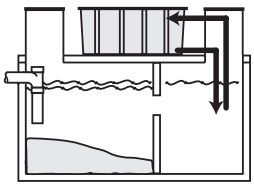
Orenco WATER *Handout*

AdvanTex® Nutrient Reduction
Performance Summary

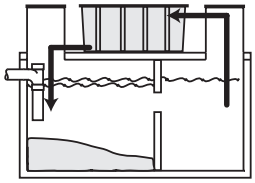
Since 2001, the performance of AdvanTex Treatment Systems has been tested in a dozen different programs, both in test centers and in the field. These programs include **first-party testing** by Orenco, **second-party testing** by Orenco distributors, and **third-party testing** by outside companies or agencies. This summary documents the performance of AdvanTex Treatment Systems in reducing Total Nitrogen (TN), Ammonia (NH_3), and Total Phosphorous (TP) and shows that AdvanTex systems easily meet advanced treatment standards for these parameters.

AdvanTex systems can be configured in different modes, depending on the degree of total nitrogen reduction needed (see illustrations below). In Mode 1, filtrate from the AdvanTex unit is recirculated to the secondary chamber of the septic tank. In Mode 3, filtrate is recirculated to the primary chamber, where the environment favors further nitrogen reduction. See AdvanTex General Reduction Performance Summary (NHO-ATX-000-1). In the Combo Mode, filtrate from the AdvanTex pod is recirculated to both chambers. There is also a Mode 1 configuration that uses a primary tank and a recirculation tank. In the primary tank, sludge and scum are separated from liquid effluent, which then flows into a separate recirculation tank, into which the AdvanTex filtrate is recirculated.

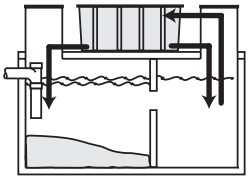
The table below summarizes effluent results from test centers and field tests. More specific results are shown on the following pages. If you have any questions about this summary, please contact Orenco's Government Relations Department.



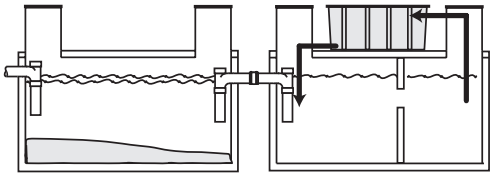
Mode 1



Mode 3



Combo Mode



Mode 1 with primary tank and recirculation tank

Test Centers

AdvanTex Effluent Averages	TN* (mg/L)	NH_3 (mg/L)	TP (mg/L)	Duration
NSF/ANSI Standard 40 Testing	12 (64%) †	0.9 (96%)	-	7 months
Rotorua District Council Approval Testing	13 (82%)	0.2 (99%)	8 (33%)	1 year, 1 month
NSF/ANSI Standard 40 Testing with UV Disinfection	13 (66%)	1.1	-	6 months
New Zealand On-site Effluent Treatment National Testing Program	12 (80%)	0.6 (99%)	-	10 months

Field Testing

AdvanTex Effluent Averages (# of single-family residences)	TN* (mg/L)	NH_3 (mg/L)	TP (mg/L)	Duration
Roger Shafer, P.E., Testing in Fractured Bedrock (1)	14 (63%) †	-	6 (33%)	8 months
La Pine National Demonstration Project (3)	17 (74%)	1.9	9 (18%)	2 years, 7 months
Virginia Approval Testing Program (13)	15	1.8	-	1 year, 6 months
Green Hill Pond Watershed Demonstration Project (5)	18	-	9	1 year, 4 months
North Carolina Approval Testing Program: Mode 1 (14) ‡	26 (63%)	-	-	2 years, 10 months
North Carolina Approval Testing Program: Mode 3 (1)	15	-	-	2 years, 10 months
Pennsylvania Testing Program (11)	17 (68%)	1.7 (96%)	-	1-3 years
Maryland Best Available Technology Field Verification (12)**	18 (68%)	-	-	1 year
Maryland Best Available Technology Field Verification (12)††	15 (82%)	1.4	-	1 year

** TN = TKN + NO_3-N + NO_2-N* *† Percent reduction* *‡ Included single-family residences and vacation rentals* *** AdvanTex AX20* *†† AdvanTex AX20-RT*

TEST CENTERS

NSF/ANSI Standard 40 Testing *(Third Party)*

Orenco contracted with Novatec to test an AX20 Mode 1 system in support of its application for NSF approval. Novatec conducts official NSF/ANSI Standard 40 testing under contract to manufacturers at its facility in British Columbia. Although the protocol doesn't require it, Orenco elected to sample for total nitrogen. The testing used composite sampling and was done at a wastewater facility that serves a residential subdivision.

