Environmental Technology Verification Program Verification Strategy

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Background

Throughout its history, the U.S. Environmental Protection Agency (EPA) has evaluated technologies to determine their effectiveness in monitoring, preventing, controlling, and cleaning up pollution. Since the early 1990s, however, numerous government and private groups have identified the lack of an organized and ongoing program to produce independent, credible performance data as a major impediment to the development and use of innovative environmental technology. Such data are needed by technology buyers and permitters both at home and abroad to make informed technology decisions. Because of this broad input, the President's environmental technology strategy, *Bridge to a Sustainable Future,* and the Vice President's *National Performance Review,* contain initiatives for an EPA program to accelerate the development of environmental technology through objective verification and reporting of technology performance. In 1994, EPA's Office of Research and Development formed a workgroup to plan the implementation of the Environmental Technology Verification Program (ETV). The workgroup produced a Verification White Paper that guided the initial stages of the program. This document, *Verification Strategy,* updates the earlier paper based upon the evolution of the program over the last two years. It outlines the operating principles and implementation activities that are shaping the program, as well as the challenges that are emerging and the decisions that must be addressed in the future. The program will continue to be modified through input from all parties having a stake in environmental technology, through further operational experience, and through formal evaluation of the program.

The goal of ETV, which remains unchanged, is to verify the environmental performance characteristics of commercial-ready technology through the evaluation of objective and quality assured data, so that potential purchasers and permitters are provided with an independent and credible assessment of what they are buying and permitting.

Important Definitions

A clear definition of the words "evaluate" and "verify", along with the word "certify", is important to establish at the outset of the program. The technology development community, the regulated community, and those charged with executing environmental standards at all levels of government require a precise understanding of what EPA means and does not mean by the activities to be undertaken through ETV. EPA intends to sponsor the evaluation of environmental technologies through adequate testing and verify that they perform at the levels reported. By evaluate and verify we mean:

Evaluate / Evaluation

To carefully examine and judge the efficacy of a technology; to submit technologies for testing under conditions of observation and analysis; *syn.*, measure, estimate, classify, test.

Verify / Verification

To establish or prove the truth of the performance of a technology under specific, predetermined criteria or protocols and adequate data quality assurance procedures; *syn.*, confirm, corroborate, substantiate, validate.

EPA does not intend to certify that a technology will always, or under circumstances other than those used in testing, operate at the levels verified. By certify we mean:

Certify / Certification

To guarantee a technology as meeting a standard or performance criteria into the future; *syn.*, ensure, warrant, guarantee.

EPA understands that the word certify can have a variety of meanings, but the Agency believes that the above definition is the one most commonly understood. Misuse of the term, could cause confusion among the public.

Operating Principles

Several important operating principles have defined the basic ETV program structure and remain fundamental to its operation. These are briefly outlined below.

1. Performance Evaluation Goal

Under ETV, environmental technologies are evaluated to ascertain and report their performance characteristics. EPA and its partners will not seek to determine regulatory compliance; will not rank technologies or compare their performance; will not label or list technologies as acceptable or unacceptable; and will not seek to determine "best available technology" in any form. In general, the Agency will avoid all potential pathways to picking "winners and losers". The goal of the program is to make objective performance information available to all of the actors in the environmental marketplace for *their* consideration and decision making.

2. Commercial-Ready Technologies

The ETV program is a service of EPA to the domestic and international marketplace in order to encourage rapid acceptance and implementation of improved environmental technology. ETV, therefore, focuses its resources on technologies that are either in, or ready for, full-scale commercialization. The program does not evaluate technologies at the pilot or bench scale and does not conduct or support research. Participation in ETV is completely voluntary.

