

Environmental Technology Verification for Air Pollution Control Technologies

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Final Report

by

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Notice

This document was prepared by RTI International (RTI) with funding from Cooperative Agreement No. CR829434-01-1 with the U.S. Environmental Protection Agency (EPA). The document has been submitted to RTI/EPA's peer and administrative reviews and has been approved for publication. Mention of corporation names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products.

Abstract

This report is submitted in fulfillment of CR 82943401 by Research Triangle Institute under the sponsorship of the United States Environmental Protection Agency and covers a period from September 15, 2001, to September 14, 2004. Work is continuing under a separate cooperative agreement.

The technical objective of the Environmental Technology Verification (ETV) Air Pollution Control Technologies Verification Center (APCT Center) is to verify environmental technology performance by obtaining objective, quality-assured data, thus providing potential purchasers and permittees with an independent, credible assessment.

A Stakeholders Advisory Committee (SAC), comprised of a highly qualified core group with a wide range of perspectives and collective experience, provided guidance and input on the various factors used to evaluate candidate technologies. Candidate technologies were ranked based on several factors, including the importance of air pollutant, commercial availability and multiple vendors, available test methods, and interest by vendors and developers.

As a priority pollutant, particulate matter was of great interest, and the APCT Center focused on technology areas that would have the most impact on reducing these emissions. Although work began during the initial pilot period, efforts continued in the verification of baghouse filtration products because of the increasing interest in high efficiency for small particle sizes. Work also continued in the verification of retrofit technologies for mobile sources and of dust suppressants, as mobile sources and fugitive dust emissions are primary sources for particulate matter. The Center also continued evaluating bioreaction technologies to reduce VOC emissions.

Over a period of three years, the APCT Center produced 12 verification reports. These documents were placed on the EPA Web site: <http://www.epa.gov/etv> and the RTI Web site: <http://etv.rti.org/apct>.

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1.0 INTRODUCTION

1.1 Background

This final report fulfills the contractual requirements in the cooperative agreement, CR82943401. The report describes the activities of the Air Pollution Control Technology Verification Center (APCT Center) and Stakeholders Advisory Committee (SAC) and summarizes the accomplishments of the specific verification areas under this agreement. Work was continued from the pilot program funded under cooperative agreement CR 82615201-3 and has been extended under a separate cooperative agreement.

Generic verification protocols (GVPs), test/quality assurance (QA) plans, verification reports, and verification statements were posted to the Web site (<http://etv.rti.org/apct>) following approval by EPA's Office of Research and Development. Meeting minutes were also posted after meeting attendees were given the opportunity to review and comment on them. Minutes of all the technical panel meetings can be accessed from the index page <http://etv.rti.org/apct/tech/index.cfm>. Other uniform resource locators (URLs) are provided here for reference.

1.2 Technical Objectives

The technical objective of the overall Environmental Technology Verification (ETV) Program is to verify environmental performance of selected technologies by developing objective, quality-assured data, thus providing potential purchasers and permittees with an independent, credible assessment.

The ETV APCT Center developed a strategy to meet its objective of furthering the development of self-supporting private testing/certification programs for air pollution control technologies. To achieve this goal, the Center:

- Convened stakeholder advisory committees and technical panels,
- Developed and verified test protocols,
- Tested commercially available technologies voluntarily offered by vendors,
- Prepared verification statements and reports and publicly disseminated them via the EPA and Research Triangle Institute (RTI) ETV Web sites, and
- Provided quality and technical support as needed during privatization.

2.0 ACCOMPLISHMENTS

2.1 Program Management

The cooperative agreement CR 82943401 (RTI 08281) is in place from September 15, 2001 to September 14, 2006; however, existing funding ran out in 2004. This final report, covering the period from September 15, 2001 to September 14, 2004, completes the requirements of this cooperative agreement. Funding was \$1,217,700. Andrew R. Trenholm was the RTI program manager. The program management personnel matrix is illustrated in Figure 1.