- **Dates/Location:** August 2001-February 2002*, British Columbia, Canada
- **Average Daily Flow:** 500gpd (1893L/day)
- **System Configuration:** AX20 Mode 1 recirculating into the secondary compartment of a 1500gal (5678L) tank

** Nitrogen results are from July to February, allowing for a two-month start-up period*

Processing Tank Influent

	TN (mg/L)	NH_3 (mg/L)
Mean	34	22
Median	33	23
Number of Samples	21	21

AdvanTex Effluent

	TN (mg/L)	NH_3 (mg/L)
Mean	12	0.9
Median	13	0.6
Number of Samples	27	19
Reduction	64%	96%

Rotorua District Council Approval Testing *(Third Party)*

Testing of residential wastewater treatment systems was initiated by the Rotorua District Council and the Bay of Plenty Regional Council. The purpose of this project was to compare systems so that manufacturers meeting specifications could be preapproved. The primary focus of the trial was nitrogen reduction.

- **Dates/Location:** May 2005-June 2006*, Rotorua, New Zealand
- **Average Daily Flow:** 265gpd (1003L/day)
- **System Configuration:** AX20 Mode 3

** Nitrogen results are from September to June, allowing for a four-month, winter start-up period.*

Processing Tank Influent

	TN (mg/L)	NH_3 (mg/L)	TP (mg/L)
Mean	72	49	12
Median	71	49	12

AdvanTex Effluent

	TN (mg/L)	NH_3 (mg/L)	TP (mg/L)
Mean	13	0.2	8
Median	13	0.2	8
Number of Samples	41	-	-
Reduction	82%	99%	33%

NSF/ANSI Standard 40 Testing with UV Disinfection *(Third Party)*

Orenco contracted with Novatec to test an AX20 Mode 1 system in support of its application for NSF approval. Novatec conducts official NSF/ANSI Standard 40 testing under contract to manufacturers at its facility in British Columbia. Although the protocol doesn't require it, Orenco elected to sample for total nitrogen. The testing used composite sampling and was done at a wastewater facility that serves a residential subdivision.

- **Dates/Location:** July-December, 2006, British Columbia, Canada
- **Average Daily Flow:** 500gpd (1893L/day)
- **System Configuration:** AX20 Mode 1 recirculating into the secondary compartment of a 1500gal (5678L) tank with UV disinfection

Processing Tank Influent

	TKN (mg/L)
Mean	38
Median	40
Number of Samples	22

AdvanTex Effluent

	TN (mg/L)	NH_3 (mg/L)
Mean	13	1.1
Median	12	0.6
Number of Samples	20	22
Reduction	66%	-

New Zealand On-Site Effluent Treatment National Testing Program *(Third Party)*

In 2009, New Zealand released a national standard and testing protocol for on-site effluent treatment. Tests of AdvanTex AX20 systems were carried out at the Rotorua Testing Facility and measured $CBOD_5$, TSS, and total nitrogen reduction, as well as electrical power consumption.

- **Dates/Location:** November 2009-August 2010, Rotorua, New Zealand
- **Average Daily Flow:** 287gpd (1086L/day)
- **System Configuration:** AX20 Mode 3

Processing Tank Influent

	TN (mg/L)	NH_3 (mg/L)
Mean	60	41
Median	60	43
Number of Samples	46	46

AdvanTex Effluent

	TN (mg/L)	NH_3 (mg/L)
Mean	13	0.6
Median	12	1
Number of Samples	43	43
Reduction	80%	96%

FIELD TESTING

Roger Shafer, P.E., Testing in Fractured Bedrock*

(Second Party)

This test included one AdvanTex system at a single-family home.

- **Dates/Location:** Summer 2001 and Winter 2002, 2007, 2008; Colorado, USA
- **Average Daily Flow:** 209gpd (791L/day), April and August, 2001
- **System Configuration:** Two AX10s (which together have the same treatment capacity as an AX20) configured in Mode 3, recirculating to the primary compartment of a 1500gal (5678L) processing tank

** Roger Shafer, "Use of a Recirculating Textile Filter Followed by a Polishing Sand Filter for Onsite Wastewater Treatment in Colorado's Fractured Bedrock Environment," presented at the Colorado Professional Onsite Wastewater 2008 Education Conference*

Septic Tank Effluent*

	TN (mg/L)	TP (mg/L)
Mean	38	9
Number of Samples	5	5

AdvanTex Effluent

	TN (mg/L)	TP
Mean	14	6
Number of Samples	13	13
Reduction	63%	33%

** Five samples collected from the outlet tee of the septic tank before installation of the AdvanTex system between April and May 2001 using a 3/4in clear plastic tank sampler*

La Pine National Demonstration Project

(First Party, Third Party)

This project was a cooperative effort by the Deschutes County Environmental Health Division, the Oregon Department of Environmental Quality, and the US Geological Survey. Denitrification technologies were evaluated in an area where the risk of groundwater contamination is high, and climate and soil conditions are unfavorable for denitrification. Three AX20 systems were installed at single-family residences.