3. Third-Party Verification Organizations

ETV leverages the capacity, expertise, and existing facilities of others through third-party partnerships in order to achieve universal coverage for all technology types as rapidly as possible. Third-party verification organizations are chosen from the both the public and private sector,

including states, universities, associations, business consortia, private testing firms, and federal laboratories. EPA designs and conducts auditing and oversight procedures of these organizations, as appropriate, to assure the credibility of the process and data. In order to determine if EPA participation is important to the commercialization process, ETV is testing the option of one totally unstructured and independent, private sector pilot in which EPA's role will be solely fiduciary. In addition, the Agency will continue to publish the results of commercial-ready technology evaluations that it conducts in the normal course of its business.

4. Pilot Phase

The program will begin with a three to five year pilot phase to test a wide range of partner and procedural alternatives, as well as the true market demand for and response to such a program. Throughout the pilot period, EPA and its partners will operate in a flexible and creative manner in order to identify new and efficient methods to verify environmental technologies, while maintaining the highest credibility standards. The operational objective will be to actively look for ways to optimize procedures without compromising quality. The ultimate objective of the pilot phase is to design and implement a permanent verification capacity and program within EPA by 2000, should the evaluation of the effectiveness of the program warrant it.

5. Pilot Technology Areas

ETV has begun with pilots in narrow technology areas in each of the major environmental media and will expand as appropriate, based on market forces, availability of resources, and the willingness of the marketplace to pay for third-party verification. For example, the drinking water technology pilot has started with a focus on microbial and particulate contaminants, and disinfection byproducts in small systems (less than 3300 users), an obvious and very large domestic and international market with pressing environmental problems. In fiscal year 1997 (FY97), the program will be expanded to the wider area of nitrates and synthetic organic chemicals and pesticides in all drinking water systems. Success in particular technology areas will allow the program to have a "pump-priming" effect to bring new technologies to the marketplace. Selection criteria for ETV pilot programs and other verification focus areas are discussed in a subsequent section of this paper.

6. Stakeholder Groups

ETV is guided and shaped by using the expertise of appropriate stakeholder groups in all aspects of the program. These groups consist of representatives of all verification customer groups: buyers and users of technology, developers and vendors, and, most importantly, technology "enablers", i.e., the consulting engineering community that recommends technology alternatives to purchasers, and the state permitters and regulators who allow it to be used. Stakeholder groups must be unique to each technology area in order to capture the important individual aspects of the different environmental media and to get buy-in from affected groups. For example, state drinking water permitters are necessary to participate in development of testing protocols for *cryptosporidium;* air pollution regulators are needed to evaluate innovative compliance monitoring devices; metal production parts manufacturers need to help design testing procedures for new coating compounds. In general, the role of stakeholders will be to assist in the development of procedures and protocols, prioritize types of technologies to be verified, review all important documents emerging from the pilot, assist in defining and conducting outreach activities appropriate to the particular area, and, finally, to serve as information conduits to the particular constituencies that they represent. As of June 1996, over 80 individuals are serving in the three stakeholder groups formed to date.

7. Private Sector Funding

Over the three to five year pilot phase of the program, the costs of verifying technologies in many pilots will move from a primarily government funded effort to a primarily private sector funded effort. At least two pilots will be vendor supported from the beginning. The original goal, as articulated in the 1994 strategy, called for complete private sector sponsorship within three years. A recent review (1995) of the program by a distinguished panel of outside experts convened by the EPA Science Advisory Board (SAB) concluded that such a goal was probably not achievable in so short a time-frame (they suggested five to eight years) and that some level of government support (10 to 20% of ongoing costs) would remain necessary to keep the activity viable. Conclusions on this issue will have to be reached as data emerge on the economic value-added of the program and the level of cost that the private sector is willing to bear in the various technology sectors.

