

**Bridging The Valley of Death:
Financing Technology for a Sustainable Future**

December, 1994

**Prepared by the U.S. Small Business Administration
for the U.S. Environmental Protection Agency
(Interagency Agreement #DW73936877-01)**

Bridging the Valley of Death: Understanding Technology for a Sustainable Future

Table of Contents

Executive Summary
1

Chapter I -- Introduction **18**

Chapter II -- Developers **21**

Chapter III -- Technology Users **35**

Chapter IV -- Policy Alternatives for Discussion **50**

APPENDICES

**Appendix 1: Memorandum of Understanding between the U.S.
Small Business Administration and the U.S.
Environmental Protection Agency**

Appendix 2: Strategic Partnerships

Appendix 3: Acronyms

ACKNOWLEDGEMENTS

NOTES

**BRIDGING THE VALLEY OF DEATH:
FINANCING TECHNOLOGY FOR A SUSTAINABLE FUTURE**

Executive Summary

Ever since the government began taking action to preserve the environment, there has been debate over whether environmental protection is a drag on the economy. If America were the only country among all of our competitors taking such steps, a case could be made that we were spending scarce resources on environmental preservation while our competitors were not, thereby causing our cost of production to rise above that of our economic rivals. Even in that case however, one could argue that in the long run it was worth doing. The U.S. was merely recognizing that the environment is a scarce resource that can be depleted and was taking steps to preserve it. Competitors would find this out later and be forced to spend even more to undo their damage.

But the U.S. is not the only Nation concerned with environmental protection. Advanced countries all over the world have environmental preservation policies. Even newly industrializing countries are moving in the same direction.

There are two important results to this sea change:

- o Taking steps to preserve the environment does not put America at a competitive disadvantage even in the short run, because our trading partners are following the same path. Some countries, most notably Germany, have even more stringent policies than does the U.S.***
- o A new industry has been created: environmental technology. Worldwide sales in 1992 amounted to nearly \$300 billion and are expected to reach \$425 annually by 1997. The United States has the largest segment of the industry, with total estimated domestic and international sales of \$134 billion.***

Therefore, far from being a drag, environmental preservation can be a boom to the economy. The U.S. has the largest domestic market and the largest

producers of environmental technologies. However, our competitors, especially Germany and Japan, are moving ahead rapidly. In some applications they have already surpassed us. We must do better.

Small business has been shown to be more efficient than larger businesses at technological innovation, but is perceived as not fulfilling its potential in environmental technology. Consequently, the Environmental Protection Agency (EPA) asked the Small Business Administration (SBA) to study the issue and recommend needed changes.

The Clinton Administration is committed to a future where our economy and environment both thrive. In the words of John H. Gibbons, Assistant to the President for Science and Technology, "technology must be the bridge to that future." It is in this spirit that the SBA and EPA -- for the first time -- have joined forces on a national level to serve a common constituency.

The study is divided into two categories of small businesses: developers and users. "Developers" include small businesses and entrepreneurs who seek to create and market new environmental technologies. The study attempts to identify the size of developers' financing needs, barriers to obtaining financing,

and the stages in the development cycle where funding is most critically needed. Where funding needs are beyond the scope of the SBA's programs or where regulations and/or permitting procedures create additional large funding needs for these businesses, alternative (non-financial) solutions to these problems are considered.

"Users" are small businesses that seek financing in order to adopt environmental technology for compliance or pollution prevention purposes. As with the developers, the study focuses on the size of the users' financing gaps and the obstacles that they face in obtaining funding.

Methodology

The study team utilized a number of methodologies to collect data for this study. In addition to reviewing the literature, three Roundtables, comprised of developers, members of the financial community, and small manufacturers, were held in Raleigh, North Carolina, Dallas, Texas, and Boston, Massachusetts. In addition, the study team conducted site visits to small businesses in Massachusetts and southern and northern California. To get the lenders perspective, the study team canvassed twenty lenders from the SBA's list of Preferred and Certified lenders.

In formulating the policy alternatives prepared for discussion, the study team looked for ways to use existing programs to better serve the environmental technology industry, rather than creating new programs.

Technology Developers

Environmental technology ventures follow a development path similar to that of other kinds of technology. Several models illustrate capital availability with respect to the various stages of technology development. Though the terminology varies from author to author, all display the process as an inverted bell curve (See Chapter 2).

Funding Needs, Sources, and Availability

As a technology developer moves successively between the six stages, the capital needs almost always rise substantially. Unfortunately, capital availability does not follow the same pattern. As with most start-up companies, the source of capital in the early stages is from the developers' "sweat equity," personal savings and small investments from family and friends. Research and development (R & D) money may also be obtained from foundations and local, state, and federal government sources.

These initial sources are usually depleted before the entrepreneur has a final model or has commercialized the product, plunging the entrepreneur into the "Valley of Death." It is from this juncture that many technology ventures either never emerge or are left with no alternative other than to sell out to foreign investors.

Demonstration activities require substantial amounts of capital. Unlike the early R & D stage(s), there is little government funding. Moreover, venture capitalists and potential customers typically wait until a technology has proven itself in the demonstration -- usually after the product has become established in the marketplace -- before making an investment or purchase. Thus, if a technology developer is unable to survive the demonstration phase, all of the funding up to this point -- including large sums of government investment dollars -- is wasted. Moreover, if foreign investors purchase the rights to the technology, the benefit accrues to a foreign purchaser.

Only five percent of U.S. venture capital firms actively invest in the environmental industry. According to a 1993 Environmental Business Journal survey, venture capitalists prefer environmental technology companies in the early-to-mid revenue earnings phases. Venture capitalists have little interest in startup investments, and even less in the pre- prototype phases.

Perhaps most discouraging, the survey shows that none of the stages were rated as "high interest" or "very high interest." Moreover, compared with a similar survey two years earlier, there is a trend for venture capitals to steer toward later-stage investing.

Barriers to Obtaining Funding

The study team found a number of serious financial barriers. They include:

Entrepreneurial Obstacles

While technology entrepreneurs are creative and have a grasp of scientific concepts, they often lack business skills. In the 1993 Environmental Business Journal survey of venture capital firms, lack of seasoned management was identified as the top reason why venture capitalists turn down environmental technology deals.

Regulatory Obstacles

Permitting Processes -- Uncertainty

Nearly every investor and developer in the environmental arena has suffered losses due the following issues: multiple permitting requirements at various levels of government; the lack of materials that explain the process; and multi-year delays. Dag M. Syrrist, a California venture capitalist who invests in environmental technologies, points out that small companies are at a particular disadvantage because they typically do not have the personnel, expertise, or capital base necessary to survive the process. From the investor's perspective,

the problem is not so much the time and cost requirements but the uncertainty of the process to predict return potentials.

The Permitting Process -- Market Fragmentation

The permitting procedure is complicated by the state authorization process, where States may opt to be more stringent in their adoption of the federal regulations. Moreover, permits are granted on a site specific basis, not on a technology, creating a market partitioned into 200-300 regional and local regulatory districts. By having vast numbers of separate regulatory districts, each requiring new testing and demonstration procedures independent of one another, significant costs are generated without the resulting benefits. This redundancy is a major inefficiency in the system.

Regulatory Uncertainty

Developers evaluate the technology needs presented by proposed regulations and try to raise capital for a technology design and product based on the expectation that the regulation will in fact be promulgated. However, after a significant amount of time and money have been spent on developing a product, the proposed regulation may be altered or even rescinded, so that the standard

is set at a level different than originally proposed. The developer's product may be rendered unnecessary.

Enforcement

Developers claim that environmental regulations are weakened due to poor enforcement of the regulations.

Testing

There are few venues available for pilot-scale or full-scale testing and testing is costly. Current regulations do not encourage industrial producers to test promising technologies while maintaining compliance with existing standards. Consequently, testing innovative technologies are not given compliance relief for any kind of "best effort."

Technology Lock-in

Customer fear of noncompliance for using innovative, untested technologies creates a tremendous marketing barrier for environmental technology developers and leads to what is termed "technology lock-in".

Lack of Information

Accurate and current information is critical to investors and developers to assess the market's needs. However, such information is not readily available in the environmental industry because of an absence of SIC codes for the environmental industry and the reluctance of the industrial community to publicize its environmental problems.

Government Contract and Procurement Inefficiencies

Government Technology Programs Do Not Provide Commercialization Support

Government technology programs emphasize the R & D aspects of technology development but provide little or no assistance for the commercialization of the technologies.

Lack of Investment Model

Since the environmental technology industry is new, there are few success stories.

Financial Institutions' Lack of Familiarity with the Industry

Banks do not generally have the resources to conduct the necessary technical research to understand innovative niche technologies.

Technology Users

Evaluation of Current Financial Resources

Financing for environmental compliance and pollution prevention projects is available through commercial lenders, various state pollution control and remediation loan and reimbursement programs, and local environmental organizations. In addition, a few private organizations, like Coastal Ventures in Maine, have developed funds to finance these types of investments. Moreover, the SBA's 7(a) and 504 loan programs can be used for many environmentally-oriented purposes.

A recent Dun & Bradstreet survey found that the most popular source of financing for small-business owners was credit from suppliers. Specifically, the survey found that 65 percent of small business owners depend on credit from suppliers, 40 percent use credit cards and 35 percent rely on commercial bank loans for funding.

Barriers to Obtaining Financing to Purchase Technologies

Lender Liability

Since the mid-1980's, the SBA and lenders have become increasingly aware of their potential liability for environmental contamination. By obtaining title to real estate that has served as loan collateral, or by becoming intimately involved in operations of failing borrowers in order to prevent a loan-default, lenders have been considered by courts and governmental enforcers to be the "owner" or the "operator" of contaminated property. This determination may result in the lender bearing the entire cleanup costs. The costs are often staggering, particularly if other owners or operators cannot be located or lack sufficient resources to perform the remediation.

Congressional reauthorization of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the EPA's proposal to restrict lender underground storage tanks (UST) liability will be helpful for lenders in mitigating their potential liability for the cleanup of hazardous contamination. Nevertheless, they are far from a complete solution to the problem. Neither proposal would adequately shield lenders or the SBA from liability under state laws, which will continue to deter the provision of credit to technology users.

Responses by SBA and Lenders

Both the SBA and lenders have been compelled to alter their lending practices in response to the threat of environmental liability. Many larger banks have set up separate divisions staffed with environmental professionals to develop and manage lending standards to minimize the risk. Other lenders have adopted an informal policy of refusing loans to selected businesses (e.g. gas stations, dry cleaners, chemical companies).

An American Bankers Association's poll in the early 1990's showed that 43 percent of small banks had cut off or were curtailing lending to "certain types of businesses, such as small enterprises...that routinely handle toxic substances."

The SBA has also revised its lending policies in response to the threat of contamination. Its standard operating procedures (SOPs) reflect a wariness about incurring environmental liability in connection with both the provision of financing and in liquidation actions taken after default.

The Center for Neighborhood Technology noted the hardest hit businesses are gas stations, dry cleaners, auto repair shops, metal fabricators and finishers, electronics and utility industries, tool and die shops, bottling and

canning plants, waste removal and chemical companies, scrap yards, and farming operations that use pesticides.

Lenders' protective measures can create prohibitive costs for small businesses. The consulting and engineering costs of environmental audits are almost always borne by the borrower.

Other Financing Issues

One of the most difficult obstacles is that the equipment for which the loans are requested does not increase business operating revenues. Hence, it effects cash flow negatively and the debt burden is increased.

Regulatory Awareness

Many small businesses are unaware of environmental regulations. Moreover, companies that seek to comply with environmental regulations often do not know how to comply. Industry Working Groups of the Small Business Forum on Regulatory Reform (Forum) found that although most small businesses want to comply with regulations, they often lacked the necessary information to do so.

Technical Guidance

The Forum's Chemicals and Metals Working Group found that there are not enough technical guidance and educational materials to help industry comply with regulations. When technical guidance is available, it often does not include specific, understandable information on regulatory responsibilities and requirements, or proven technical procedures and approaches for managing and controlling environmental emissions.

