NSF Standard 245

Nitrogen Reduction

Presented at the 2008

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NSF Today

- Offices in over 80 countries
- 450-plus employees
- Recently added 80,000 square feet of new laboratory space at Ann Arbor

Wastewater Program Milestones

- 1965 Ann Arbor, MI test facility opened
- 1970 Standard 40 for advanced treatment systems adopted
- 1977 Chelsea, MI test facility opened
- 1978 Standard 41 for composting toilets adopted
- 1991 ANSI Accreditation
- 1997 EPA Cooperative Agreement (ETV SWP)
- 1999 Standard 46 for components of advanced treatment systems adopted

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Wastewater Program Milestones

- 2001 Onsite Wastewater Inspector Accreditation introduced
- 2002 Disinfection Devices added to Standard 46
- 2003 Waco, TX Test Facility Opened
- 2006 Onsite Monitoring Program introduced
- 2007 Standard 245 for nitrogen reducing technologies adopted

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How Are NSF Standards Created?

- Must address consensus, due process and openness
- Accomplished through a committee structure
- NSF Joint Committee on Wastewater Technology – at the core
- Equal representation from industry, public health and user communities – each with approximately 12 seats & membership rotation

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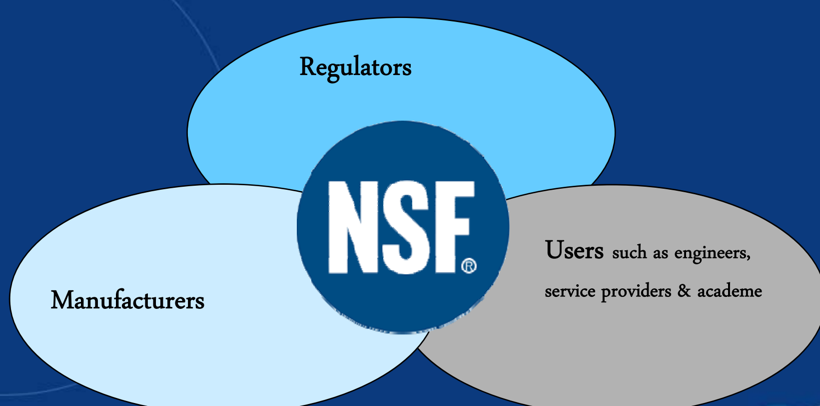
Consensus Standards:
Key to Success – Stakeholder Involvement

NSF/ANSI Standards are developed and overseen by the NSF Wastewater Treatment Technology Joint Committee, which is comprised of volunteer members.



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Consensus Standards:

Controlled by Oversight

NSF's standards development and adoption are reviewed and approved by ISO, ANSI, and the SCC.

International Organization for Standardization

ANSI ACCREDITED CERTIFICATION PROGRAM

Standards Council of Canada Accredited Certification Organization

Conseil canadien des normes Organisme de certification accrédité

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NSF/ANSI Wastewater Standards

- Standard 40: Residential Onsite Wastewater Treatment Systems – 400 to 1500 GPD
- Standard 41: Non-Liquid Saturated Treatment Systems – Primarily composting toilets
- Standard 46: Evaluation of Components and Devices Used in Wastewater Treatment Systems – Grinder pumps, septic filters, disinfection devices
- Standard 245: Wastewater Treatment Systems - Nitrogen Reduction

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Nitrogen Reduction

Rationale

- Why has Nitrogen Reduction become a focus?
  - Environmental concerns
    - One of several "limiting nutrients"
    - Surface waters – eutrophication
    - Groundwater quality
  - Public Health concerns
    - Methemoglobinemia

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Nitrogen

- Nitrogen reduction in wastewater has been heavily regulated in large treatment plants (NPEDS) for many years and more stringent regulation is now making it's way into the onsite wastewater industry and into controls of agricultural run-off via Total Maximum Daily Load (TMDL) requirements.

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- The NSF Joint Committee formed a task group to develop the Standard and to bring recommendations to the Joint Committee. The task group decided to narrow the focus to nitrogen reduction and revisit the issue of reduction of other nutrients at a later time.
- Standard 245 was developed using the existing NSF/EPA Environmental Technology Verification (ETV) Nutrient Reduction protocol and elements of Standard 40.

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- Standard 245 – for residential wastewater treatment systems designed to provide for nitrogen reduction.
- The system must have met Class I requirements of NSF/ANSI Standard 40 or meet the Class I requirements during concurrent testing for nutrient removal.
- Involves six months of performance testing, incorporating stress tests to simulate wash day, working parent, power outage, and vacation conditions.