8. Pilot Evaluation and Program Decisions

The Agency will collect data on operational parameters, e.g., number of participants; cost and time required to perform tests and report results, and on outcomes, e.g., use of data by the states and public; sales reported by vendors, in order to evaluate all aspects of the program. EPA will use this information to make long-term recommendations to the Congress on the future and shape of the program in December 1998. Among the choices at that time will be the formulation of a permanent, broad scale program; the narrowing of efforts to certain areas in which ETV appears to be effective; or the discontinuance of verification efforts. The latter conclusion could be reached either because state regulators/permit writers and the technology innovation industry are not assisted by ETV or because the cost of verification proves to be prohibitive.

9. Outreach and Information Diffusion

As was pointed out by the SAB in its 1995 review of ETV, verification alone will not move better, cheaper, faster technologies to success in the marketplace. Substantive and substantial interface with the permitters of environmental technology (primarily at the state level) will be necessary to have any chance of rapidly implementing innovative approaches. To date, the outreach activities of the program have been limited to assuring substantial state representation on the Stakeholder Groups that are designing the protocols and procedures for each pilot; developing informational fact sheets about the program; and placing a Web page on the Internet. In 1997, the Agency intends to develop an overarching outreach strategy with the help of a "corporate board" of major organizations in the technology area, e.g., National Governors Association, Western Governors Association, Environmental Council of the States, National Pollution Prevention Roundtable, appropriate corporations, and others. State permitter training, a national conference and other efforts will be included.

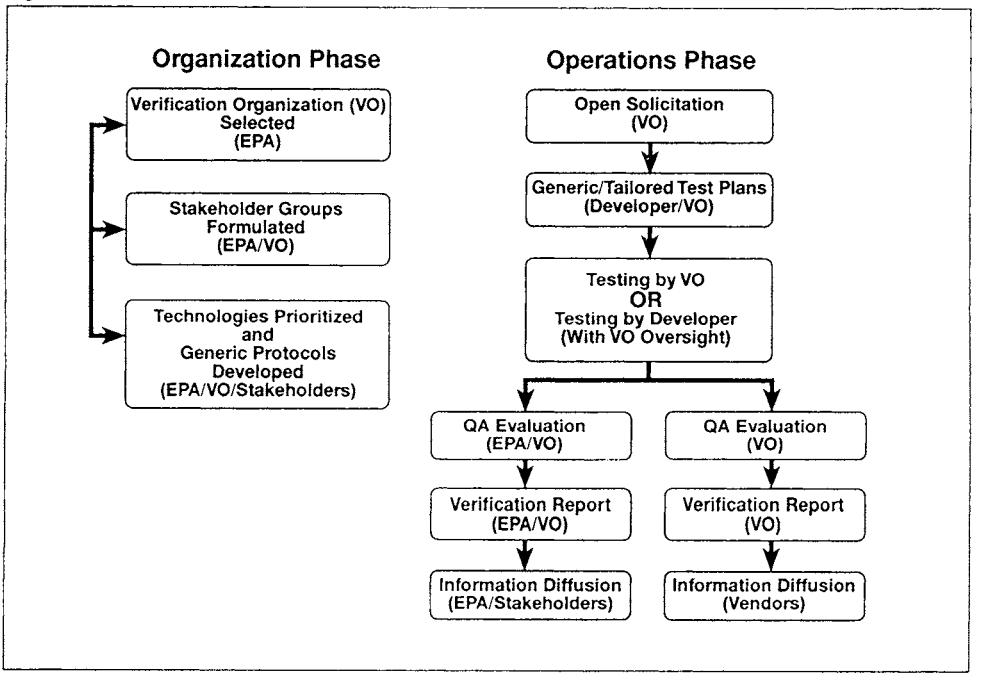
10. Market Gap Definition

Lastly, EPA will track applications and expressions of interest on the part of technology developers who come to all parts of the Agency that do not fit into the present suite of verification activities. This universe will be characterized during the initial stages of the pilot period and a strategy to address gaps will be developed.

ETV Pilot Process

Although a wide degree of flexibility will characterize the pilot projects (see above), each ETV pilot generally will go through two periods of development: an organizational phase and an operational phase (see Figure 1).