Policy Alternatives for Discussion

The Regulatory Process

Underlying all of the discussion points is the understanding that both demand for the products of this industry and their supply are strongly influenced by the nature of the regulatory process. Without regulations, the demand for the goods and services of this industry would be very low. And we have found, through the course of this study, evidence of an important feedback loop between the regulatory process as it exists today and the willingness of capital providers to invest in new technology for this industry. In each of the following ways, the regulatory environment is an important determinant of the perceived shortfall of capital for new environmental technology from small companies.

- o Delays and Uncertainties Surrounding the Permitting and Approval Process.***
- o Performance Standards versus Specific Technology.***
 - o The Lack of a Nationwide Process for Certifying the Effectiveness of New Technologies***
 - o The Lack of "Hold Harmless" Testing of New Technologies***
- o The Lender Liability Problem***

Each of these can be expected to retard the development of new technologies, and indeed each of them does. This should come as no surprise. The economic system is functioning as one would predict. None of the remedies discussed below will be effective so long as these problems persist. Fortunately, the EPA is well aware of these factors and they are at the forefront of the Environmental Technology Initiative.

The President has issued an Executive order requiring agencies to identify and address available alternatives to direct regulation, such as user fees or marketable permits. The Order also requires agencies to consider incentives for innovation and to specify performance objectives if possible, rather than specifying the behavior or manner of compliance that regulated entities must adopt.

Permitting

Developers and investors uniformly request that the permitting process be streamlined. Many investors suggested a certification process for streamlining permits (See Chapter 3). A technology certification process would eliminate the

engineering review process required for permit decisions. State and Federal permit writers would use the specific certification claims as their engineering decision in the permit process.

State environmental offices and the U.S. EPA realize the problems contained in current permitting procedures and are taking steps to reform them.

Testing and Certification

Developers and investors uniformly request that the EPA put more resources into testing technologies for their ability to meet standards, either by conducting this testing itself or contracting it out to a non-government entity.

The shortage of testing venues can be partly eliminated by making use of contaminated federal facilities. Another important improvement is to allow selected sites to be used for testing new technologies with a hold-harmless provision if the technology doesn't meet the target standards.

Current practice creates a disincentive to allow one's business or property to be used to test a new technology, because if the technology fails to meet the standards, the business has undergone the expense of the new technology and it is still liable for further cleanup or to buy yet another technology. One expert recommended that a user be allowed to contract with a developer to test a technology so that if it worked, the user would pay a previously agreed upon price for the service. If it did not meet specifications, the user would not have to pay for the technology, nor would it be liable for further cleanup. The cost would be borne by the developer, the government, or by cost-sharing.

Many of the study team's contacts call for a national technology certification process that functions much like the FDA drug approval process. Under such a scenario a product must pass through one set approval process. Once it passes those tests it receives a "stamp of approval" for use anywhere in the country for similar types of clean-ups.

Such a process would serve to streamline the permitting process because it would eliminate the need for a series of site-specific tests. This would drastically reduce permitting delays and therefore reduce one of developers' major financing gaps. It would also help greatly in selling U.S. products abroad. The EPA stamp of approval that "this technology works" is a powerful selling tool for American businesses.

Lender Liability

Lenders are not going to make loans unless their concerns are addressed, because their obligations to their stockholders and account holders place upon them an obligation to exercise due diligence in avoiding unacceptable risk in their loan making. Bank regulators will put loans with unacceptable liability risk into special classifications, with undesirable consequences for the bank and the employee that made the loan.

All-out pursuit of the deep pockets of lenders may increase funds for environmental cleanup in the short run, but at present and for the future it is stifling the flow of funds to businesses in which there is a risk of lender liability.

The economy is an interrelated system. Actions result in reactions. Suboptimizing in one part of the system can result in a failure to optimize the system overall.

At a minimum, Congress should clarify and expand the protection given lenders under the Superfund statute, and extend this protection to other environmental laws. Congress and the EPA should also eliminate the contradiction between SBA's role as a lender of last resort and its exposure to environmental liability by specifically limiting the liability of SBA under federal and state laws, which would greatly enhance the SBA's ability to provide credit to needy small business.

In formulating our policy alternatives, we have looked for ways to use existing programs to better serve the needs of this industry, rather than creating new programs and new bureaucracies. Fortunately, there are a number of existing programs that can be better targeted at this industry.

We have also used the framework set forth in the President's Technology for a Sustainable Future: A Framework for Action. Our discussion points follow the strategy of focussing upon regulatory policy, market stimulation, fiscal policy, partnerships, education & training, and information dissemination.

In addition, we must recognize the budget realities of the 1990s. There are no funds available for a new program of grants, loans, or loan guarantees targeted at the environmental technology industry, and no such programs have been recommended here. Policies calling upon additional SBA resources, both

dollars and staffing, are assumed to be funded out of appropriations for the Environmental Technology Initiative.

The Federal budget for environmental technology programs was more than \$4 billion in fiscal year 1994. "These programs are primarily focused on the front end of the continuum --technology research, development, and demonstration -- with little funding, in comparison, directed to commercialization. . ."

Policy Alternatives for Financing Developers

**The Environmental Technology Bank of the United States (Envirobank)
Even though we believe that regulatory problems are an important determinant of the financing shortfall, we nevertheless think that to optimize this industry's performance, improvements in financing are needed as well as improvement in the regulatory process. There are two principal reasons for this:**

- 1. Public Good.** *Because of the public good nature of environmental preservation, there is a rationale for public sector involvement. In general, the private market will not bring forth an optimum amount of environmental preservation because many of the benefits accrue to the public at large rather than to individual customers, and providers do not receive revenue from these beneficiaries.*
- 2. International Competitiveness.** *This is an industry in which in most areas the U.S. is still pre-eminent in the technology. However, Japan and Germany are gaining. In some areas they have already surpassed us. The growth potential of this market world-wide is enormous. Eastern Europe, Asia, Africa and South America will have a huge and growing demand for these services in the next decade. This industry should be on our list of critical technologies. Upon the success of this industry will depend many high paying jobs, exports, and part of America's technological prestige world-wide. We should not let this be another industry in which we were once pre-eminent but lost our lead to others.*

The proposal is to create the Environmental Bank of the United States. The bank would be a small business investment company (SBIC). SBICs, licensed and regulated by the SBA, are privately owned and managed

investment firms. They use their own funds, plus funds obtained by borrowing at favorable rates with an SBA guarantee and by selling their preferred stock to SBA, to make venture capital investments in small businesses. The SBICs provide equity capital, long-term loans, debt-equity investments and management assistance to qualifying small businesses. Their incentive is the chance to share in the success of the small business as it grows and prospers.

We have found that there is a variety of types of financing that these businesses need, depending upon the stage of development of the firm and of the technology. We also found that only about five percent of U.S. venture capitalists actively invest in the environmental technology industry and that even among those, there is a movement away from early-stage investing.

The Envirobank can provide a wide variety of financing to small environmental technology businesses: equity, debt, debt with equity features, strategic partnerships with large businesses, promoting the use of informal investors, etc. As a venture capitalist it can also provide the management assistance many of these firms badly need.

The Envirobank would concentrate on the environmental technology industry. And it would, by design, fill a gap and provide more upstream funding than venture capitalists are doing today. However, it would be operated by professional venture capitalists with the goal of providing a competitive risk-reward structure to its investors. This cannot be an organization that shovels money out the door simply in order to say that it is helping firms with great ideas for saving the environment and no one else will listen to them because they don't have a track record.

The Envirobank's investments must be profitable. It must invest in companies with sound management or provide the assistance necessary to add good management to a promising technology. Otherwise Envirobank will not survive, and the government's and the private sector's investments will be lost.

Financing commitments can be secured from a number of sources:

- 1. Foundations.**
- 2. Investment Banks.**
- 3. Pension Funds**
- 4. Trade Associations**
- 5. States, cities, counties.**
- 6. Private Investors.**

SBA's funding will come from a transfer of funds from EPA.

The next step would be to do a rigorous feasibility analysis of the desirable size of the organization in terms of staffing and funding, a risk-return analysis, etc. Next, the SBA and the EPA would facilitate communication with potentially interested participants, such as investors, venture capital experts, environmental technology experts, etc. It would be appropriate for the EPA to take the lead role in this next phase in order that the SBA's licensing, funding, and regulatory role with respect to the SBIC industry not be compromised.

More Effective Use of the SBIR Program for Environmental Technology
The Small Business Innovation Research (SBIR) program was designed to assist small technology-based firms that are in the "valley of death" stage of their development. Each federal agency with an extramural research and development budget in excess of \$100 million must establish an SBIR program, under which it sets aside at least 1.5 percent of its R & D budget in 1993 and 1994, at least 2 percent in 1995 and 1996, and not less than 2.5 percent thereafter. Eleven agencies currently participate.

The program is working well across the board. However, the flow of funds into the environmental technology industry has been rather small. Although precise estimates are difficult to make because there are no unique SIC codes for the environmental technology industry, SBA's Office of Innovation, Research and Technology estimates that government-wide in fiscal year 1991 only \$3.6 million out of \$483 million in total awards went to environmental technology. At the EPA, only 45 such awards out of more than 2,000 were made.

Because of the importance of this industry both to the protection of our environment and to America's international competitiveness, we recommend that agencies whose research mandates include activities falling under the environmental technology umbrella, consider targeting more research topics and funds into this area. Since these budget allocations are normally made on a decentralized basis by each agency, Office of Management and Budget involvement may be necessary to realize a significant funding increase.

Technical Assistance Centers

Lack of information by lenders is an impediment to the flow of capital into small environmental technology companies. If a lender is not comfortable with his

understanding of the amount of risk involved in a business, it is not prudent for him to make a loan. There exists across the country many organizations that could be configured to provide technical assistance to lenders on various aspects of environmental technology. These would include, for developers, an assessment of the firm's technology (both the technology it is selling and the technology it uses to manufacture what it sells) and management. For users of environmental technology (discussed in the following section), the assessment would focus on the technology to be purchased by the firm, its technical feasibility and its effect on the firm's rate of return.

Consider environmentally-friendly ink for the printing industry as an example. An assessment would answer such questions as "does it work, if so does it require more down-time to clean the presses, what effect does this have on profits, is there an alternative process that is as friendly to the environment but not so costly to the bottom line, etc.?"

Existing government-financed technical assistance networks include Small Business Development Centers, National Institute of Science and Technology Centers, and centers that are in the network of the National Coalition for Advanced Manufacturing, among others. Technical assistance could be provided via training courses, a national computer network or on a case-by case basis. The facility could be created initially with government funding and its ongoing expenses paid for as much as possible by fees charged to its customers.

Strategic Partnerships and Informal Investors

The study team encountered a great deal of support for developers bridging the financing gaps and obstacles mentioned earlier by joining forces with a "strategic partner." These partnerships may be with medium to large businesses, potential users, public sector groups, equipment manufacturers, larger environmental vendors, academia, R & D institutions, or some combination thereof. These alliances can various many forms, such as joint ventures and licensing agreements.

Strategic partnerships make sense as capitalizing upon unique aspects of American competitive advantages, joining small technology-based firms that are world-renowned as the most efficient producers of technological innovation and larger firms that are better at raising capital and manufacturing and selling a product.

Examples abound of how environmental technology developers have used strategic partnerships to their advantage - if only to stay alive. Unfortunately, out of an inability to secure sufficient financing or partnership agreements with domestic organizations, many environmental technology developers opted or were forced to develop partnerships with foreign companies and other investors. One of the consequences of this situation is that technologies that were originally developed in the United States - many with public R & D monies - are sent overseas to be manufactured into products that are exported back into the U.S.

On future grants and contracts the government may wish to require that, if owners of technology financed in whole or in part by the U.S. taxpayer wish to sell to or form partnerships, etc. with foreign-owned companies, the government funds used to develop the technology be repaid with interest to the government. The repayment should be placed in a special fund at the Envirobank to finance environmental technology development and commercialization. Requiring repayment would help close a leak in the system in which the benefits of government-financed R & D are going to the competitors of American business.