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- Emphasizes importance of water chemistry in ability of systems to nitrify/ denitrify.
- Alkalinity and organic carbon important to nitrification/denitrification process.
- Alkalinity destroyed during nitrification, created during denitrification.
- Low pH can result, with nitrifier activity stopped around pH 6.0.
- Organic carbon essential to denitrification process.

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NSF Wastewater Standards

- Standard 245 Onsite Wastewater Treatment Unit Nitrogen Reduction

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NSF/ANSI Standard 245
Testing Conditions

- Influent alkalinity and available carbon allowed to be adjusted to not limit nitrification or denitrification.
  - Sodium bicarbonate for alkalinity
  - Methanol for carbon addition
- Allowance made for influent temperatures that would limit nitrifying organisms – suspension of sample collection for low temperatures.
- Samples collected three times per week.

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Parameters Monitored

Parameter	Sample type	Raw influent	Treated effluent
BOD_5	24 h composite	X	
$CBOD_5$	24 h composite		X
Total suspended solids	24 h composite	X	X
pH	Grab	X	X
Temperature (°C)	Grab	X	X
Dissolved oxygen	Grab		X
Alkalinity	24 h composite	X	X
TKN	24 h composite	X	X
Ammonia Nitrogen	24 h composite	X	X
Nitrite/nitrate	24 h composite		X

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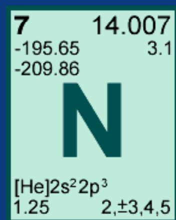
Nitrogen



- TKN, Total Kjeldahl Nitrogen, is the test method that measures the combination of organically bound and ammonia nitrogen.
- Total Nitrogen = TKN + nitrite + nitrate

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Influent Wastewater Characteristics

Required average over period of testing:

- BOD – 100 mg/L - 300 mg/L
- TSS – 100 mg/L - 350 mg/L
- TKN – 35 – 70 mg/L (as N)
- Alkalinity – >175 mg/L
- Temperature – 10°C to 30°C
- pH – 6.5 to 9

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Effluent Wastewater Characteristics

- Only samples collected during design loading periods used in pass/fail calculations.
- Effluent concentrations averaged over course of testing period shall not exceed:
  - $CBOD_5$ – 25 mg/L
  - TSS – 30 mg/L
  - Total Nitrogen – <50% of average influent TKN
  - pH – 6.0 to 9.0

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Testing Standard	*NSF/ANSI 245*	*ETV Nutrient Reduction*
Duration of testing	6 months; up to 37 weeks total	1 year
System start-up	Up to 3 weeks	Up to 8 weeks
Influent requirements	Average required over course of test: BOD5 100 – 300 mg/L TSS 100 – 350 mg/L TKN 35 – 70 mg/L Alkalinity >120 mg/L Temperature 10°C - 30°C Allows chemical addition to adjust influent – sodium bicarbonate for alkalinity; urea and methanol at a C:N ratio of not less than 5:1 for TKN.	Only suggested ranges: BOD5 100 – 450 mg/L TSS 100 – 500 mg/L TKN 25 – 70 mg/L Phosphorus 3 – 20 mg/L Alkalinity >60 mg/L Temperature 10°C – 30°C Allows chemical addition to adjust influent – sodium bicarbonate for alkalinity.

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Testing Standard	*NSF/ANSI 245*	*ETV Nutrient Reduction*
Temperature impacts (temperatures below 10°C impact process bacteria)	Allows for suspension of Nitrogen sampling when temperature drops below 10°C, with extension of sampling to obtain a minimum of 55 valid sample sets	No allowance, test runs 1 year and all data is reported
Maintenance during testing	None – same as NSF/ANSI 40	Maintenance allowed, but documented and reported in final report
Stress Sequences	– same as NSF/ANSI 40 – wash day, working parent, equipment/power failure, vacation	5 - wash day, working parent, equipment/power failure, low loading, vacation

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Testing Standard	*NSF/ANSI 245*	*ETV Nutrient Reduction*
Sampling	3 times/week during design loading (weeks 1–16 and weeks 24½–26); 2 times during the week following each stress test	Minimum 1 time/month; same as NSF/ANSI 40 during stress sequence; also for 5 consecutive days at end of test
Acceptance criteria	For pass/fail, only samples collected during design loading periods (samples during stress sequence reported, but not included in the pass/fail criteria calculation). Average of all effluent samples may not exceed: CBOD5 25 mg/L TSS 30 mg/L TKN <50% of average of all influent pH 6.0 – 9.0 SU	None; all data is reported

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SUMMARY

- **NSF is a world leader in standards development and is committed to protecting public health, safety, and the environment.**
- As awareness of environmental impacts increases and regulations become more stringent, NSF will continue to work with all stakeholder groups and the Joint Committee to ensure that existing, planned and future standards, as discussed in this presentation, are established and maintained with a goal of consensus, due process and openness.

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Questions & Answers

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