Figure 1. ETV Pilot Process



Organizational Phase

During the organizational phase, EPA will select one or more partner organizations to oversee and conduct verification activities. This important step will usually occur through an open solicitation process, although some exceptions will be appropriate. All partner proposals will be peer reviewed. EPA and its partner(s) will then select approximately 25 appropriate participants for the Stakeholder Group (see #6) that will guide the progress of the program. EPA may formulate the Stakeholders Group prior to selecting the partner organization if the procurement process is protracted. Stakeholder Groups will then begin the important process of establishing priorities and defining procedures and protocols appropriate to that particular type of environmental technology and customer group.

Operational Phase

Once the basic building blocks of the program are in place, actual verification activities begin (these steps will not always be strictly sequential). Verification activities in each technology area will be announced in the Commerce Business Daily and other appropriate publications to encourage maximal participation by technology developers, and to assure a level playing field. Test plans will be developed with the participation of developers and tests conducted by independent third parties (either the verification organization or other testing organizations approved by the verification organization). Appropriate quality assurance procedures will be incorporated into all aspects of the project and reports will be peer reviewed. Verification statements of three to five pages, based on the performance data contained in the reports, will be issued by EPA and appear on the ETV Internet Web page. Other outreach activities, as defined by the Stakeholder Group, such as state permitter training, will be conducted.

Selection Criteria for ETV Pilot Projects

The selection of verification pilot programs and other ETV verification activities to be carried out under the program is critical to its ultimate success. The ETV pilot programs are designed to meet the needs of the many stakeholders in environmental technology, while allowing EPA to experiment with a variety of procedures and partnership arrangements to determine the optimal form of program implementation. The following criteria are being used to choose ETV verification pilots and other verification activities. The first three criteria are applied in cascading order, i.e., each pilot must pass the previous criterion in order to go on to the next.

1. Address Important Environmental Needs

All programs conducted by the EPA have environmental improvement and protection as their ultimate objective. It is particularly important that this program, which is designed to assist the environmental technology industry, select pilot verification activities that have clear and positive environmental benefits. Such benefits may improve the environment by achieving higher levels of pollution reduction or by accelerating the rate of technology implementation through lower cost or simplified operation.

2. Present Substantial Business Opportunities for the Private Sector

Pilot areas selected will have clear market niches, both domestically and internationally, that present the potential for a substantial increase in technology sales and use. Although voluntary environmental improvement technologies, e.g., indoor air filtration systems, and existing regulatory program technologies, e.g., hazardous waste monitoring devices, are of interest to the program, particular attention will be paid to technology areas that stress the Agency's commitment to pollution prevention or address upcoming regulatory requirements

and deadlines that present obvious and major opportunities for innovation and increased conomic activity.

3. Involve Multiple Developers and Vendors

To clearly demonstrate the potential of a successful verification program, the ETV pilots must benefit the largest possible number of technology developers and users. Pilot programs will focus on areas in which a number of technologies and companies are active.

The last two criteria are programmatic and allow the Agency to test operating program parameters in the pilot phase.

4. Address the Full Range of Environmental Media

Assuring that all major environmental media and program areas are included in the pilots will allow ETV to begin interaction with interested parties, e.g., technology developers, technology buyers, regulation writers and state permitters, across a broad range of environmental areas. This will assist the program to identify particularly fruitful technology focus areas for the future, spread the word about the EPA verification function widely, identify regulatory barriers that inhibit the use of verified technologies, and assist developers across a wide spectrum of technology.

5. Test a Variety of Verification Organization Types

As described above, EPA is interested in evaluating all possible verification organization alternatives, including federal government laboratories, state verification programs, universities, industry associations, independent testing organizations, and developer conducted testing (with verification organization or EPA oversight). Pilot programs selected are expected to cover all of these alternatives.