Another source of financing that appears underutilized is the wealthy private individual investor, sometimes referred to as "angels" or "informal investors." The private investor's resources are considerable, with their venture investment portfolios aggregating in the neighborhood of \$50 billion according to a study carried out by William Wetzel for the SBA in 1989. Acting alone or through a syndicate of friends and acquaintances, he can raise as much as \$1 million for a given deal.

Occasionally the prospective individual investor participates in local groups like the MIT Enterprise Forum, where early-stage entrepreneurs present their aspirations and problems. Such investors rely heavily on the advice of their friends and other backers when making investment decisions. Few make a detailed analysis of the situation, evaluating the company primarily on the basis of its management. The investments are usually straight equity. Thus, the entrepreneur needs only to find the right angel for his company. This is not easy.

The SBA or the EPA could provide or facilitate a mechanism to match environmental technology developers with potential strategic partners and informal investors. The study team found tremendous support for the idea.

Small businesses do not have the resources to gain the necessary information and contacts to locate suitable partners. Thus, an inexpensive, efficient and neutral arbitrator for partner matching would be of great assistance to them. The SBA act could as a clearinghouse for a partnering system, with data collected locally or regionally and maintained in one central location. The Envirobank could also play a role.

The SBA's Commercialization Matching System might be adapted to this purpose. It currently lists the 22,000 SBIR awards given during the last 11 years. 600 private venture capital firms are also listed. The list for can be searched and sorted by geographical location, investment amounts, type of financing and industry or technology preference.

The SBA or EPA could also facilitate the expansion of the MIT Forum concept to other areas of the country in which the environmental technology industry is concentrated.

Policy Alternatives for Financing Users

A nation's firms gain competitive advantage if domestic buyers are, or are among, the world's most sophisticated and demanding buyers for the product or service. Such buyers provide a window into the most advanced buyer needs. . . Sophisticated and demanding buyers pressure local firms to meet high standards in terms of product quality, features, and service. . . The presence of sophisticated and demanding buyers is as, or more, important to sustaining advantage as to creating it. Local firms are prodded to improve and to move into newer and more advanced segments over time, often upgrading competitive advantage in the process.

-- Michael E. Porter

The strategy set forth in these pages recognizes the interplay between technology developers and technology users. We aim not merely to facilitate the ability of small business users to attract capital for their purchases of environmental technology, but to help them become world-class consumers. "Buyers are demanding where the product needs in an industry are especially stringent or challenging because of local circumstances." There is no necessary conflict between stringent environmental standards and economic advance. Stringent domestic standards can help keep the American environmental technology industry world-class. Lender and small business education as set forth below are aimed at facilitating the growth of user and lender sophistication.

Environmental Protection Fund.

Due to the existence of the lender liability problem and in an effort to help the market over a time of transition to more stringent environmental requirements, policy makers may wish to consider creating a fund for small business-dominated polluting industries, such as dry cleaners, printers, jewelry manufacturing, etc. All firms in the named industries would pay a small percentage of their revenues into the fund. Then they could receive financial assistance (grants, zero or low interest loans, etc.) to fund their purchases of pollution control or prevention technology. In this way, the industry and its customers would finance the pollution costs associated with the industry in the form of user fees. The industry's customers would thus finance the environmental preservation costs produced by the products they buy. The cost

of preventing environmental damage would thereby be internalized to that industry rather than being paid by society at large.

Lenders would not be asked to fund investments that do not add to the bottom line or that subject them to potentially costly liability. All firms in the industry would be treated the same. This would be analogous to the fund to finance the cleanup of underground storage tanks in Texas and to programs in Germany, Japan, and Sweden.

Lender Education

We recommended earlier the creation of a national network of technical assistance centers. These centers would also work with lenders and technology users.

Small Business Education

As Michael Porter noted, sophisticated domestic buyers of technology help producers become world class by demanding the best products. The Small Business Development Center (SBDC) program, sponsored by the SBA in a cooperative effort with the private sector, the educational community, and Federal, state, and local governments, is ideally suited to provide education to small businesses on how to buy and use environmental technology.

The 57 SBDCs provide management and technical assistance counseling services and training opportunities for present and prospective small business owners in over 960 locations nationwide. The SBDCs work with paid, private sector consultants, engineers, and testing laboratories to provide clients with specialized expertise.

The SBA and EPA are already looking into ways to utilize the SBDC network for educating small business owners on adopting environmental technologies. The FY 94 Environmental Technology Initiative funded four pollution prevention assistance pilot programs which will assist technology users to become, among other things, sophisticated buyers. A nationwide program, delivered through the SBDC network, is recommended.

Policy Alternatives: A Final Word

We have attempted with these policy alternatives to design remedies built upon the complex and interrelated nature of the environmental technology industry: the interplay between regulators, developers, users, and sources of

finance. Our discussion points address each of these. It would be simplest to recommend freely available loans and grants, but funding on demand would not accomplish the goal of developing an ever more flourishing industry. Instead we stress the importance of improving the regulatory environment, using existing programs better to provide capital and management assistance to qualified developers, providing technical assistance to lenders in understanding environmental technology, promoting strategic partnerships and informal investors, providing a new and better source of financing to users, and educating small businesses to become world-class consumers of environmental technology.

CHAPTER 1

Introduction

Ever since the government began taking action to preserve the environment, there has been debate over whether environmental protection is a drag on the economy. If America were the only country among all of our competitors taking such steps, a case could be made that we were spending scarce resources on environmental preservation while our competitors were not, thereby causing our cost of production to rise above that of our economic rivals. Even in that case however, one could argue that in the long run it was worth doing. The U.S. was merely recognizing that the environment is a scarce resource that can be depleted and was taking steps to preserve it. Competitors would find this out later and be forced to spend even more to undo their damage.

But the U.S. is not the only Nation concerned with environmental protection. Advanced countries all over the world have environmental preservation policies. Even newly industrializing countries are moving in the same direction.

There are two important results to this sea change:

- o Taking steps to preserve the environment does not put America at a competitive disadvantage even in the short run, because our trading partners are following the same path. Some countries, most notably Germany, have even more stringent policies than does the U.S.¹**
- o A new industry has been created: environmental technology. Worldwide sales in 1992 amounted to nearly \$300 billion and are expected to reach \$425 annually by 1997. The United States has the largest segment of the industry, with total estimated domestic and international sales of \$134 billion.²**

Therefore, far from being a drag, environmental preservation can be a boom to the economy. The U.S. has the largest domestic market and the largest producers of environmental technologies. However, our competitors, especially Germany and Japan, are moving ahead rapidly. In some applications they have already surpassed us.³ We must do better.

The Clinton Administration is committed to a future where our economy and environment both thrive. In the words of John H. Gibbons, Assistant to the

President for Science and Technology, "technology must be the bridge to that future."⁴ It is in this spirit that the U.S. Small Business Administration (SBA) and the U.S. Environmental Protection Agency (EPA) -- for the first time -- have joined forces on a national level to serve a common constituency.

Memorandum of Understanding

On November 15, 1993, Erskine B. Bowles, then Administrator of the SBA and Carol M. Browner, Administrator of EPA signed a Memorandum of Understanding (MOU) to "ensure that the U.S. Government effectively encourages, supports and enables U.S. small businesses to develop, market and/or adopt cost-effective environmental (including pollution prevention) technologies to achieve economic growth and environmental compliance." (See Appendix 1)

The MOU has seven objectives that address the management, regulatory, exporting, and financing issues faced by environmental technology developers and users. Research has shown small businesses to be the most efficient creators of technological innovation. The perception prevails however, that such businesses have been underutilized in the development of environmental technology because of a shortage of capital. Hence, as one of its first joint initiatives, the EPA has asked the SBA to study the issue and recommend policies to correct any problems discovered.

The Study

The study team was comprised of Allan Mandel, Ph.D., Director of SBA's Office of Economic Development & Rural Affairs, Natalie Birk, SBA's Assistant Advocate for Innovation and Technology Policy, and Michael Forlini, Program Specialist, in EPA's Technology Innovation Office. In addition, Susan McLaughlin, a recent MBA graduate from the University of Texas School of Business, provided research support.

For purposes of this study, the definition of environmental technology cited in H.R. 3870 -- the Environmental Technologies Act of 1994 -- was used. The bill defines the term as "a technology that is primarily intended to improve the quality of the environment through pollution prevention, pollution monitoring, pollution control, pollution remediation, reuse, recycling, or disposal, or that is capable of cost-effectively offering significant environmental benefits when compared with a technology it replaces." (Title I, Sec. 104, Paragraph 3).

The study is divided into two categories of small businesses: developers and users. "Developers" include small businesses and entrepreneurs who seek to create and market new environmental technologies. The study attempts to identify the size of developers' financing needs, barriers to obtaining financing, and the stages in the development cycle where funding is most critically needed. Where funding needs are beyond the scope of the SBA's programs or where regulations and/or permitting procedures create additional large funding needs for these businesses, alternative (non-financial) solutions to these problems are considered.

"Users" are small businesses that seek financing in order to adopt environmental technology for compliance or pollution prevention purposes. As with the developers, the study focuses on the size of the users' financing gaps and the obstacles that they face in obtaining funding.

Methodology

The study team utilized a number of methodologies to collect data for this study. In addition to reviewing the literature, three Roundtables, comprised of developers, members of the financial community, and small manufacturers, were held in Raleigh, North Carolina, Dallas, Texas, and Boston, Massachusetts. In addition, the study team conducted site visits to small businesses in Massachusetts and southern and northern California. In Nevada, where the Small Business Development Center sponsors a thriving pollution prevention program, the study team met with representatives of trade associations and users of environmental technologies.

At least one member of the study team was in attendance at each of the Environmental Technology Initiative public hearings were held in the spring of 1994 which generated additional individuals to be interviewed. Moreover, the study team met with other leaders in the environmental technology community including representatives from the California Environmental Business Opportunities (CEBO), the Environmental Business Council (EBC), Environmental Business Cluster, California Environmental Protection Agency, etc.

To get the lenders perspective, the study team canvassed twenty lenders from the SBA's list of Preferred and Certified lenders. Two lenders were chosen from each of SBA's ten regions representing varying sizes of metropolitan areas,

no more than one bank in any state, and no more than one branch of any particular financial institution. The discussions with the PLP lenders took place by telephone August 10, 1994 to August 19, 1994 and are incorporated into the Developers and Users chapters.

In formulating the policy alternatives, the study team looked for ways to use existing programs to better serve the environmental technology industry, rather than creating new programs.

CHAPTER 2

Developers

Environmental technology ventures follow a development path similar to that of other kinds of technology. Several models illustrate capital availability with respect to the various stages of technology development, as illustrated in Figures 1, 2, and 3. Though the terminology varies from author to author, all display the process as an inverted bell curve.

Despite having different terminology, the stages listed in the illustrations are essentially equivalent. This study cites the terminology used in Figure 2, which was developed with the environmental industry in mind.

The first step, "Idea Development," refers to product conceptualization and initial drawings, calculations, and theoretical validation. The developer at this stage may construct a crude, inexpensive, non-functioning model for feedback from colleagues.

The next stage, "Proof of Concept," refers to the construction of a rough, yet functioning model of the technology. This model may be less than full-scale. Its purpose is to test the most basic operating parameters and to aid in the design of an engineering prototype (pilot).

The "Pilot" phase is an actual working version of the technology of adequate technical quality. It tests the technology's operating performance and gauges its production requirements and feasibility.

The "Prototype" stage is the last model built before actual use of production machinery. It is a full-scale, completely operational model built to conform as closely as possible with final production design standards. The prototype is used to determine the product's production requirements as well as the product's operational performance.

In the "Application/Demonstration" stage, an actual market-ready model is manufactured in a limited production run. This stage tests the production process and produces a product that is used in third party testing; e.g. for obtaining a federal or state government permit. Application/Demonstration requires a great deal of private sector capital since very little government funding is available.

Figure 1

Finally, "Commercial Sales" is the result of the first five stages and especially of extensive marketing and manufacturing activities (commercialization activities). The name of the stage may be misleading, as it is sometimes characterized more by commercialization activities than by sales.