Program Management Andrew R. Trenholm		
<i>Technology</i>	<i>Administrative</i>	<i>Quality Assurance</i>
Mobile Sources Jenni M. Elion Dust Suppressants Deborah L. Franke Baghouse Filtration Products Andrew R. Trenholm Volatile Organic Compounds Andrew R. Trenholm Emulsified Fuels Andrew R. Trenholm Add-on NOx Controls Douglas W. Van Osdell	Financial Jennifer L. Westcott Communication & Outreach Jenni M. Elion	Gene Tatsch

Figure 1. Organization of the Air Pollution Control Technology Verification Center

The APCT Center submitted separate monthly and quarterly progress reports to Michael Kosusko, the EPA Center Manager.

2.1.1 ETV Team Meetings

RTI participated in the following ETV team meetings and provided updates of our center.

- October 21-23, 2002, Cincinnati, OH
- April 1-3, 2003, Charleston, SC
- October 14-15, 2003, Las Vegas, NV
- May 11-12, 2004, Arlington, VA

2.1.2 Quality

The value of ETV/APCT Center data rests on the credible, high-quality performance information released in Verification Statements and Verification Reports. To produce such data, the APCT Center quality program, developed and implemented by RTI depends on systematic application of activities addressing the quality of processes and oversight, including verification-specific activities. These activities are consistent with the spirit and letter of EPA's quality system requirements and guidance. Program-related activities included:

- Paul Groff and Robert Wright of EPA met with Gene Tatsch (quality manager), Andrew Trenholm (program manager), and Jenni Elion of RTI/APCT Center on December 29, 2003, and conducted a quality systems audit of the center
- The program manager with the active support of the quality manager (and other RTI staff, as appropriate) ensured that the various processes and activities specified in the approved APCT Center QMP were implemented in a timely, effective, and efficient manner

Within the APCT Center management responsibility are technology-specific tasks, including preparation of Generic Verification Protocols (GVPs), Test/Quality Assurance Plans (T/QAPs), Verification Statements (VSs), and Verification Reports (VRs). These activities included:

- All the above mentioned documents underwent EPA technical and quality review for each technology tested
- The APCT Center program manager (PM) and quality manager (QM) participated in development of four GVPs, one T/QAP, and four associated T/QAP addenda prior to their submission to EPA for review
- The PM and QM reviewed each data package from each technology test in detail for technical and quality-related issues to ensure the credibility and high quality of VSs and VRs submitted to EPA

2.1.3 Business Plan

The APCT Center monitored marketing activities with ETS and the SAC to better inform vendors, users, and regulators about center activities. Marketing efforts have focused on developing case studies of vendors who have completed the verification process and how they have benefited from the ETV program. The center has marketed its accomplishments in trade journals, publications, and conferences via program fact sheets and technology-specific profiles. The center has posted the fact sheets and profiles on its web site, along with pdf files of papers and presentations.

2.2 Technical Achievements

A highly qualified core group that agreed to participate in the SAC during the APCT pilot program continued their involvement as the center evolved. With its wide range of perspectives and collective experience, the SAC provided guidance and input on the various factors used to evaluate candidate technologies.

Candidate technologies were ranked based on the following factors:

- Importance of air pollutant,
- Commercial availability and multiple vendors,
- Available test methods,
- Interest by vendors and developers,
- Market potential, and
- Potential for self-sustainability.

The SAC and the technology focus areas are discussed in greater detail in the following sections. A summary of the test protocols and test/QA plans and verification reports is given in Table 1. This does not include test protocols, test/QA plans, and verification reports completed during the pilot phase. All the completed verification reports are listed later with reference to their web site location.

Table 1. Summary of APCT Center Technical Achievements

	# members	# meetings	Vendor mtgs.	# protocols	# test plans	# reports
Stakeholders Advisory Committee	27	3 ^a				
Mobile Sources	71	6 ^b	2	2	7	7
Dust Suppressants	33		1		3 ^c	5
Baghouse Filtration Products	41	1 ^b	1	1 ^d		
Volatile Organic Compounds	23	1 ^b		1		

^a A fourth SAC meeting, scheduled for 9/20/01 was cancelled following the terrorist attack of 9/11.

^b Technical panel established during pilot phase of program; technical meetings held between 9/15/01 and 9/14/04.

^c Includes one test plan for the demonstration phase and two test plans for verification testing at two different sites.

^d Protocol revised to reduce filtration velocity.