Table 1 contains the application of these criteria to the pilots that were selected for implementation in FY96 using FY95 funds. Table 2 contains those that have recently been approved (8/16/96) for implementation in FY97 using FY96 funds.

Table 1. Selection Criteria and Customer Drivers — ETV FY95 Pilots

Five Selection Criteria and Customers	Small Package Drinking Water Systems	P2 (Pollution Prevention)/ Waste Treatment Systems	Site Characterization and Monitoring Technologies	Indoor Air Products	Independent Entity (See page 12)
1. Address Important Environmental Needs	*Cryptosporidium* Other DW problems	Industrial waste reduction	Lower cost of site characterization and monitoring	Toxic compounds & biocontaminants in the indoor environment	Unknown
2. Present Substantial Business Opportunities to the Private Sector	Thousands of communities worldwide	Hundreds of companies	Superfund sites, Brownfields	Thousands of offices, homes	Assumed
3. Involve Multiple Developers and Vendors	Numerous	40 applicants to first solicitation	Growing universe	Hundreds of products	Assumed
4. Address Full Range of Environmental Media	Drinking water	P2/waste treatment	Remediation	Air	Unknown
5. Test Variety of Verification Organization Types and Processes	Private sector	State	DOE, Federal Laboratories	Private sector, university	Private sector association
Targeted Customers	State regulators; small communities	CSI (Common Sense Initiative) industries	Federal & state regulators	Consumers, consulting engineers, industry	Unknown

Table 2. Selection Criteria and Customer Drivers — ETV FY96 Pilots

Five Selection Criteria and Customers	Advanced Monitoring Systems	Air Pollution Control Technologies	Wet Weather Flow Technologies	P2 (Pollution Prevention) Coatings and Coating Equipment
1. Address Important Environmental Needs	Basic to regulatory reinvention	Needed to implement Clean Air Act (CAA)	Leading cause of water quality impairment, Clean Water Act (CWA)	Pollution prevention for Volatile Organic Compounds (VOCs), CAA, others
2. Present Substantial Business Opportunities to the Private Sector	Regulatory reinvention growing area of environmental focus	Thousands of businesses in regulated universe	Over 1 M businesses, thousands of municipalities	Large number of small businesses use coatings
3. Involve Multiple Developers and Vendors	Dozens of new technologies emerging	Hundreds of vendors	Dozens of vendors & developers, 5 companies identified	22 vendors identified to date
4. Address Full Range of Environmental Media	Air, water, soil monitoring	Air pollution control	Water, soil, air	Air pollution prevention
5. Test Variety of Verification Organization Types and Processes	Private sector	Private sector	Private sector associations, universities	DoD Laboratory
Targeted Customers	Federal & state regulators; industry	Federal & state permitters; industry	Small & large municipalities & businesses	Small business (metal & plastic)

Program Implementation To Date

FY95 - $7 million[1]

In September 1995, EPA initiated four pilot programs that were selected through its competitive Environmental Technology Initiative process. These were: Small Package Drinking Water Systems, with NSF International, a private sector testing and standards organization as partner; Pollution Prevention and Waste Treatment Systems, with the State of California EPA as partner; Site Characterization and Monitoring Technologies, with Sandia National Laboratories as partner; Indoor Air Products, with Research Triangle Institute, a private sector organization, as partner. In addition, the Agency solicited proposals for a fifth pilot to test the option of a private sector, non-technology specific, independent entity. Through a peer reviewed process, the Civil Engineering Research Foundation has been selected and will shortly initiate a pilot effort. ETV activities during the first year of the program focused on program planning, the selection of stakeholder group participants, procedures and protocol development, priority setting, and solicitation of technologies for testing. The Site Characterization and Monitoring Technologies pilot, the first to become operational, completed tests of five technologies. (See Table 3 for budget summary.)