Funding Needs, Sources, and Availability

As a technology developer moves successively between the six stages, the capital needs almost always rise substantially. Unfortunately, capital availability does not follow the same pattern. As with most start-up companies, the source of capital in the early stages is from the developers' "sweat equity," personal savings and small investments from family and friends. Research and development (R & D) money may also be obtained from foundations and local, state, and federal government sources.

These initial sources are usually depleted before the entrepreneur has a final model or has commercialized the product, plunging the entrepreneur into the "Valley of Death" (See Figures 1, 2 and 3). It is from this juncture that many technology ventures either never emerge or are left with no alternative other than to sell out to foreign investors.

Demonstration activities require substantial amounts of capital. Unlike the early R & D stage(s), there is little government funding. Moreover, venture capitalists and potential customers typically wait until a technology has proven itself in the demonstration -- usually after the product has become established in the marketplace -- before making an investment or purchase. Thus, if a technology developer is unable to survive the demonstration phase, all of the funding up to this point -- including large sums of government investment dollars -- is either wasted, or, if foreign investors purchase the rights to the technology, accrues to the benefit of a foreign purchaser.

Environmental industry experts generally agree that a greater amount of government funding is available in the early developmental stages and that more financing is needed for commercialization activities. Organizations such as the Environmental Business Cluster, an environmental technology incubator in San Jose, CA, attempt to serve companies ready for commercialization. However, this type of assistance is the exception rather than the norm.

At the 1993 meetings of the California Environmental Technology Partnership, members lamented that few funds are available for

commercialization, advertising and other marketing activities. They concluded that existing capital markets do not adequately fund environmental technologies at the commercialization stage.

Figure 2

Figure 3

Only five percent of U.S. venture capital firms actively invest in the environmental industry. According to a 1993 Environmental Business Journal survey, venture capitalists prefer environmental technology companies in the early-to-mid revenue earnings phases. Venture capitalists have little interest in startup investments, and even less in the pre-prototype phases.

Perhaps most discouraging, the survey shows that none of the stages were rated as "high interest" or "very high interest." Moreover, compared with a similar survey two years earlier, there is a trend for venture capitals to steer toward later-stage investing.⁵

The study team spoke to 20 active SBA lenders (PLP lenders) about their views on environmental technology. Fourteen of them had never received a loan application from an environmental technology developer. The other six had received loan applications ranging from \$100,000 to \$1,500,000.

Three of the six banks approved those loans. One bank has made two SBA loans to environmental consulting companies that are developing management information systems. Both companies are ongoing, growing concerns that sought roughly \$500,000 for operating capital and equipment purchases.

A second bank made loans to two recycling companies, both of which were also ongoing concerns. The third bank, made a SBA 7(a) loan of \$900,000 to an expanding reclaimer of combustion engine fuels.

The PLP lenders were asked for their reasons for not being inclined to lend to environmental technology firms. Most of their reasons had no relevance to the environmental industry, but had to do with young companies in general. In fact, of the 20 PLP lenders, only three gave reasons that were specific to this industry.

At the SBA/EPA Roundtable in Dallas, TX on May 19, 1994, one lender said that the banking community is not willing to lend to young, unestablished companies. The lender further stated that banks do not "invest" in companies. Unlike venture capitalists, banks receive no benefit from taking on additional risk, unless they charge prohibitively high interest rates, which is self-defeating. Thus, banks typically provide funding only when a company has a proven product that already generates income.

The PLP lenders' comments concur with what was said in Dallas. Even with the added security of SBA guarantees, PLP lenders do not consider loans to companies that are not ongoing concerns (typically businesses with two to three years of revenue generation). Loan applicants in earlier stages are referred to SBA's Small Business Investment Companies (SBIC) or venture capitalists. Only one banker said that he might consider making a loan to a start-up if it could show letters of interest from customers.

The three remaining PLP lenders that did not approve the loan applications claiming that the funding requests were too high. In addition, one lender said that an applicant demonstrated inadequate managerial background.

The uncertain regulatory arena and the banking community's lack of familiarity with the industry were the most cited concerns and will be addressed later in this study. Other PLP lenders argued that these barriers are not unique. Generally, bankers lend money to clients that have a good customer base. Until a developer achieves this base, bankers will still have a great deal of apprehension.

Barriers to Obtaining Funding

Entrepreneurial Obstacles

Environmental entrepreneurs typically face a series of cash flow crises while developing and commercializing their technologies. When bank loans are obtained, small companies often pay more for capital than larger companies.

The extra cost is due to several factors. These factors include: the lack of liquidity, the risks associated with commercialization, and the limited understanding of environmental entrepreneurs' new technologies.

As a result, many developers turn to venture capitalists. In return for their investment however, venture capitalists require some form of control over the business.

The loss of some or most of the company's ownership and the loss of independence is simply unacceptable to some developers, and to others, an unattractive option at best. Many developers expressed their concern about what they considered unreasonable demands imposed by the venture capitalist.

To the venture capitalist, these are viewed as a necessary quid pro quo for the risky investment. Consequently, many developers try to avoid venture capital as much as is possible.

While technology entrepreneurs are creative and have a grasp of scientific concepts, they often lack business skills. Thus, developers often do not have the management experience necessary to successfully market their products and to build a successful business.

It is important to note, that when trying to obtain financing, especially for marketing the product, the quality and benefits of the technology matter less than the ability of the developer to present a good argument and convey a sense of credibility. Specifically, the developer needs to place greater emphasis on a business plan than on the benefits of the technology.

Entrepreneurs usually overestimate the potential and demand for their products to prospective investors. The inability to realistically identify and document their market can scare away potential investors; even when the technology is sound. Hence the saying familiar among venture capitalists: "We'd far rather take a chance on a first-rate manager with a second-rate product than on a first-rate product in the hands of a second-rate manager."

Table 1

In the 1993 Environmental Business Journal survey of venture capital firms (See Table 1), lack of seasoned management was identified as the top reason why venture capitalists turn down environmental technology deals.

Despite the growing public sentiment for companies to provide products and services in an environmentally sensitive manner, it is recognized that governmental regulation is the principal driver behind the environmental technology industry. Thus, an efficient, predictable regulatory arena is extremely important to the success of the industry. Governmental permitting and regulation setting procedures create the barriers that environmental industry participants cite most.

Regulatory Obstacles

Permitting Processes -- Uncertainty

Dag M. Syrrist, a California venture capitalist who invests in environmental technologies, believes that the uncertain permitting process is one of the greatest impediments facing these technologies. According to Syrrist, nearly every investor and developer in the environmental arena has suffered losses due the following issues: multiple permitting requirements at various levels of government; the lack of materials that explain the process; and the multi-year delays.

Syrrist also pointed out that small companies are at a particular disadvantage because they typically do not have the personnel, expertise, or capital base necessary to survive the process. From the investor's perspective, the problem is not so much the time and cost requirements but the uncertainty of the process to predict return potentials.

The EPA is well aware of these issues. In numerous agency publications, including the Technology Innovation Strategy, the EPA identified the following concerns: varying regulatory requirements and processes; uncertainties to permit issuance; and the scarcity and credibility of a technology's performance data with respect to compliance requirements. Moreover, the EPA recognizes that simply having a technology that produces significant environmental benefits is not enough to make it a good investment.

The Permitting Process -- Market Fragmentation

The permitting procedure is complicated by the state authorization process (40 CFR 271 requirements). In this process, federal regulations are developed based on the federal statute and requires state adoption. Thus, federal regulations such as permitting requirements serve as a blueprint for state authorization. States may opt to be more stringent in their adoption of the federal regulations. This in turn becomes a nuisance for developers since regulations may differ in stringency from state to state.

Moreover, permits are granted on a site specific basis, not by technology, creating a market partitioned into hundreds regional and local regulatory districts. By having vast numbers of separate regulatory districts, each requiring new testing and demonstration procedures independent of one

another, significant costs are generated without the resulting benefits. This redundancy is a major inefficiency in the system.

Regulatory Uncertainty

Some developers looking for a competitive edge will evaluate the technology needs presented by proposed regulations. In doing so, these developers will raise capital for a technology design and product based on the expectation that a proposed regulation will be promulgated. However, after significant amount of time and money have been spent on developing a product, the proposed regulation may be rescinded or altered so that the promulgated standard is set at a different level than originally proposed. Hence, the developer's product may be rendered unnecessary.

Sometimes a developer may be in a position to alter and redirect the technologies market audience as in the case of AirXchange, a Massachusetts company with an indoor air purification system. Initially the technology targeted the problem associated with indoor formaldehyde air emissions in mobile homes. The developer was almost certain that formaldehyde federal standards would be developed but were not. Fortunately, the developer was able to broaden the scope of the technology after the regulatory provisions had been dropped.

Stephen S. Miller, President of Stephen G. Miller Associates, a marketing consulting firm, presented another example. Three years before the promulgation of a final EPA ruling, a group of Arizona entrepreneurs built a continuous leak detection system for underground storage tanks (USTs). At the onset, it appeared that the EPA would require a continuous leak detection system in the final ruling. At the end however, the promulgated regulation allowed owners of USTs to conduct annual tightness tests for up to ten years.

In this case, the regulation resulted in a much slower demand for the technology. Consequently, the developers were forced to put their technology aside and go into the annual testing business.

Rules are developed on the basis of a more limited group of technologies currently available at the time the rule is written, since the development cycle for technological innovations is usually ten years or more. Furthermore, without greater predictability, developers run the risk of producing innovations that either over or under comply with the new standard. In short, since it is difficult to synchronize innovation and production with uncertain demand, the financial community is unable to calculate the risks of investment.

Enforcement

Enforcement of EPA standards and other environmental regulatory entities is also extremely important to technologies, especially those technologies designed to meet a demand created by regulation. However, developers claim that environmental regulations are weakened due to poor enforcement of the regulations. Thus, many small businesses find it difficult to survive. According to the Environmental Business Journal, weak enforcement is a major reason for market stagnation the last three years.⁶

In June, 1994, the EPA established a new Office of Enforcement and Compliance Assurance (OECA), consolidating a number of functions formerly shared among several different EPA programs. One major component of OECA is the Office of Compliance, whose overriding mission is to improve compliance with environmental laws. The office will accomplish this goal by working with the 10 EPA regions, states, municipalities, citizen groups and industry. OECA plans to improve the targeting of the enforcement actions against the worst violators, while at the same time reduce the transaction costs of understanding and complying with statutory and regulatory requirements.

Testing

The demonstration stage of an environmental technology's development is a critical step, since demonstration is needed not only for government permitting agencies, but also for potential customers and investors.

Full-scale testing under real-world conditions place a heavy burden on developers. There are few venues available for pilot-scale or full-scale testing and testing is costly. Furthermore, when the testing process must be repeated in multiple jurisdictions or regions, the developer must continue to absorb the same costs.

One reason for the lack of testing sites is the inability of developers to gain permission from potential customers to use their sites. Ideally, developers would test their technology on an area where the environmental problem exists. The California Environmental Technology Partnership (CETP) discovered however, that due to the penalties for non-compliance, potential customers rarely allow unproved technologies to be used on their premises.

Current regulations do not encourage industrial producers to test promising technologies while maintaining compliance with existing standards.

Consequently, testing innovative technologies are not given compliance relief for any kind of "best effort."

Technology Lock-in

Customers' fears of noncompliance for using innovative, untested technologies creates a tremendous marketing barrier for environmental technology developers and leads to what is termed "technology lock-in". At the SBA/EPA Roundtable in Dallas, TX, two developers said that potential customers constantly ask them if their products are "EPA approved" or "EPA certified." Since EPA does not offer such services, the developers face a marketing impasse.

EPA realizes that even though most EPA standards are technically performance-based and do not require a specific technology, the regulated parties are reluctant to depart from using the technology on which the standard is based and which EPA describes in the control technology guidance documents accompanying the regulation. Therefore, even the developer with a less expensive or more effective technology often finds it difficult to penetrate the market.