2.2.1 Stakeholders Advisory Committee

Over the course of the program, members representing the Air & Waste Management Association (AWMA), American Boiler Manufacturers Association (ABMA), American Chemistry Council (ACC), American Society of Mechanical Engineers (ASME), American Society for Testing and Materials (ASTM), California Air Resources Board (CARB), Chemical Manufacturers Association (CMA), Council of Industrial Boiler Owners (CIBO), Dayton Regional Air Pollution Control Agency, U.S. Environmental Protection Agency (U.S. EPA), Institute of Clean Air Companies (ICAC), Manufacturers of Emissions Controls Association (MECA), National Association of Manufacturers (NAM), National Audubon Society, National Council of Air and Stream Improvement, Northeast States for Coordinated Air Use Management (NESCAUM), and State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO) have served on the SAC.

Under this cooperative agreement, stakeholder meetings have been held on a biannual basis in the fall and spring.

- September 20, 2001, Research Triangle Park, NC
This meeting was cancelled on 9/17 due to the terrorist attacks of 9/11.
- March 13, 2002, Research Triangle Park, NC
(<http://etv.rti.org/apct/advisory/02Mar13/index.html>)
- September 18, 2002, Research Triangle Park, NC
(<http://etv.rti.org/apct/advisory/02Sep18/index.html>)
- March 5, 2003, Research Triangle Park, NC
(<http://etv.rti.org/apct/advisory/03Mar05/index.html>)

The SAC continues to provide guidance and input to the APCT Center under cooperative agreement CR 831911-01-1.

2.2.2 Mobile Sources

This area was proposed as a technology for ETV testing because of the intense interest in controlling NO_x and PM from mobile sources, the new highway regulations scheduled to go into effect in 2004, the new fuel requirements scheduled to go into effect in 2007, and voluntary retrofit programs for state implementation plan (SIP) credits. The SAC recommended that the task area be expanded to include nonroad engines as well.

The protocol was based on the Federal Test Procedure (FTP) described in 40 CFR Part 86 for highway engines and 40 CFR Part 89 for nonroad engines. After completing a protocol for verification of retrofit devices, the technical panel held additional meetings in 2002 to develop a protocol for selective catalytic reduction systems and a protocol for alternative and reformulated fuels. These protocols, *Generic Verification Protocol for Determination of Emissions Reductions from Selective Catalytic Reduction Control Technologies for Highway, Nonroad, and Stationary Use Diesel Engines* and *Generic Verification Protocol for Determination of Emissions Reductions Obtained by Use of Alternative or Reformulated Liquid Fuels, Fuel Additives, Fuel Emulsions, and Lubricant for Highway and Nonroad Diesel Engines and Light-Duty Gasoline Engines*, were approved in September 2003 and posted to the Web site the following month.

Many of the applicants to the verification program were seeking approval for the Voluntary Diesel Retrofit Program (VDRP) from EPA's Office of Transportation and Air Quality (OTAQ), certification from California Air Resources Board (CARB), or both. The center worked closely with the applicants and representatives from OTAQ and CARB to ensure that the test plans developed would produce data suitable for vendor submission under VDRP.

Most of the manufacturers that contacted the center during this period were seeking verification under the devices protocol. These applicants listed below either contacted the center for general information, or submitted the Intent to Verify form or application, but did not sign a contract with the center to conduct verification.

- AES, EPCS exhaust headers
- Algae-X International, magnetic fuel conditioning device
- Allison Transmission, hybrid propulsion system
- Arvin Meritor, diesel oxidation catalyst
- Arvin Meritor, diesel particulate filter thermal regeneration system
- Bose, Bose System Mark I automobile anti-air pollution and energy conservation system
- CleanAir Associates, fuel line catalyst
- Concepts Unlimited, (AEGIS) Air Enriched Gas Induction System
- Dr. Performance, diesel propane engine kit
- Egregor, ThermaPore biofilter
- Faurecia Exhaust Systems, diesel particulate filter and selective catalytic reduction
- Finnkat, diesel oxidation catalyst
- FreEnergy Group, LLC, EnergyCel magnetic fuel ion modifier
- Fuel Preparator, Inc. (formerly Diesel Products, Inc.), FP-135 fuel delivery system
- Infineum, Vektron gasoline additive
- Magna-Guard, Inc., oil filter magnets
- Mann+Hummel, Pro-Vent 200 CCV coalescing filter
- Mirenco, DriverMax throttle management system
- Nett Technologies, DH diesel oxidation catalyst + SF1100 diesel particulate filter
- Octel, fuel-borne catalyst plus diesel particulate filter
- PFC Environmental Products, Flux wave cell
- PFC Environmental Products, PM catalyst
- Rotec Design Ltd., FreedomAir Twin Stroke CU-C-1000
- Tadger Group International, Tadger (creates controlled turbulence in fuel that results in more efficient combustion)