FY96 - $10 million

In FY96, Congress directed that all ETI funds be focused on verification. Activities for this year include expansion of the scope of the first year verification pilots under ETV and initiation of four new pilots. The technology categories selected for the new pilots are: Advanced Monitoring Systems to encourage regulatory reinvention; Air Pollution

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1 FY95 funds were distributed at the end of that fiscal year and were expended in FY96. Similarly, FY96 funds were distributed at the end of FY96 and are being expended in FY97.

Table 3. ETV FY95 and FY96 Pilot Program Funding

Pilot Area	Partner	EPA Contact Telephone #)	Amount ($million)		
			FY95	FY96	Total
Drinking Water Systems	NSF International Ann Arbor, MI	Jeff Adams (513-569-7835)	1.4	1.1	2.5
Site Characterization & Monitoring Technologies	Sandia National Lab. Alburquerque, NM Oak Ridge National Lab. Oak Ridge, TN	Eric Koglin (702-798-2432)	1.1*	0.6	1.7
Pollution Prevention (P2)/Waste Treatment Systems	State of California Sacramento, CA	Greg Carroll (513-569-7948)	1.8	0.8	2.6
Indoor Air Products	Research Triangle Institute RTP, NC	Les Sparks (919-541-2458)	1.0	0.2	1.2
Independent Entity	CERF Washington, DC	Norma Lewis (513-569-7665)	1.8	0.0	1.8
P2/Innovative Coatings and Coating Equipment	CTC Johnstown, PA	Mike Kosusko (919-541-2734)	0.0	0.6	0.6
Advanced Monitoring Systems	Open Solicitation	Robert Fuerst (919-541-2220)	0.0	1.6	1.6
Air Pollution Control Technologies	Open Solicitation	Ted Brna (919-541-2683)	0.0	1.4	1.4
Wet Weather Flows Technologies	Open Solicitation	Mary Stinson (908-321-6683)	0.0	0.8	0.8
US TIES (International Verification)	Open Solicitation	Steve James (513-569-7877)	0.0	1.0	1.0
Total			7.1	8.1	15.2

*FY94 and FY95 funding

Control Technologies aimed at facilitating the Clean Air Act Amendments of 1990; Innovative Coatings for Pollution Prevention; and Wet Weather Flow Technologies. Remaining resources will focus on verification activities under the Design for the Environment pollution prevention program conducted by the Office of Pollution Prevention and Toxic Substances, and USTIES (U.S. Technology for International Environmental Solutions) verification activities abroad with EPA's Office of International Affairs as an active partner (See Table 3). Important support activities will include the ongoing ETV program evaluation; a study of the fate of technologies for which no verification pilots exist ("market gap" study); and a substantially expanded information diffusion/outreach/ technology transfer program. These activities are summarized on the next page.

Other FY96 ETV Funded Activities - $1.9 million

ETV Outreach and Support ($0.5M)

Evaluation Process ($0.1M)

Technology Data Collection ($0.1M)

Design for the Environment (DFE) ($1.0M)

Small Business Innovation Research (SBIR) set aside ($0.2M)