Permitting officials are also reluctant to risk the potential environmental consequences of approving an innovative technology. Enforcement personnel do not normally grant exceptions for businesses that make bona fide attempts to comply using innovative approaches, but fall just short of regulatory level. The result is, as EPA's Technology Innovation Strategy aptly states, the nation has fewer technologies to choose from as it moves to the next generation of environmental protection goals.

Lack of Information

Accurate and current information is critical to investors and developers to assess the market's needs. However, such information is not readily available in the environmental industry.

Investors have blamed this deficiency on two factors: (1) An absence of SIC codes for the environmental industry; and (2) The reluctance of the industrial community to publicize its environmental problems. Thus, the more acute the problem and the higher the immediate need, the less likely it is that the marketplace will learn of it.

Additionally, according to the July, 1994 Task Force Report of the California Environmental Technology Partnership, industry often attempts to shield itself from negative publicity and protect proprietary information. Consequently, they will not disclose environmental technology products they have developed themselves, thus "hiding" many environmental solutions from the marketplace.

Government Contract and Procurement Inefficiencies

Many developers who have focused on the government market are frustrated by the fact that procurement is conducted by individual laboratories or contractors rather than on a national basis. For example, procurement for DOE cleanup efforts has traditionally been conducted by individual laboratory contractors who do not necessarily view cleanup as a national effort. An article in the Environmental Business Journal noted that contractors are reluctant to be the first to try an innovative technology - even if the technology was developed at a Department of Energy lab in the first place.⁷

The cost-plus structure of contracts serves as a further disincentive for contractors to use procurement methods that minimize the public's expenditures. Stephen Miller provided the study team with the following example. A small company developed a portable testing system to detect quantities and types of contaminants at a contaminated site. The use of this system was less expensive and time-consuming than sending samples off-site for laboratory testing. The developer attempted to sell its system to EPA contractors hired to clean up Superfund sites. However, services of off-site EPA laboratories are free to Superfund contractors. Consequently, no cost was incurred by the contractor, whereas the portable testing system would come out of the contractors' profits. Thus, contractors have no incentive to use the more efficient system.

Government Technology Programs Do Not Provide Commercialization Support

Government technology programs focus on the R & D aspects of technology development but provide little or no assistance for the commercialization of the technologies. Some programs go as far as assisting with the demonstration stage of technologies, but do not do enough to commercialize the product. In an article that he wrote for Environmental Business Journal, Andrew Paterson, President of RIMTech in Pasadena, California, said that too many federal agencies, such as DOD testbeds and the EPA-SITE program, "just kick up dust with no pathway to paydirt -- real sales. No revenues, no commercialization."⁸

Lack of Investment Model

Since the environmental technology industry is new, there are few success stories. In fact, CETP contends that the venture capital industry's experiences with early-stage environmental technologies has been generally

negative. Hence, without a precedent to follow, most investors simply prefer to capitalize technologies in more established sectors.

Financial Institutions' Lack of Familiarity with the Industry

Some financial institutions have shied away from funding environmental technologies because they do not sufficiently understand the industry. The study team encountered industry analysts that said private investors are often reluctant to invest in environment ventures because of their lack of familiarity with the industry. Small-to-mid-sized banks are known to not generally have the resources to conduct the necessary technical research to understand innovative niche technologies.

Investors look for a competitive return on investments. For reasons typical of all varieties of small companies (e.g., poor management skills, overly competitive market, etc.), and to a list of regulatory and marketing obstacles peculiar to the environmental industry (especially the uncertain cost and length of the permitting process), the investment community does not perceive sufficiently high returns on environmental technology products to justify the perceived high risk of these investments.

There is consensus among the environmental industry that there is a great deal - perhaps excessive amounts - of capital available in the R & D stages and in the late commercialization period, after environmental technology developers have received the necessary permits and established a customer base. However, there is a vast chasm between those stages. (See Figure 4.) If the U.S. environmental technology industry is to prosper, that gap needs to be filled.

Figure 4

CHAPTER 3

Technology Users

Evaluation of current financial resources

Financing for environmental compliance and pollution prevention projects is available through commercial lenders, some state pollution control and remediation loan and reimbursement programs, and some local environmental organizations. In addition, a few private organizations, like Coastal Ventures in Maine, have developed funds to finance these types of investments. Moreover, the SBA's 7(a) and 504 loan programs can be used for many environmentally-oriented purposes.

A recent Dun & Bradstreet survey found that the most popular source of financing for small-business owners was credit from suppliers. Specifically, the survey found that 65 percent of small business owners depend on credit from suppliers, 40 percent use credit cards and 35 percent rely on commercial bank loans for funding.⁹ Representatives of the metal finishing industry concur that suppliers have been the key financier for that industry.

This study explores federal assistance programs rather than the availability of supplier credit, or credit card financing. Moreover, the discussion in Chapter 2 suggests that developers have enough of their own financing difficulties. As such, this Chapter will examine the other financing options available and/or what is preventing users from obtaining more traditional sources of credit.

Preferred Lender Program (PLP Lenders)

The literature and the PLP lenders suggest that funding requests for pollution control or prevention technologies normally range from \$5,000 to \$250,000. The rarely used SBA Pollution Control Loan program which has a \$1,000,000 guarantee limit (\$250,000 more than the general 7(a) loan program) supports the premise that equipment is in this range.

Ten of the twenty PLP lenders surveyed, specified that they had received loan applications for compliance. Seven lenders indicated that the applications were for underground storage tanks. Another seven applications specifically discussed other types of compliance issues. Six PLP lenders said that they had at some time turned down compliance applications due to liability or credit reasons.

Barriers to Obtaining Financing

Lender Liability

Since the mid-1980's, the SBA and lenders have become increasingly aware of their potential liability for environmental contamination. By obtaining title to real estate that has served as loan collateral, or by becoming intimately involved in operations of failing borrowers in order to prevent a loan-default, lenders have been considered by courts and governmental enforcers to be the "owner" or the "operator" of contaminated property. This determination may result in the lender bearing the entire cleanup costs. The costs are often staggering, particularly if other owners or operators cannot be located or lack sufficient resources to perform the remediation.

Overview of Relevant Laws

There are principally three statutory bases for potential environmental liability faced by lenders and the SBA. First, the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), establishes the liability of present and certain past owners and operators of property where a release of a hazardous substance has taken place.¹⁰

Second, lenders face potential liability under Subtitle I of the Resource Conservation and Recovery Act ("RCRA"), as an owner or operator of an underground storage tank that leaked petroleum or hazardous materials. RCRA also imposes criminal penalties on persons who "knowingly" violate regulatory requirements.

State environmental laws serve as the third source of liability for lenders and the SBA, whose sovereign immunity from such state laws has been waived by Congress along with that of other federal agencies. Although the variety and number of state laws prohibit their discussion here, these laws often contain language similar to that contained in CERCLA and RCRA.

This study does not address environmental laws that require the reduction of pollutants created during the active operation of a facility or the management and disposal of waste materials. These laws frequently require the use of highly expensive environmental technology or procedures, and thus have had a considerable impact on small business users. However, lenders are more likely to face cleanup liability as a result of foreclosure than for violation of these operational regulations.

CERCLA

In 1980, Congress enacted CERCLA in response to environmental and public health threats posed by improper disposal of hazardous materials. The events at Love Canal, in Buffalo, New York, where extensive contamination was found to have resulted from waste-disposal actions taken in the 1940's, served as a major catalyst for this legislation.

Section 107(a) of CERCLA identifies the following potentially responsible parties ("PRPs") as liable for a cleanup: (1) the current owner or operator of the contaminated facility; (2) any past owner or operator of the facility at the time that a disposal (which is broadly defined to include passive leaking) of a hazardous substance takes place; (3) any person who arranged for the treatment or disposal of hazardous substances at or arranged for transportation of the material to the facility found to be contaminated; and (4) any person who actually transported a hazardous substance for treatment or disposal at the subsequently contaminated facility.

Under CERCLA, any PRP can be liable for all cleanup costs, regardless of whether that party had any responsibility for or contributed to the contamination, and regardless of the volume of waste that a party might have contributed to a site. A PRP may be liable for an actual release of a hazardous substance and a "threatened release," which has been held to include the mere ownership of "corroding and deteriorating tanks." State of New York v. Shore Realty Corp., 759 F.2d 1032, 1045 (2d Cir. 1985).

CERCLA expressly limits the liability of lenders in the so-called "secured creditor exemption," which defines the term "owner or operator" so as to exclude a person who "[1] without participating in the management of a ... facility, [2] holds indicia of ownership primarily to protect his security interest in the ... facility". These terms are not defined, and courts have issued varied interpretations.

In one of the earliest decisions interpreting the exemption, a court held that a lender that was involved in managing the day-to-day operations of the borrower may be liable for the cleanup costs. United States v. Mirabile, 15 E.L.R. 20884 (E.D. Pa., Sept. 4, 1985) No. 84-2280. However, the court held that another lender that had foreclosed on the property was not liable because its actions "were plainly undertaken in an effort to protect its security interest in the

property." The court also held that SBA was not liable, even though the loan agreement with the borrower allowed for "some degree of involvement which could be characterized as participation in day-to-day management," and imposed certain restrictions on the borrower's finances. The court held that this capacity to become involved in management of the facility did not trigger liability: "participation in purely financial aspects of operation, of the sort that occurred here" is insufficient "to bring a lender within the scope of CERCLA liability."

In another decision, the court held that the bank's purchase of the property at a foreclosure sale classified it as the "current owner" of the facility, and subjected it to cleanup liability. U.S. v. Maryland Bank & Trust Co., 632 F. Supp. 573 (D. Md. 1986). The fact that the bank was not responsible for the contamination did not exempt it from liability.

A 1990 decision generated considerable alarm in the lending community by suggesting a broad expansion of a lender's CERCLA liability. U.S. v. Fleet Factors Corp., 901 F.2d 1550 (11th Cir. 1990), cert. denied, 498 U.S. 1046 (1991). The court indicated that liability could arise from a lender's "capacity to influence the corporation's treatment of hazardous wastes," id. at 1557, or from a lender's financial control over a firm that was "sufficiently broad to support the inference that it could affect hazardous waste disposal decisions if it so chose." Id. at 1558. In finding potential liability, however, the court also pointed to a number of other factors, including the fact that the creditor had hired an auctioneer to dispose of some of the machinery and equipment, and had arranged for the removal of the rest. Other courts have disagreed with the Fleet court's reasoning. See, e.g., In re Bergsoe Metal Corp., 910 F.2d 668 (9th Cir. 1990) ("there must be some actual management of the facility before a secured creditor will fall outside the exception").

The EPA subsequently issued a regulation to mitigate the potential liability of lenders under CERCLA as a result of the Fleet decision. The rule provided that, prior to foreclosure, lenders would not incur liability by monitoring a borrower's financial condition or requiring a borrower's environmental compliance or remediation prior to default. Lenders that were active in the operational management and control of the company prior to default were not exempt. The rule also protected lenders that obtain title to property through foreclosure or other means if they make prompt efforts to sell the property and do not refuse a "bona fide" offer to purchase the property.

In February 1994, a court vacated this regulation holding that it exceeded EPA's statutory authority and was, thus, invalid. The Solicitor General's Office is currently deciding whether to file an appeal.

CERCLA will expire in 1995 unless reauthorized by Congress. Both houses of Congress are currently considering broad reform legislation, which includes amendments to CERCLA's secured creditor exemption. The House version would overrule Kelley by retroactively endorsing EPA's secured creditor rule. The Senate proposal would revise the secured creditor exemption to provide greater protection for lenders and exempt federal lending agencies, including the SBA, from any CERCLA liability unless they had "caused or contributed" to the problem. Other measures that would be beneficial to lenders, among other parties, would limit the liability of certain small businesses and of parties that were only responsible for a minute percentage of the contamination at a site, and encourage the allocation of liability based on a party's actual contribution rather than imposing the entire cleanup responsibility on a party. However, prospects for passage of the reform legislation in 1995 remain uncertain.