- Tipaz, Zetron mobile electron beam systems

The following manufacturers contacted the Center during this period seeking verification under the fuels protocol. These applicants either contacted the Center for general information, or submitted the Intent to Verify form or application, but did not sign a contract with the center to conduct verification. The high cost of the verification testing was usually cited as the reason for not conducting verification testing, although some manufacturers sought financing through award and grant programs administered by other agencies.

- Agro Management, AMG2000 vegetable-based lubricant
- Aquafuel, HFO3 emulsified fuel
- Bio*Friendly, Green Plus combustion catalyst added to fuel
- EcoEnergy Solutions, A-55 emulsified boiler fuel
- EnviroFuels, Diesel fuel catalyzer
- Filtakleen, ILFC 1035 fuel line catalyst
- GTA Technologies, high molecular weight polymer fuel additive
- H2OIL Corp., F2-21 10/5J fuel additive and F2-21 3/9C fuel additive
- Oryxe Energy International, Inc., OR-EPA diesel fuel additive
- Pacific Petroleum, fuel additive, lube oil additive
- SolPower, Soltron enzyme fuel treatment
- World Energy Alternatives, Envirodiesel B20 biodiesel fuel
- Panther Water & Fuel Solutions
- Rentar Fuel Catalyst

The following manufacturers contacted the center during this period seeking verification under the SCR protocol. These applicants either contacted the center for general information, or submitted the Intent to Verify form or application, but did not sign a contract with the center to conduct verification. Discussions with these manufacturers are continuing under the new cooperative agreement.

- Combustion Components Associates, Elim-NOx MSCR-00 urea-based SCR
- Johnson Matthey, SCR urea system with CRT filter
- Haldor Topsoe
- KleenAir, SCR plus DPF

The following manufacturers contacted the center during this period seeking general information only. They did not provide enough information to classify their technology or respond to follow-up emails.

- Afco Environmental
- American Energy Group
- Cleaire Advanced Emissions Controls
- CleanAIR Systems
- Clear Imaging Alternatives
- Combustion Technologies, Ltd.
- DCL-International
- FuelFX
- Lyon Development
- Metalbrook Energy Group
- Motormaster

- Oxy-Adders Inc.
- Peroulis
- PowerClean 2000
- Precision Combustions
- Universal Cams

During this period, the center verified the technologies from four different applicants under the devices protocol, resulting in seven verification reports.

- Donaldson Company, Inc., Series 6000 Diesel Oxidation Catalyst Muffler and Spiracle Closed Crankcase Filtration System
(http://etv.rti.org/apct/pdf/Donaldson%20VR_6000+spiracle.pdf)
- Donaldson Company, Inc., Series 6100 Diesel Oxidation Catalyst Muffler
(http://etv.rti.org/apct/pdf/Donaldson%20VR_6100.pdf)
- Donaldson Company, Inc., Series 6100 Diesel Oxidation Catalyst Muffler and Spiracle Closed Crankcase Filtration System
(http://etv.rti.org/apct/pdf/Donaldson%20VR_6100+spiracle.pdf)
- Lubrizol Engine Control Systems Purifier SC17L
(http://etv.rti.org/apct/pdf/Lubrizol_Verification_Report_6-9-04.pdf)
- Clean Diesel Technologies Fuel-Borne Catalyst with CleanAir System's Diesel Oxidation Catalyst
(http://etv.rti.org/apct/pdf/CDT_FBC+DOC_VerificationReport_2-5-04.pdf)
- Clean Diesel Technologies Fuel-Borne Catalyst with Mitsui/PUREarth Catalyzed Wire Mesh Filter
(http://etv.rti.org/apct/pdf/CDT_FBC+CWMF_VerificationReport_9-27-04.pdf)
- Clean Clear Fuel Technologies, Inc., Universal Fuel Cell
(<http://etv.rti.org/apct/pdf/CCFTVerificationReport2-22-05.pdf>)

Activities in this area will continue under RTI's new cooperative agreement.