- **Dates/Location:** January 2002-July 2004, Oregon, USA
- **Average Daily Flow:** 108-334gpd (409-1264L/day)
- **System Configuration:** AX20 Mode 3 recirculating into the primary compartment of a 1500gal (5678L) processing tank

Septic Tank Effluent

	TN (mg/L)	NH_3 (mg/L)	TP
Mean	66	-	11
Median	63	-	10
Number of Samples	427	-	429

AdvanTex Effluent (Mode 3 Systems)

	TN (mg/L)	NH_3 (mg/L)	TP
Mean	17	1.9	9
Median	16	0.8	9
Number of Samples	57	57	68
Percent Reduction	74%	-	18%

Virginia Approval Testing Program *(Third Party)*

This testing was conducted by Mark Gross, P.E., Ph.D., of the University of Arkansas Department of Civil Engineering and used AdvanTex AX20 systems, which were installed at 13 single-family homes and sampled for 18 months.

- **Dates/Location:** October 2002-October 2006, Virginia, USA
- **Average Daily Flow:** 90-308gpd (341-1166L/day)
- **System Configurations:** AX20 Mode 1 (4 sites) recirculating into a recirc tank following a separate primary septic tank; AX20 Mode 3 (14 sites) recirculating into the primary compartment of a 1500gal (5678L) processing tank

AdvanTex Effluent

	TN (mg/L)	NH_3 (mg/L)
Mean	15	1.8
Median	12	0.4
Number of Samples	84	84

Green Hill Pond Watershed Demonstration Project *(Third Party)*

The University of Rhode Island Cooperative Extension On-Site Wastewater Training Center constructed and tested several treatment systems, including five AdvanTex systems, in the Green Hill Pond Watershed. The Training Center evaluated the systems' performance while training installers, homeowners, designers, and regulators.

- **Dates/Location:** August 2003-December 2004, Rhode Island, USA
- **System Configuration:** Five AX20s at single-family homes, all configured as Mode 3 and recirculating into the primary compartment of a 1500gal (5678L) processing tank

AdvanTex Effluent (Mode 3 Systems)

	TN (mg/L)	TP
Mean (all sites)	18	9
Median	17	10
Number of Samples	24	24

FIELD TESTING, CONT.

North Carolina Approval Testing Program

(Second Party)

This testing was conducted under state oversight and included 15 AdvanTex systems at single-family homes and vacation rentals. The data include results from both AX20 and AX100 systems.

- **Dates/Location:** August 2003-June 2006, North Carolina, USA
- **Average Daily Flow:** 75-2200gpd (284-8328L/day)
- **System Configurations:** AX20 Mode 1, AX20 Mode 3, and AX100; one system configured as Mode 3 with a single processing tank, and all others configured as Mode 1 with recirculation into a recirc tank following a separate primary septic tank

Septic Tank Effluent (Mode 1 Systems)

	TKN (mg/L)
Mean	66
Median	68
Number of Samples	26

AdvanTex Effluent (Mode 1 Systems)

	TN (mg/L)
Mean	26
Median	25
Number of Samples	95
Percent Reduction	63%

AdvanTex Effluent (Mode 3 System)

	TN (mg/L)
Mean	15
Median	13
Number of Samples	5

Pennsylvania Testing Program *(Third Party)*

This test was performed as required by the State of Pennsylvania under its Onlot Technology Verification Program. NSF International was contracted to oversee the testing, which used AX20 systems installed at 11 single-family homes.

- **Dates/Location:** September 2005-2008, Pennsylvania, USA
- **Average Daily Flow:** 100-300gpd (379-1136L/day)
- **System Configuration:** AX20 Combo Mode recirculating into the primary compartment and secondary compartment of a 1500gal (5678L) processing tank

Processing Tank Influent

	TN (mg/L)	NH_3 (mg/L)
Mean	54	42
Median	43	31
Number of Samples	42	38

AdvanTex Effluent

	TN (mg/L)	NH_3 (mg/L)
Mean	17	1.7
Median	16	0.6
Number of Samples	212	213
Reduction	68%	96%

Maryland Best Available Technology Field Verification *(Third Party)*

Field verification testing was performed on AdvanTex AX20 and AX20-RT systems to qualify them for the "Best Available Technology" designation in Maryland. A total of 24 single-family residences were selected, with 12 of them receiving AX20 units and 12 receiving AX20-RT units. Each system was sampled every quarter for one year.

- **Dates/Location:** May 2008-March 2010 (AX20), August 2010-March 2012 (AX20-RT), Maryland, USA
- **Average Daily Flow (AX20):** 90-400gpd (341-1514L/day)
- **Average Daily Flow (AX20-RT):** 100-400gpd (379-1514L/day)
- **System Configuration:** Mode 3 for all units

AdvanTex AX20 Effluent (Mode 3 Systems)

	TN (mg/L)
Mean	18
Median	14
Number of Samples	48

AdvanTex AX20-RT Effluent (Mode 3 Systems)

	TN (mg/L)
Mean	15
Median	14
Number of Samples	48