RCRA

Lenders and the SBA also face liability under Subtitle I of RCRA for the release of petroleum or hazardous substance from an UST. Although not discussed in this study, Subtitle C of RCRA establishes requirements for the storage, transportation, and disposal of hazardous waste. The statute also establishes civil liability for the failure to report contamination or to comply with a governmental directive to undertake cleanup of contamination, and imposes fines and criminal penalties for certain violations.

Congress has authorized the EPA to review a State's UST or hazardous waste program and to delegate the primary enforcement authority for each program to that State. A state program may be more stringent than its federal counterpart. Even without federal delegation, Congress has made federal departments and agencies, such as the SBA, subject to state and local requirements.

Underground Storage Tanks

Subtitle I imposes liability upon an UST owner or operator that has leaked petroleum or hazardous materials. EPA or an authorized state agency may issue a cleanup order to an owner and/or operator to address a leak or, if the owner or operator will not comply, recover cleanup costs of a leaking UST from these parties. The statute imposes strict liability in such cost recovery actions.

Under EPA regulations, an UST owner or operator must report any leak to the EPA (or the implementing state agency) within 24 hours of discovery. The owner or operator is directed to investigate any suspected release, and to undertake corrective action to remediate any leak that is discovered. A party that fails to comply with the regulations risks a civil penalty of up to \$10,000 for each tank for each day of violation.

Subtitle I contains a secured creditor exemption, similar to that in CERCLA, for the owner of an UST. However, the exemption does not apply to the "operator" of a tank, a term that is broadly defined. The exemption, thus, may have limited relevance to a lender that forecloses on property where a leaking UST is located and that exercises operational control over the property.

In June, 1994, EPA issued a proposed rule to restrict the liability of lenders from UST contamination. 59 Fed. Reg. 30448, 30463 (June 13, 1994). The proposal extends protection to an UST operator, and limits the liability of secured creditors with respect to actions taken before and after foreclosure, as set forth in EPA's CERCLA regulation. However, to obtain the benefit of the proposed rule, a lender must empty any UST with petroleum or a hazardous substance within 15 days of foreclosure. A foreclosing lender must also "close" the tank in compliance with regulations, a process that may prove sufficiently costly that it undermines the collateral value of the property. EPA declared that it will not require states with an approved UST program to implement a security interest exemption.

Criminal Liability Under RCRA

Another area of concern is the potential criminal culpability of lending and SBA officials involved in the liquidation of businesses. The law provides criminal sanctions for anyone who "knowingly" transports certain types of hazardous waste to a facility which does not have a permit. Similarly, the law requires a permit for the storage, treatment, or disposal of certain types of hazardous waste at a site. If the site does not have a permit, such storage, treatment, or disposal may constitute a felony. In addition, certain releases of hazardous

waste above threshold quantities must be reported to EPA. Failure to report such releases can constitute a felony. Thus, lenders have the additional concern of potential criminal liability for disposing of hazardous waste improperly.

A number of appellate decisions have sanctioned a liberal use of circumstantial evidence to establish the necessary knowledge that a permit was required. One such case involved the prosecution of a company official that had sent hazardous waste to a facility that was believed to hold a valid permit. The court upheld the conviction, stating in this regulatory context a defendant acts knowingly if he willfully fails to determine the permit status of the facility.

Summary

Congressional reauthorization of CERCLA and EPA's proposal to restrict lender UST liability will be helpful for lenders in mitigating their potential liability for the cleanup of hazardous contamination. Nevertheless, they are far from a complete solution to the problem. Neither proposal would adequately shield lenders or the SBA from liability under state laws, which will continue to deter the provision of credit to technology users.

Responses by SBA and Lenders -- General Discussion

The potential liability for the cleanup of contaminated property at sites throughout the country has had a considerable impact upon the lending decisions of banks and the SBA. The scope of the problem facing the SBA can be gauged from the fact that as early as 1989, in response to an inquiry from Congress, the Agency conducted an informal survey which determined that, with respect to at least 140 sites, the SBA had either abandoned collateral because of the risk of incurring cleanup costs or had actually incurred liability for such costs. Thus, the risk of liability has compelled lenders and the SBA to exercise considerable caution in providing financing to borrowers which use petroleum or chemical products in their business operations and/or which generate hazardous waste as a result of those operations.

The concerns of the lending community result not only from the prospect of incurring liability for cleanup costs, but also from the ramifications of potential environmental contamination upon collateral given to secure a lien and upon the borrower. As a practical matter, real estate that is actually or potentially subject to contamination has little or no collateral value to a lender seeking to recover a debt on a loan. Foreclosure may result in liability; even absent liability, however, prospects for sale of contaminated property are minimal, except at a price that is far below the property's "clean" market value. Moreover, the high costs of environmental liability may so financially impair a borrower that it triggers a default on a loan.

The credit concerns of lenders are even more acute with respect to small businesses that often have little real collateral to secure a loan other than real estate, and which are more vulnerable to the financial impact of environmental liability. SBA faces a similar concern; the Small Business Act mandates that "all loans ... shall be of such sound value or so secured as reasonably to assure repayment." SBA, thus, cannot grant requests for financial assistance where this statutory criteria is not met.

Both the SBA and lenders have been compelled to alter their lending practices in response to the threat of environmental liability. A recent survey by Dun and Bradstreet as well as studies conducted by the EPA and SBA revealed that prior to approving real estate and environmentally risky loans, most lenders employ site visits, environmental audits, reviews of state enforcement actions regarding a particular site, or a combination of all three.

Even when a loan is granted, lenders may require covenants in the loan agreements that require the borrower to submit periodic environmental reports and allow the lender to conduct environmental inspections over the course of the loan. The lenders take these measures to ensure that borrowers stay in compliance with all environmental laws and take the necessary steps to avoid any future environmental risk.

Many larger banks have set up separate divisions staffed with environmental professionals to develop and manage lending standards to minimize the risk. Other lenders have adopted an informal policy of refusing loans to selected businesses (e.g. gas stations, dry cleaners, chemical companies). An American Bankers Association's poll in the early 1990's showed that 43 percent of small banks had cut off or were curtailing lending to certain types of businesses, such as small enterprises...that routinely handle toxic substances.

The PLP lenders interviewed shared a wide range of opinion about liability issues. A few expressed little concern about environmental liability risk. However, that was mainly because they have had little cause to worry about such issues in their market (e.g., the community has little manufacturing activity to create any significant contamination problems). At the other extreme, a few lenders have completely restricted lending to certain small businesses solely because of potential environmental risk. For example, one lender said that he declines requests from gasoline stations unless it is backed by a large oil company. Another lender said that although his bank sometimes makes general-purpose loans to retail gasoline stations, dry cleaners, and metal fabricators, they have also backed away from a number of loan requests to these types of businesses due to the potential for on-site contamination - even if the business is "clean" at the time of the loan application. Moreover, the lender says that higher interest rates and/or periodic audits of the business' facilities do not sufficiently mitigate the problem to warrant a loan approval.

The majority of the PLP lenders interviewed are concerned about environmental issues, but do not completely eliminate lending to any particular industry. Rather, they handle each loan on a case-by-case basis. In general, these banks are unwilling to lend to businesses that have any environmental problems. A PLP lender in New York said that contamination "killed" many of his bank's real estate deals. However, he and others indicated that exceptions

are made when the borrower has sufficient non-real estate assets to provide as collateral and is in good financial standing.

SBA Policy Under The Standard Operating Procedures

The SBA has also revised its lending policies in response to the threat of contamination. Its standard operating procedures (SOPs) reflect a wariness about incurring environmental liability in connection with both the provision of financing and in liquidation actions taken after default.

The SOPs governing review of applications for financial assistance under the business loan program require a Phase I environmental audit in two instances: 1) If a loan applicant falls into one of the "frequently polluting industries" listed in Appendix 7 of SOP 50 10 (1991); or 2) For companies not so listed, if a loan officer's site visit and/or the applicant's responses to an SBA questionnaire, set forth in Appendix 9 of SOP 50 10, indicate the existence of an environmental problem. A Phase I audit entails a historical review of relevant files and interviews with individuals knowledgeable about site operations. If the audit reveals significant contamination problems, the SOPs require, at the applicant's expense, a Phase II audit, which includes actual physical sampling and analyses of soil and groundwater, which should clearly identify the contamination problem, and which should contain an estimate of the cost of any necessary cleanup.

With respect to the 504 loan program, the SOP mandates that a loan authorization require that the borrower certify and warrant that no contamination has or is likely to occur, that the borrower is, and will remain, in compliance with all environmental laws, and that the borrower will indemnify SBA for any liability resulting from past, present or future contamination or cleanup responsibilities.

The SOPs also require that the applicant make available the results of any environmental checklist, analysis or audit performed by any third-party lender who is providing interim financing. The SOPs place the responsibility for determining a borrower's compliance with environmental laws and the absence of contamination upon the Certified Development Company ("CDC") that makes the loan. The CDC is required to proceed with a Phase I audit if a previous site visit has indicated the existence of contamination or the likelihood of contamination. In the event that the audit indicates "problem areas and unanswered questions," a Phase II audit is required.

In 1993, the SBA revised its SOPs for loan liquidation. Some of the most significant changes are guidelines to minimize liability for contaminated property. After a loan is placed into liquidation, the loan officer is directed to make a field visit on all loans which are secured by real estate, except residential real estate, to inspect the site for environmental problems and to complete an environmental questionnaire. A Phase I audit is required if this questionnaire indicates the possibility of site contamination or if the borrower is within one of the frequently polluting industries.

A Phase II audit is necessary if the questionnaire or the Phase I audit reveals the possibility of significant contamination problems. The SOPs advise that the high cleanup costs of contamination may render collateral worthless; abandonment of collateral may be appropriate if "the estimated costs of its disposal ... exceed the estimated sales proceeds, leaving no amount available for credit on the debt"

Effect Upon Small Businesses

Banks' recent measures to minimize their environmental risk have had a heavy impact on small businesses that handle dangerous chemicals or produce contaminated waste. Large companies often have a variety of assets to offer as collateral to cover any potential environmental liability that small businesses do not. Although a 1991 survey by the National Association of Manufacturers indicated that only three percent of small manufacturers had been turned down for a bank loan for environmental risk reasons, many other sources argue that the problem is much more extensive within specific industries. The Center for Neighborhood Technology noted the hardest hit are gas stations, dry cleaners, auto repair shops, metal fabricators and finishers, electronics and utility industries, tool and die shops, bottling and canning plants, waste removal and chemical companies, scrap yards, and farming operations that use pesticides.

Discussions with representatives of the metal finishing industry indicate that banks' lender liability concerns prohibit some businesses from obtaining financing for any purposes, including for the purchase of environmental technologies. For example, the owner of a Michigan metal finishing company said that although his facility is not contaminated and his manufacturing operations are in compliance with environmental regulations, bankers will not accept his real estate or building as collateral. He believes the problem is that most lenders are not familiar with the industry and are therefore unable to evaluate the cleanliness of the business' processes. Thus, once lenders learn

that the business uses regulated chemicals, they deny the business a loan out of fear that the entire property could be contaminated - or could become so in the future.

It is important to note that not all metal finishers that the study team spoke with have faced such financing obstacles. One industry representative insisted that the only issue that concerns the banks is the creditworthiness of the borrower. However, in this case, the business owner enjoyed a long-standing relationship with his bank. Hence, the bank was familiar with the business' operations and trusted the business' management. Many small businesses do not enjoy such relationships.

While a few of the PLP lenders said that they had received loan requests wholly or partially for pollution control or prevention purposes, overwhelmingly the environmental problem faced by their customers was the cleanup of contaminated sites, particularly leaks from gasoline underground storage tanks (USTs). Small businesses under the UST umbrella include service stations, any business that sits on a site that covers USTs installed for businesses previously at that site, or any business that sits on land that has been contaminated by leaking USTs from neighboring property. The willingness of the lenders to assist customers in cleaning up UST contamination varies from state-to-state and from bank-to-bank.

