Stormwater Technologies

The U.S. EPA Environmental Technology Verification (ETV) Program's Water Quality Protection (WQP) Center, operated by NSF International under a cooperative agreement with EPA, recently verified the performance of 14 stormwater technologies[1]: nine stormwater source-area treatment devices, one in-drain treatment technology, two induction mixers, and two flow meters. Two additional verifications for stormwater technologies will be completed in 2007. ETV also developed a protocol to verify grouting materials for infrastructure rehabilitation, in preparation for testing in this area. These grouts can be used to control leaks in wastewater and stormwater collection and dispersion systems.

Roads, parking lots, and other impervious surfaces can prevent stormwater from naturally infiltrating into the ground. When this occurs, excess stormwater flows overland into streams, rivers, or storm drains, often picking up debris, particulate matter, nutrients, pesticides, metals, and other pollutants along the way. Unless treated properly, polluted stormwater can cloud rivers, destroy habitats, and adversely impact the growth and survival of aquatic life. Pathogens, and toxic chemicals carried by polluted stormwater also present a human health risk.

Stormwater Treatment at a Glance

Based on the results of the 2000 National Water Quality Inventory, approximately 39% of streams, 46% of lakes, and 51% of estuaries assessed as part of the survey do not meet water quality standards. EPA identified urban runoff and stormwater sewers as major sources of this impairment, impacting 13% of impaired rivers, 18% of impaired lakes, and 32% of impaired estuaries (U.S. EPA, 2002). Stormwater discharges from urban and industrial sources are regulated through the National Pollutant Discharge Elimination System (NPDES) Stormwater Program, which is mandated under the Clean Water Act. This program uses NPDES permits to ensure that controls are put in place to prevent polluted stormwater from entering the nation's waterways.

Table 1 includes the thirteen verified stormwater treatment technologies and two verified flow meters. The verified source-area treatment devices are used to treat stormwater runoff from urban or catchment areas before it enters a stormwater collection system or surface water body. The verified in-drain treatment technology is used within existing catch basins at industrial and commercial sites. The verified induction mixers are used to disinfect combined sewer overflows and sanitary sewer overflows by rapidly dispersing a fine spray of chemical disinfectant within the contaminated wastewater. Collaborators included the United States Geological Survey (USGS); the State of Wisconsin; the City of St. Clair Shores, Michigan; the City of Griffin, Georgia; and the City of Harrisburg, Pennsylvania.

Table 1. Verified Stormwater Treatment Technologies

Technology Category	Developer and Name
Source-Area Treatment Devices	Stormwater Management, Inc., Stormscreen® Treatment System
	Stormwater Management, Inc., StormFilter® using ZPG Filter Media
	Stormwater Management, Inc., StormFilter® using Perlite Media
	Stormwater Management, Inc., Catchbasin Stormfilter™
	Zeta Technologies, Inc., Arkal Pressurized Stormwater Filtration System
	Vortechnics, Inc., Vortechs® System, Model 1000
	Baysaver Technologies, Inc., Baysaver Separation Systems, Model 10K
	Practical Best Management of Georgia, Inc., CrystalSteam™ Water Quality Vault Model 1056
	Terre Hill Concrete Products, Inc., Terre-Kleen[A]
In-Drain Treatment Technology	Hydro-Kleen™ Filtration System
High-Rate Disinfection - Induction Mixers	Mastrrr Company, GAS MASTRRR Series 32 Submersible Chemical Induction Mixer
	USFilter/Stranco Products, Water Champ® F Series Chemical Induction System
Flow Meters	ADS Environmental Services Model 3600 Open Channel Flow Meter
	ADS Environmental Services Model 4000 Open Channel Flow Meter

[A] Verification report will be posted on the ETV Web site in the near future.

www.epa.gov/etv

[1] The ETV Program operates largely as a public-private partnership through competitive cooperative agreements with non-profit research institutes. The program provides objective quality-assured data on the performance of commercial-ready technologies. Verification does not imply product approval or effectiveness. ETV does not endorse the purchase or sale of any products and services mentioned in this document.