2.2.3 Dust Suppressants

This area was selected for verification because PM is one of EPA's six criteria pollutants, and fugitive emissions from unpaved roads represent about 41% of direct PM₁₀ emissions, making them the greatest single source. Fugitive emissions from unpaved roads also make up about 34% of direct PM_{2.5} emissions.¹

Before assembling a technical panel, the task leader convened a meeting for manufacturers and possible participants to gauge interest. The manufacturers noted several concerns to be addressed by the technical panel:

- Location of the test (e.g., geography, geology, and climate),
- Proposed verification test approach (e.g., application rate),
- Associated environmental impacts (e.g., storm water run-off), and

¹ Watson, J.G., Chow, J.C. *Reconciling Urban Fugitive Dust Emissions Inventory and Ambient Source Contribution Estimates: Summary of Current Knowledge and Needed Research*. DRI Document No. 6110.4F. Desert Research Institute, Reno NV, 2000.

- Markets (e.g., focus the road dust suppressant verification on a market of broad interest).

The task leader assembled a technical panel comprised of members representing manufacturers of dust suppressants and soil stabilizers, state and local government agencies, end users, and the Civil Engineering Research Foundation (CERF). The manufacturers wanted a simple test program that would give good results at a reasonable cost so that verification would be within financial reach of small companies.

A profiling technique has been used for some time to collect total PM, PM₁₀, and PM_{2.5}. This method is labor-intensive and very dependent upon wind direction. With support from the U.S. Army, MRI developed a mobile sampling device mounted behind a truck. Mobile sampling, when correlated with the results from profiling, will be substituted in later tests for profiling to reduce testing costs.

Under the guidance of *Test/QA Plan for Testing of Dust Suppressant Products and Comparison of Dust Emissions Monitoring Methods at Fort Leonard Wood, Missouri*, MRI conducted a 3-month preliminary test at Fort Leonard Wood, MO, to compare the control efficiencies resulting from profile measurements and the mobile sampling device measurements. The preliminary test included six products from three vendors and was conducted from October 2001 to January 2002.

Because the test/QA plan was developed for the preliminary test and not the verification test, it was not published on the Web site. Test reports for the six products included in the pilot test, which are listed below, were not published on the Web sites.

- Enviroseal Corporation (Port St. Lucie, FL), Enviroseal LDC
- Midwest Industrial Supply, Inc. (Canton, OH), EK35
- Midwest Industrial Supply, Inc. (Canton, OH), EnviroKleen Version C
- Midwest Industrial Supply, Inc. (Canton, OH), EnviroKleen
- SynTech Products Corporation (Toledo, OH), EC CRYL SUPPRESS
- SynTech Products Corporation (Toledo, OH), PetroTac

Based on the results of the pilot test, several changes were made to the *Generic Verification Protocol for Dust Suppression and Soil Stabilization Products*:

- EPA Method 9E observations were removed,
- Water baseline testing was removed, and
- Statistical analysis was improved.

Test/QA plans based on the protocol were developed for the two sites chosen for field testing:

- *Test/QA Plan for Testing of Dust Suppressant Products at Fort Leonard Wood, Missouri* (<http://etv.rti.org/apct/pdf/FLW1-yrDraftTest-QAPlan10-17-02.pdf>), and
- *Test/QA Plan for Testing of Dust Suppressant Products at Maricopa County, Arizona* (<http://etv.rti.org/apct/pdf/Maricopa1-yrDraftTest-QAPlan10-17-02.pdf>).

Full verification tests of dust suppression products were begun in June 2002. At Fort Leonard Wood, MO, testing includes two products from Midwest Industrial Supplies, two products from

Syntech Products Corporation, and one product from North American Salt Corporation. At Maricopa County, AZ, testing included two products from Midwest Industrial Supplies. Testing was completed in September 2003, and five verification reports were posted to the Web sites in December 2005.