California has a fund that reimburses businesses for UST cleanup beyond a deductible of up to \$20,000. However, the turnaround time on the fund - from completion of cleanup to receipt of reimbursement - ranges from four weeks to two years. Although it is essentially assured of eventual reimbursement, banks are often unwilling to lend the money for the cleanup because it is concerned about collateralizing a dirty piece of property. Remediation contractors are also often unwilling to wait for payment from the reimbursement fund.

Wisconsin also has a reimbursement fund for the correction of leaking USTs and petroleum spills. The Petroleum Environmental Cleanup Fund Act (PECFA) has a deductible of \$2500 plus 5 percent of the cleanup costs, with a \$7500 limit. The fund covers up to \$1 million per case. PECFA is thought of as well-funded and very reliable. However, many banks in Wisconsin will only supply these loans to existing customers. Other banks supply PECFA loans to new customers, but only when the customer has sufficient non-contaminated assets to secure the loan. Since there are a number of service stations and

small businesses that do not have the banking relationships or the collateral to secure the necessary funding, many contaminated sites are unable to take advantage of the program.

Lenders' protective measures can create prohibitive costs for small businesses. The consulting and engineering costs of environmental audits are almost always borne by the borrower. Phase I audits generally cost approximately \$1500, but range between \$500 and \$7,000. On the other hand, phase II audits, average around \$8000, but can be as high as \$60,000 or more. The PLP lenders indicated that they typically require the borrowers to pay for the audits up front and, if the loan is approved, the cost of the audit may be added to the loan principal. A few of the PLP lenders indicated that for some of their customers, the Phase II audits were cost prohibitive causing would-be borrowers to withdraw their applications.

The PLP lenders also indicated that if a bank senses environmental risk in a loan, it may still approve the loan, but at less favorable terms. For example, the lenders might offer the loan at a relatively high interest rate or offer a level of principal lower than the borrower originally requested. Banks might also require their customers to purchase environmental insurance, especially for real estate loans.

Although the SBA is very reluctant to guarantee loans to contaminated facilities, a 1993 EPA study showed that some banks have managed to use the SBA's guarantee program to minimize their own risk of liability. According to the EPA's report, "one lender noted that loans to gas stations for tank conversions could only be done with a SBA guarantee."¹¹

Finally, environmental regulations create many transaction costs for small business. Environmental questionnaires, ongoing reporting requirements and audits required by lenders create paperwork as well as direct costs for small businesses. Additionally, federal, state and local environmental agencies' numerous and redundant reporting requirements put a time and financial strain on small businesses, making it more difficult to comply.

Other Financing Issues

Some of the respondents of the 1991 survey of the National Association of Manufacturers noted that there is a credit crunch hitting many segments of the business community, and that lender liability is one, but certainly not the primary concern. This section addresses the non-liability issues that contribute

to the difficulty that small businesses face in obtaining financing compliance equipment or pollution prevention technologies.

One of the most difficult obstacles is that the equipment for which the loans are requested does not increase business operating revenues. For example, the replacement of USTs or the installation of air pollution prevention equipment bring the business into compliance with environmental regulations (and therefore allow the business to legally remain open), but productivity and revenues do not increase. Instead, it effects cash flow negatively and the debt burden is increased.

One owner of a dry cleaning operation said that most businesses in her industry do not have established relationships with their bankers. Although her operation is large enough to support the purchase of environmental compliance equipment, she believes that many of the smaller dry cleaners are not able to afford the required equipment.

Representatives from the dry cleaning and printing industries told the study team that competitiveness in these industries prohibits businesses from passing on the costs of environmental equipment and materials to their customers. Specifically, one printing company owner said that companies need help in classifying environmental equipment for the lenders. He used the following example: "Is monitoring equipment a capital expenditure or should it be considered part of working capital needs?" The same printer had difficulties switching to the use of an environmentally-sound cleaning agent because the new cleaning agent is more labor-intensive and requires more machine down-time. His bank would not make loans that reduced productivity.

As is the case with developers, lenders appear uncomfortable working within an arena of stringent and changing government regulation. Bankers and borrowers alike are concerned that a technology or standard which is required today may change within a few years, wasting money, and possibly requiring another investment in equipment.

Norman F. Peters, Executive Vice President at Texas Commerce Bank told the study team that banks are also concerned about the "intrinsic value of the environmental technology as collateral." A lack of familiarity with environmental technologies makes it difficult for lenders to estimate the resale value of the technology. Indeed, the uncertain nature of environmental regulations makes it

difficult for banks to not only anticipate the technology's obsolescence factor, but to determine the number of years over which to amortize the loan.

One recurring theme the study team encountered was that business owners who did enjoy a good banking relationship prior to a compliance requirement, or before discovering contamination on the property, had a much better chance at having their loan approved. Therefore, a bank's long standing familiarity with the business appears to be crucial.

Regulatory Awareness

Many small businesses are unaware of environmental regulations. An EPA Region III study of the banks in that area reports that "many of the lenders commented that they found themselves educating, or counseling, the small businesses about environmental regulations. They cited instances when companies only became aware of certain regulations or that they were in violation because they requested bank financing and needed an environmental audit."¹²

Companies that seek to comply with environmental regulations do not always know how to comply. For example, one PLP lender said that small businesses are sometimes aware that they were using regulated hazardous materials, but did not comply with hazardous waste disposal regulations because they did not know where to dispose of the waste. Representatives of the printing industry also told the study team said that within that industry there is considerable confusion as to what environmental regulations require of them. According to EPA's 1994 Permit Improvement Team's study, many small businesses have no understanding of the State and Federal regulatory requirements. These businesses are too apprehensive to seek Federal or State regulatory assistance. Others wait until an enforcement action is levied against them to come into compliance.

These comments are consistent with the findings of the Small Business Forum on Regulatory Reform (the Forum). The Forum was co-sponsored by the SBA and Office of Management and Budget's Office of Information and Regulatory Affairs (OIRA) in 1994 to "address both the concerns of small business and the need for more effective regulatory compliance."

Industry Working Groups of the Forum found that although most small businesses want to comply with regulations, they often lacked the necessary

information to do so. Two of the main issues and concerns that the Forum identified were: 1) The uncertainty of small business owners as to which regulations apply to them and the need for more effective communication of compliance requirements to small business; and 2) The inability of small business owners (because of limited temporal, financial, legal and technical resources) to comprehend overly complex regulations and those that are overlapping, inconsistent and redundant.

It is clear that small business needs a better understanding of the regulatory arena both for the purpose of learning what environmental regulations require of them and for the purpose of commenting on proposed regulations. The Environmental Products, Recycling and Waste Management/Disposal Industries Working Group of the Forum reported that many small businesses do not subscribe to the Federal Register. Instead they rely on accountants, attorneys, and trade associations for their regulatory information. However, the former two groups are too expensive for small businesses to afford on a continual basis, and the trade associations reportedly only able to focus on the proposed regulations with the biggest potential impact.

As mentioned earlier, the Chemicals and Metals Working Group discovered that many small businesses were reluctant to contact regulatory agencies for advice on regulatory compliance out of fear that the agency will send inspectors to the inquiring business and punish any violations uncovered. Along the same lines, the Environmental Products, Recycling and Waste Management/Disposal Industries Working Group found that small businesses perceive that agencies are more concerned with assessing penalties and fines than helping small businesses achieve compliance.

Lack of financial incentives for environmental compliance and pollution prevention was frequently cited as a reason that small businesses do not expend the time and effort to learn of environmental regulations and examine the possibilities for pollution control and prevention. The Forum noted that tax policy does not encourage capital expenditures to comply with environmental regulations. Moreover, the EPA Region III report stated that most of the lenders contacted in the study felt that, given small businesses' time and resource constraints, it is difficult to convince them of the merits of pollution prevention unless there were tangible benefits or monetary incentives.

Technical Guidance

The Forum's Chemicals and Metals Working Group found that more technical guidance and educational materials are warranted to help industry comply with regulations. The available technical guidance does not include specific, understandable information on regulatory responsibilities and requirements, or proven technical procedures and approaches for managing and controlling environmental emissions. Among the suggestions offered by small business were: Industry specific guidance that cuts across all regulatory programs; The development of more technical information and delivery systems, such as use of limited third-party assistance, to communicate requirements; Additional educational materials and information kits suitable for the small business audience; and more consultation with small business trade associations, state and local government; and other agencies when developing educational guidance on compliance methods.

CHAPTER 4.

Policy Alternatives for Discussion

The Regulatory Process

Underlying all of the discussion points is the understanding that both demand for the products of this industry and their supply are strongly influenced by the nature of the regulatory process. Without regulations, the demand for the goods and services of this industry would be very low. And we have found, through the course of this study, evidence of an important feedback loop between the regulatory process as it exists today and the willingness of capital providers to invest in new technology for this industry. In each of the following ways, the regulatory environment is an important determinant of the perceived shortfall of capital for new environmental technology from small companies.

- ***Delays and Uncertainties Surrounding the Permitting and Approval Process. Regulatory approval of new technologies is slow and uncertain. Regulatory jurisdiction is fragmented. Every state has its own regulatory bodies, and approval in one state does not automatically bring approval in any other jurisdiction. All of this adds cost and risk to the developers and those who finance them.***
- ***Performance Standards versus Specific Technology. Many environmental regulations specify that a particular technology must be used, thus stifling the development of new technologies that might do the job better or cheaper. Instead, specifying a performance standard and leaving the technology for the marketplace to decide can lead to new technologies and improvements to existing ones.***
- ***The Lack of a Nationwide Process for Certifying the Effectiveness of New Technologies***
- ***The Lack of "Hold Harmless" Testing of New Technologies***
- ***The Lender Liability Problem***

Each of these can be expected to retard the development of new technologies, and indeed each of them does. This should come as no surprise. The economic system is functioning as one would predict. None of the remedies discussed below will be effective so long as these problems persist. Fortunately, the EPA is well aware of these factors and are at the forefront of the Environmental Technology Initiative.

The President has issued an Executive order requiring agencies to identify and address available alternatives to direct regulation, such as user fees or marketable permits. The Order also requires agencies to consider incentives for innovation and to specify performance objectives if possible, rather than specifying the behavior or manner of compliance that regulated entities must adopt.¹³

Permitting

Developers and investors uniformly request that the permitting process be streamlined. Many investors suggested a certification process for streamlining permits (See below). A technology certification process would eliminate the engineering review process required for permit decisions. State and Federal permit writers would use the specific certification claims as their engineering decision in the permit process. Developers also suggested that clarification materials (e.g., a flow chart) be created for developers, and that reciprocal agreements be developed between states. State environmental offices and the U.S. EPA realize the problems contained in current permitting procedures and are taking steps to reform them.

Recently, the EPA established a Permits Improvement Team to improve the process for obtaining environmental permits. The team is currently addressing the recommendations developed by the Agency as part of the Vice President's National Performance Review. The Permit Improvement Team is made up of regulators from EPA, state, tribal and local governments. The team conducted five national stakeholder meetings throughout the country. The results from the meetings will be presented at the White House Conference on Environmental Technology.

Another measure taken by the EPA to improve the permit process is the Common Sense Initiative. The initiative is designed to achieve greater environmental protection at less cost by creating pollution control and prevention strategies on industry-by-industry basis, rather than by the current pollutant-by-pollutant approach. The Common Sense Initiative is expected to result in significant improvements to current regulations (including permitting requirements), as well as proposals for Congress to consider in cases where legislative reforms may be required. Consensus proposals generated by the Initiative will be designed to better protect the environment, reduce pollution

overall in the U.S., and reduce by millions of dollars the costs that industry faces.

The six industries selected by EPA's Administrator Browner to participate in the "pilot" phase of the initiative are: auto manufacturing, computers and electronics, iron and steel, metal finishing and plating, petroleum refining, and printing.

Testing and Certification

Developers and investors uniformly request that the EPA put more resources into testing technologies for their ability to meet standards, either by conducting this testing itself or contracting it out to a non-government entity.

The shortage of testing venues can be partly eliminated by making use of contaminated federal facilities. The Western Governor's Association has done precisely this by picking 13 sites to test 20 innovative environmental technologies, ranging from mixed waste to groundwater cleanup techniques.

