wks), overloading (150%; 1x48 hr), peak flow (+200L, 1/wk for 30 wks)
 - 26 composite samples total
 - Routine maintenance allowed per the manufacturer's instructions
 - No pass/fail

Summary

- Many standards exist today for the proper evaluation of onsite wastewater treatment systems.
- Products meeting these standards have demonstrated compliance with strict measures of performance.
- All standards are consensus driven, and all represent the American National Standards.
- No standard is ever complete, but instead undergoes regular revision to keep current with the changing market.

THANK YOU FOR ATTENDING

NSF.

Live safer.™

Contact Information

- Tom Bruursema
General Manager
(734) 769-5575
bruursema@nsf.org
- Sharon Steiner
Business Unit Manager
(734) 827-6846
steiner@nsf.org
- Ron Grimes
Regulatory Affairs Manager
(734) 827-6863
rgrimes@nsf.org
- NSF Web Site:
www.nsf.org
- Toll free 800-673-6275

MOU Partnership info:

http://cfpub.epa.gov/owm/septic/septic.cfm?page_id=260

Link to Wiki:

https://wiki.epa.gov/septic/index.php/Main_Page

NSF.

Live safer.™