Total ETV FY95 and FY96 Funding—$17.1 million

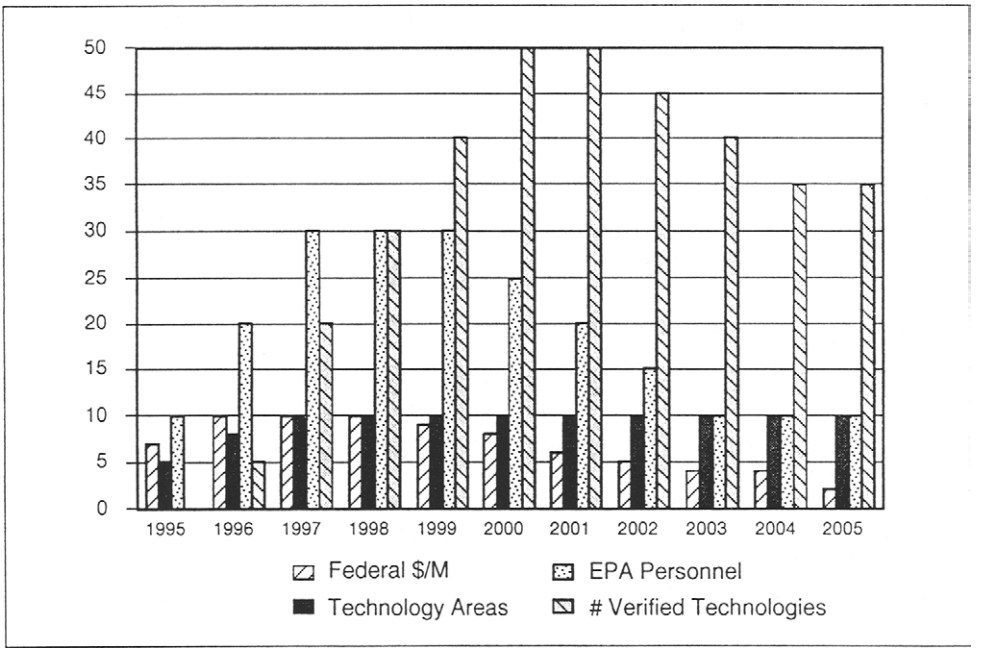
FY97 - $10 million

Investment of FY97 resources will follow the pattern of FY96 for verification activities, with additional emphasis on communication, outreach and evaluation. The existing pilots will be entering the full scale operational phase of the program and will be expanded to include new technology areas as the market dictates. Candidate technology categories for one or more new pilots will be based upon the results of the "market gap" studies conducted during 1997. These new areas would be created to support segments of the environmental technology industry that are not adequately addressed by the existing ETV program. Outreach and information diffusion on the results of the earlier evaluations will be expanded, and program results to date will be evaluated for preparation of decision options on the future of the program.

ETV Program Vision and Projected Development Scenario

Figure 2 lays out the projected ten year development scenario for the ETV Program in which assumptions are made concerning: (1) the amount of funding received by the program; (2) the number of viable technology areas (defined as pilots in the early stages) needed; (3) the

Figure 2. ETV Program Scenario



number of EPA staff assigned to quality assurance and technical oversight; and (4) the number of new technologies that come to the program for verification. All of these assumptions are projections based upon the experience of technology verification programs in other fields and the level of resources needed to accomplish the work projected. Changes to any of the assumptions would, of course, change all of the projections.

1. Federal Funding

The projected budget moves from $7M in 1995 to $10M for three years of development and building market acceptance. It then begins a gradual decline as the private sector pays more and more of the costs. By 2005 the steady-state cost of the program for all environmental areas is projected to be $2M.

2. Technology Areas

Starting in 1995, pilot programs gradually expand to cover all appropriate environmental areas (areas defined primarily by customer groups). By 1997, ten areas are defined and implemented and remain in place throughout the program, although their technology focus can shift over time, based on market forces.

3. EPA Personnel[2]

EPA staff necessary to oversee third-party verifiers and maintain the quality and credibility of the program move from 10 in 1995 to as many as 30 while the program is in its formative stages. As procedures and quality assurance measurers become routinized, staff demands gradually lower to a steady state of 10 FTE by 2003.

4. Verified Technologies

Due to a demand backlog, the number of technologies verified rapidly rises from five in 1996 to 50 in 2000, stays at this level for a few years, and then declines to a steady state of about 30 to 35 technologies.

If executed as projected in this scenario, the Environmental Technology Verification Program could reasonably be expected to verify the performance of approximately 350 innovative technologies in a decade.

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2 EPA personnel are assigned to ETV from appropriate media areas (e.g., drinking water, advanced air monitors) within ORD's national laboratories and centers based upon programmatic requirements. Six EPA staff are assigned to ETV directly for management coordination, information dissemination, and oversight.