Test Descriptions and Results

Below are short descriptions of the stormwater treatment tests:

Source-Area Treatment: ETV field tested the ten devices for approximately a year, sampling a minimum of 15 qualified-as-testable rain events for each device. ETV evaluated pollutant reductions including total suspended solids (TSS) and nutrient concentrations.

In-Drain Treatment: ETV verified the in-drain treatment technology using a testing apparatus designed to simulate a catch basin receiving surface runoff under a variety of hydraulic flows and contaminant loadings. ETV determined reductions in TSS, oil and grease (O&G), total petroleum hydrocarbons (TPH), and other parameters.

Induction Mixers: ETV verified the induction mixers at the USGS's Conte Anadromous Fish Research Center by evaluating the volume of water affected by the mixer (i.e. mixing zone); testing used dyes and clean water in place of chemical disinfectants and wastewater.

Tables 2 and **3** summarize the performance data for the verified source-area and in-drain treatment technologies; performance data for the verified induction mixers and flow meters are not listed. Verification reports are located at: http://www.epa.gov/etv/verifications/vcenter9-2.html, http://www.epa.gov/etv/verifications/vcenter9-6.html, http://www.epa.gov/etv/verifications/vcenter9-7.html, and http://www.epa.gov/etv/verifications/vcenter9-9.html. These reports fully describe the verification tests and results.

Selected Potential Outcomes of Verified Stormwater Technologies

Performance information for these systems can be used by potential owners/operators of these systems when making purchasing decisions to reduce pollutant loading from stormwater discharges. Planners, policy makers, and permitters can use it to develop area- and watershed-wide plans for water quality improvement using regulatory standards-based and/or tradable credits-based approaches. Permitters can also use ETV data to help determine whether a verified technology can be used at a permitted site and to support other permitting decisions at these sites.

References

U.S. EPA, 2002. National Water Quality Inventory 2000 Report. EPA/841/R-02/001. August.

U.S. EPA, 2003. After the Storm. EPA/833/B-03/002. January.

U.S. EPA, ETV, http://www.epa.gov/etv, particularly the verification report locations cited above.

Table 2. Selected Performance of Verified Source-Area Treatment Devices[A]

Parameter	Average Reductions
Total suspended solids	11-82%
Suspended sediment concentration	9-89%
Total Kjeldahl nitrogen	13-26%
Total phosphorus	9-55%

[A] Not all units were tested for all parameters. Averages were calculated by aggregating the results obtained for the different parameters and applying a sum of loads method.

Table 3. Selected Performance of Verified In-Drain Treatment Technology[A]

Statistical Measure[B]	TPH Influent mg/L	TPH Effluent mg/L	TPH Percent Reduction	O&G Influent mg/L	O&G Effluent mg/L	O&G Percent Reduction
Average	48	13	77	62	13	78
Median	47	11	81	65	14	78
Maximum	88	22	95	126	19	97
Minimum	10	<10	32	7.8	5.5	29
Standard Deviation	24	3.8	0.2	31	4.6	0.2

[A] Excerpted from http://www.epa.gov/etv/verifications/vcenter9-6.html .
[B] Statistical measures based on 17 sets of TPH samples and 15 sets of O&G Samples.

Flow Meters at a Glance

ETV verified two flow meters that can be used to measure wastewater, stormwater, and combined sewer system flow rates. Local sewer authorities and private facility owners/operators can use these data to more confidently calculate pollutant and hydraulic loadings from facilities. State and local permitting authorities can also use the information to make permitting decisions. The ETV Program verified the meters in two phases, first in the laboratory and then in the field. The Utah Water Research Laboratory, at Utah State University in Logan, Utah, performed the laboratory testing with field testing conducted in a section of the Quebec Urban Community's sewer network, located in the City of Sainte-Foy, Quebec, Canada. ETV evaluated flow meter performance relative to reference devices that are directly traceable to the National Institute of Standards and Technology.

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