- Midwest Industrial Supply, Inc. (Canton, OH), EK[®]35 (http://etv.rti.org/apct/pdf/VREK352005_12-13-05.pdf)
- Midwest Industrial Supply, Inc. (Canton, OH), EnviroKleen[®] (<http://etv.rti.org/apct/pdf/VREnviroKleen2005-12-13-05.pdf>)
- North American Salt Company (Overland Park, KS), DustGard (http://etv.rti.org/apct/pdf/VRDustGard2005_12_13_05.pdf)
- SynTech Products Corporation (Toledo, OH), PetroTac[®] (<http://etv.rti.org/apct/pdf/VRPetroTac2005-12-13.pdf>)
- SynTech Products Corporation (Toledo, OH), TechSuppress[™] (<http://etv.rti.org/apct/pdf/VRTechSuppress2005-12-13.pdf>)

2.2.4 Baghouse Filtration Products

As with dust suppressants, this area was selected for verification because PM is one of EPA's six criteria pollutants. The test method, developed for the protocol during the pilot phase of the program, was accepted by the American Society to Testing and Materials and published as ASTM method D6840 in December 2002.

The center verified the performance of 15 products total for eleven vendors during three rounds of testing during the pilot phase. In October 2002, the technical panel met to consider whether changes to the protocol were necessary. Because more applications requiring high efficiency at small particle sizes were using light-weight membrane fabrics, the technical panel decided to modify the protocol to allow testing of such fabrics at a lower pressure drop.

During a vendors' teleconference on April 17, 2003, potential changes to the BFP protocol regarding testing of light-weight membrane fabrics, use of a reference fabric for performance comparisons, and lowering the detection limit for outlet dust concentration were discussed. Suggested improvements included generating reports that were more readable for end users and more closely aligned with field experience and adding an option to test light-weight membrane fabrics. Some vendors volunteered to supply information that may allow comparison between verified fabrics and their use in the field. Suggestions for sources of funding were requested for the work needed to change the protocol.

The protocol developed during the pilot phase was modified to allow testing at a lower filtration velocity and approved. No verification tests were conducted in this area over the time period. Activities in this area will continue under RTI's new cooperative agreement.

2.2.5 Volatile Organic Compounds

This area was selected for verification because the market for VOC control technologies is expected to grow substantially, driven by MACT/RACT/BACT/LAER regulations.

The task leader assembled a technical panel comprised of members representing manufacturers, test laboratories, state and local government agencies, and end users. The protocol was limited to bioreaction technology, defined as a closed system using microbes to control a gas stream containing VOCs, and included bioreactors, biofilters, bioscrubbers, and biomembranes. Open systems were not covered within the scope of the protocol. The protocol, *Generic Verification Protocol for Bioreaction System Control Technologies for Volatile Organic Compound Emissions*, was approved in September 2003 and posted to the Web site the following month.

One vendor applied for verification testing of a biofilter installed at a paint manufacturing facility in California for VOC control. Verification of the technology was delayed until the plant came up to full production capacity.

Activities in this area will continue under RTI's new cooperative agreement.

3.0 OUTREACH

Outreach activities conducted by the APCT Center included periodic communication with the SAC and technical panel members through meetings and email, updates to the center website, and publication of accomplishments in trade journals and presentations at trade shows.

3.1 Constituent Information System (CIS)

The Constituent Information System (CIS) is a database of air pollution control technology developers/vendors; regulators; test laboratories; end users; trade associations; and local, State, and Federal agencies. The database was initially compiled from technical association Web sites (Institute of Clean Air Companies, A&WMA, Pollution Online Guide to Products); published buyer's guides (Pollution Equipment News); manufacturers' Web sites; and trade magazines and journals. It includes names, addresses, telephone numbers, fax numbers, and email addresses when available. For technology developers and vendors, the control technologies offered by each company are listed. The database has grown to over 1000 firms and organizations. The CIS has been used to identify and contact manufacturers and vendors of the technologies selected thus far and invite their participation in the testing program. This tool is also used as a messaging center for communication with individuals, companies, and groups via email and fax, as well as for scheduling events related to the ETV program.

3.2 APCT Center Web Site

The APCT Center Web Site supplements the EPA's ETV Web Site. It was launched to disseminate information about the program to the targeted community of air pollution control technology developers, manufacturers, vendors, end users, regulators, and others, as well as the general public. Completed verification reports and verification statements are posted on both the APCT Center and ETV Web Sites, along with the GVPs and test/QA plans. Visitors to the APCT Center Web Site can also review recent publications and minutes of previous meetings, see when upcoming meetings were scheduled, submit technologies to be verified, and request to be added to the CIS.

As seen by the usage statistics in Figure 2, the Web site has become a valuable tool. In this figure, a visitor is usually defined simply as a unique internet protocol (IP) address, and a visit is a collection of requests that represent all the pages and graphics seen by a particular visitor at one time.

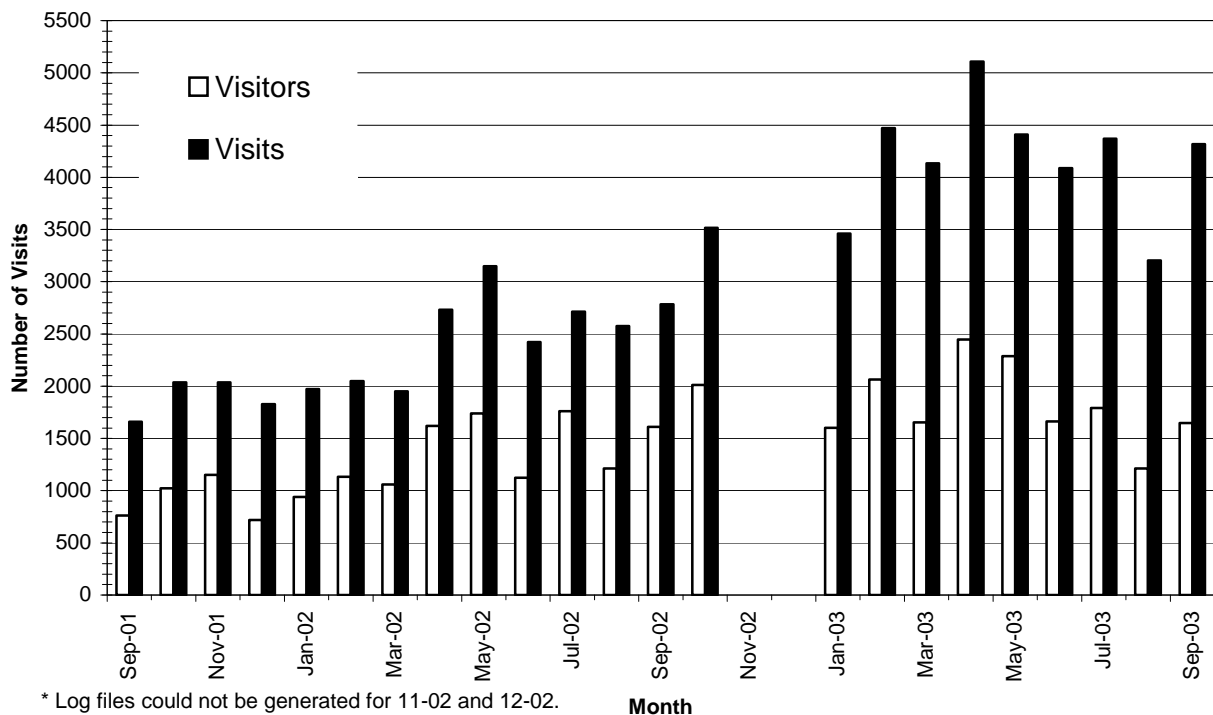


Figure 2. Usage Statistics for APCT Center Web site

3.3 Published Articles and Presentations

Nine articles and presentations were prepared by the APCT Center under this cooperative agreement. Selected publications are available on the APCT Center Web Site.

- McKenna, J. “ETV APCTVC Overview.” Virginia Department of Environmental Quality, Richmond, VA, December 6, 2002.
- McKenna, J. “ETV APCTVC Overview.” Virginia Department of Environmental Quality, Roanoke, VA, January 6, 2003.
- Trenholm, A. R. “Environmental Technology Verification.” Texas Industries of the Future and DOE, Houston, TX, March 17-18, 2003.
- Trenholm, A. R. “Improving Air Quality Through Environmental Technology Verifications,” National Defense Industrial Association (NIDA), Richmond, VA, April 7-9, 2003.

- Brna, T. “Environmental Technology Verification: A Vehicle for Independent Creditable Performance Results on Commercially Ready Technologies (Paper #71006).” A&WMA 96th Annual Conference & Exhibition, San Diego, CA, June 22-26, 2003.
- Trenholm, A. R. “Verifying the VOC Control Performance of Bioreactors (Paper #69850).” A&WMA 96th Annual Conference & Exhibition, San Diego, CA, June 22-26, 2003.
- Franke, D. L. “Dust Suppression and Soil Stabilization Products — Long Term Verification of Performance on Roads (Paper #69623).” A&WMA 96th Annual Conference & Exhibition, San Diego, CA, June 22-26, 2003.
- Trenholm, A. R. “Performance Verification for Air Pollution Control Technologies.” Environmental Innovations Summit, Washington, DC, July 16, 2003.
- Trenholm, A. R. “Performance Verification for Air Pollution Control Technologies.” Industrial Emissions Conference, sponsored by the Council of Industrial Boiler Owners, Charlotte, NC, August 2003.

3.4 Conference Attendance

Andrew Trenholm represented the APCT Center at seven conferences and workshops.

- SERDP & ESTCP Symposium & Workshop, Washington, DC, December 3-5, 2002.
- Clean Heavy-Duty Vehicles, Phoenix, AZ, February 19-21, 2003.
- Texas Industries of the Future and DOE, Houston, TX, March 17-18, 2003.
- National Defense Industrial Association (NIDA), Richmond, VA, April 7-9, 2003.
- 96th Annual Conference and Exhibition, AWMA, San Diego, CA, June 22-26, 2003.
- Environmental Innovations Summit, Washington, DC, July 16, 2003.
- Industrial Emissions Conference, sponsored by the Council of Industrial Boiler Owners, Charlotte, NC, August 2003.

4.0 BUDGET

EPA provided \$1,217,700, with RTI committing to a cost share of \$60,885. RTI exceeded its cost share commitment by \$471,470. Cost share was earned through program income and donated services. Fees paid by the applicants for product verifications generated program income. SAC members’ time to attend the SAC meetings contributed to donated services. The sources and amounts of income are shown in Table 2.

Table 2. Funding Sources for APCT Center ETV Program

EPA	\$1,217,700
COST SHARE EARNED	\$532,355
<i>Program Income</i>	\$530,490
<i>Donated Services</i>	\$1,865
TOTAL FUNDING	\$1,750,055

5.0 CONCLUSIONS

The APCT Center is an environmental technology verification organization with active programs in six technology areas; paint overspray arrestors, baghouse filtration products, add-on NO_x controls, mobile sources, dust suppressants, and VOC controls. This Center is one of six selected from the initial 12 pilot programs for continued funding. Other conclusions are listed below.

- Areas of most interest have focused on control of particulate matter (i.e., mobile sources, baghouse filtration products, and dust suppressants).
- The mobile sources area attracted greater interest than other areas because it was coordinated with a specific EPA regulatory program, the voluntary diesel engine retrofit program. The verification tests, while conducted independently of this program, provided data that was acceptable to the regulatory program.
- The cost of a verification test continues to be a barrier to attracting greater numbers of vendors to participate in the APCT Center. This is particularly true when the verification tests must be conducted one device at a time on a full-scale installation (i.e., only one vendor provides funds).
- The use of interested stakeholders to provide guidance and direction to the APCT Center and to help prepare generic verification protocols was very efficient and effective.
- The ETV Program and the APCT Center are not widely recognized and understood by vendors, users, and permittees.

6.0 RECOMMENDATIONS

EPA's ongoing involvement is integral to the continued success of the ETV program. EPA should continue funding for the APCT Center to support operation and marketing of the center, and development of additional verification areas. In addition, the EPA and the APCT Center should increase interaction and leveraging of funds with other organizations such as DOD, the Texas Council on Environmental Technology, grant programs, etc.

When possible, verification approaches should focus on generating verification data that can be used by vendors to market their products for compliance with existing or upcoming regulatory programs. Also, an increase in effort by the EPA and the APCT Center is needed to gain greater

exposure and recognition for the “ETV” and “APCT Center” names.