A public/private partnership at federal facilities has been developed to evaluate innovative hazardous waste treatment technologies. The scope of this initiative is to obtain market, regulatory and public acceptance of hazardous waste innovative treatment technologies through full-scale demonstrations. Clean Sites, Inc. (through cooperative agreement with the EPA) is working with a number of organizations to establish partnerships between federal agencies, federal and state regulators, and fortune 500 companies to demonstrate and evaluate innovative treatment technologies. These systems target contamination problems of mutual concern at federal facilities and private sites across the country. Although this initiative is limited to Fortune 500 companies and hazardous waste remediation technologies, small businesses require similar programs to address the generic problem of full-scale demonstration through the use of a federal partnerships.

The EPA's Design for the Environmental Program is a partnership initiative designed to assist small and medium metals manufacturers with innovative treatment technologies, pollution prevention opportunities, and compliance information and assistance. Partners for this project are between industry and government and include: Sandia National Laboratory, the National Institute of Standards, The Manufacturing Technology Centers of the Midwest and Great Lakes, and the EPA.

Another important improvement is to allow selected sites to be used for testing new technologies with a hold-harmless provision if the technology does not meet the target standards. Current practice creates a disincentive to allow one's business or property to be used to test a new technology, because if the technology fails to meet the standards, the business has undergone the expense of the new technology and it is still liable for further cleanup or to buy yet another technology. One expert recommended that a user be allowed to

contract with a developer to test a technology so that if it worked, the user would pay a previously agreed upon price for the service. If it did not meet specifications, the user would not have to pay for the technology, nor would it be liable for further cleanup. The cost would be borne by the developer, the government, or by cost-sharing.

The EPA could work with the thirty-nine state Science and Technology Foundations. These organizations have technical departments that can identify and evaluate environmental technologies. Panels of scientists from these organizations be used to locate environmental technology entrepreneurs, to oversee the testing, and to administer the funds.¹⁴

Sites should be chosen so that a failure of the technology would not be catastrophic to the local environment. There should be many such sites available. With all the pollution of the earth that is taking place, surely there will be no significant additional deterioration of the environment from such failures of technology, while the potential benefit from technologies that can be proven to work is enormous.

Many individuals interviewed call for a national technology certification process that functions much like the FDA drug approval process. Under such a scenario a product must pass through one set approval process. Once it passes those tests, it receives a "stamp of approval" for use anywhere in the country with similar types of clean-up activities.

Such a process would serve to streamline the permitting process because it would eliminate the need for a series of site-specific tests. This would drastically reduce permitting delays and therefore reduce one of developers' major financing gaps. It would also help greatly in selling U.S. products abroad. The EPA stamp of approval that "this technology works" is a powerful selling tool for American businesses.

Developers and investors call for an EPA certification process per se not only because it would eliminate testing repetition (except where state and local standards are higher than those of the EPA), but also because it would give potential users confidence in the technology - domestically and internationally.

Investors are not requesting that the EPA select and support specific technologies. Rather, they prefer to see that the EPA set the standards, create a

well-developed body of technology performance data across a range of conditions, and in the certification process simply verify that the technology meets those standards or, more simply, that the product label accurately reflects how the product performs.

Certification measures are being taken in some places of the country. California has just developed its own certification process to streamline that state's permitting practices. The program is well-heralded by investors and there are expectations that it will be replicated in other states. Additionally, the Western Governors Association is examining the possibility of creating approval reciprocity among thirteen states.

Lender Liability

A discussion of the various means of mitigating the effect of environmental liability upon the lending and small business communities would be incomplete without an examination of the current contradiction between the SBA's role as a lender of last resort -- which is generally recognized as being of great significance to small business development -- and its potential liability for environmental contamination for which it is not responsible.

Congress has created and funded the SBA to provide financial assistance to small businesses in recognition of the great difficulty these firms frequently experience in obtaining credit and the importance of the small business community towards the country's economic expansion. This role is hampered by the congressional waiver of the SBA's sovereign immunity from environmental liability under state and federal laws, and the inconsistent and vague statutory protection for lenders from environmental liability generally. Similarly, the historically aggressive role taken by enforcement officials at the EPA and state agencies towards the SBA, which is frequently viewed as a "deep pocket" with the resources to fund a cleanup operation, has contributed towards the Agency's reluctance, and inability, due to limited resources, to provide financing if there is a risk of liability.

In view of the benefit to be gained by facilitating SBA financing, the premise underlying the Agency's environmental liability is questionable since SBA, unlike other federal departments and agencies, has not created or contributed to hazardous contamination around the country. Thus, there is no compelling reason to support the conclusion that SBA should bear the same

sort of liability for environmental problems, especially when these are caused by third parties, not the Agency.

Lenders are not going to make loans unless their concerns are addressed, because their obligations to their stockholders and account holders place upon them an obligation to exercise due diligence in avoiding unacceptable risk in their loan making. Bank regulators will put loans with unacceptable liability risk into special classifications, with undesirable consequences for the bank and the employee that made the loan. All-out pursuit of the deep pockets of lenders may increase funds for environmental cleanup in the short run, but at present and for the future it is stifling the flow of funds to businesses in which there is a risk of lender liability.

The economy is an interrelated system. Actions result in reactions. Suboptimizing in one part of the system can result in a failure to optimize the system overall.

At a minimum, Congress should clarify and expand the protection given lenders under the Superfund statute, and extend this protection to other environmental laws. Congress and the EPA should also eliminate the contradiction between SBA's role as a lender of last resort and its exposure to environmental liability by specifically limiting the liability of SBA under federal and state laws, which would greatly enhance the SBA's ability to provide credit to needy small business.

In formulating our policy alternatives, we have looked for ways to use existing programs to better serve the needs of this industry, rather than creating new programs and new bureaucracies. Fortunately, there are a number of existing programs that can be better targeted at this industry.

We have also used the framework set forth in the President's Technology for a Sustainable Future: A Framework for Action.¹⁵ Our policy alternatives follow the strategy of focussing upon regulatory policy, market stimulation, fiscal policy, partnerships, education & training, and information dissemination.

In addition, we must recognize the budget realities of the 1990s. There are no funds available for a new program of grants, loans, or loan guarantees targeted at the environmental technology industry, and no such programs have been recommended here. Policy Alternatives calling upon additional SBA

resources, both dollars and staffing, are assumed to be funded out of appropriations for the Environmental Technology Initiative.

The Innovation Process

The innovation process consists of a number of stages. Various observers have given them different names but in general they subscribe to the states described in Figures 1 - 3.

The consensus of interviews and the literature is that financing for the early R & D stages is generally adequate. Likewise, once a company and a new product have proven that they can generate sales, financing is available. It is in the in-between stages that capital to finance a working model, engineering prototype, and production prototype is very hard to come by. This is a fact of life for all small firm developers of new technology, but it is especially acute among environmental technology developers for the reasons cited above.

The Federal budget for environmental technology programs was more than \$4 billion in fiscal year 1994. "These programs are primarily focused on the front end of the continuum --technology research, development, and demonstration -- with little funding, in comparison, directed to commercialization. . ."¹⁶

Policy Alternatives for Financing Developers

The Environmental Technology Bank of the United States (Envirobank)

Even though we believe that regulatory problems are an important determinant of the financing shortfall, we nevertheless think that to optimize this industry's performance, improvements in financing are needed as well as improvement in the regulatory process. There are two principal reasons for this:

- 1. Public Good. Because of the public good nature of environmental preservation, there is a rationale for public sector involvement. In general, the private market will not bring forth an optimum amount of environmental preservation because many**

of the benefits accrue to the public at large rather than to individual customers, and providers do not receive revenue from these beneficiaries.

- 2. International Competitiveness. This is an industry in which in most areas the U.S. is still pre-eminent in the technology. However, Japan and Germany are gaining. In some areas they have already surpassed us.¹⁷ The growth potential of this market world-wide is enormous. Eastern Europe, Asia, Africa and South America will have a huge and growing demand for these services in the next decade. This industry should be on our list of critical technologies. Upon the success of this industry will depend many high paying jobs, exports, and part of**

America's technological prestige world-wide. We should not let this be another industry in which we were once pre-eminent but lost our lead to others.

The proposal is to create the Environmental Bank of the United States. The bank would be a small business investment company (SBIC). SBICs, licensed and regulated by the SBA, are privately owned and managed investment firms. They use their own funds, plus funds obtained by borrowing at favorable rates with an SBA guarantee and by selling their preferred stock to SBA, to make venture capital investments in small businesses. The SBICs provide equity capital, long-term loans, debt-equity investments and management assistance to qualifying small businesses. Their incentive is the chance to share in the success of the small business as it grows and prospers. Many SBICs specialize in the field in which their management has special knowledge or competency.

We have found that there is a variety of types of financing that these businesses need, depending upon the stage of development of the firm and of the technology. We also found that only about five percent of U.S. venture capitalists actively invest in the environmental technology industry and that even among those, there is a movement away from early-stage investing.

Envirobank can provide a wide variety of financing to small environmental technology businesses: equity, debt, debt with equity features, strategic partnerships with large businesses, promoting the use of informal investors, etc. As a venture capitalist, it can also provide the management assistance many of these firms badly need.

The Envirobank would concentrate on the environmental technology industry. And it would, by design, fill a gap and provide more upstream funding than venture capitalists are doing today. However, it would be operated by professional venture capitalists with the goal of providing a competitive risk-reward structure to its investors. This cannot be an organization that shovels money out the door simply in order to say that it is helping firms with great ideas for saving the environment and no one else will listen to them because they don't have a track record.

Envirobank's investments must be profitable. It must invest in companies with sound management or provide the assistance necessary to add good

management to a promising technology. Otherwise Envirobank will not survive, and the government's and the private sector's investments will be lost.

This would not be an ordinary SBIC. But the SBIC program and structure are flexible enough to enable the SBA and the EPA to facilitate the creation of such an SBIC. Financing commitments would be sought from a number of sources including the following:

- 1. Foundations.** *Large and small foundations will be solicited to invest part of their investment portfolios in the SBIC. They would not have to make grants.*
- 2. Investment Banks.**
- 3. Pension Funds**
- 4. Trade Associations**
- 5. States, cities, counties.** *These entities can invest up to 30% of an SBIC's non Federal dollars. They could make grants or invest their investment funds. State x, for example, contributes \$1 million. This is matched by \$3 million of SBIC federal leverage. The \$4 million can be set aside for firms located in state x. This gives these entities a way to leverage their own dollars.*
- 6. Private Investors.** *The SBIC could sell shares to individuals either through private or public offerings. A large part of the American public are sufficiently concerned about environmental preservation that they would invest in an enterprise that would help preserve the environment and earn them a profit at the same time. For example, mutual funds that invest in non-polluting companies have raised millions of dollars from investors.*

The key to the success of Envirobank is the quality of its own management. The first step would be to find a high quality investment manager who would be interested in running such an organization. Such an individual will be the magnet for the investors.

The next step would be to do a rigorous feasibility analysis of the desirable size of the organization in terms of staffing and funding, a risk-return analysis, etc. Next, the SBA and the EPA would facilitate communication with potentially interested participants, such as investors, venture capital experts, environmental technology experts, etc. It would be appropriate for the EPA to take the lead role in this next phase in order that the SBA's licensing, funding, and regulatory role with respect to the SBIC industry not be compromised.

SBA's funding will come from a transfer of funds from EPA. Forty-five million dollars in private sector funding would leverage \$90 million in participating securities, which is the current ceiling. For budgetary purposes, SBA assumes leverage will be drawn down over four years, or at the rate of \$22.5 million per year in this case. With the current Participating Security subsidy rate of 8.9%, subsidy budget authority of \$2 million per year for four years would be required to fund Envirobank at this level. With the leverage fully drawn down, Envirobank would have a total initial capitalization of \$135 million.

This plan achieves the ETI goal of working through partnerships. This would be a partnership between SBA, EPA, and all the private sector entities, states, cities, etc. that would be involved.

More Effective Use of the SBIR Program for Environmental Technology

The Small Business Innovation Research (SBIR) program was designed to assist small technology-based firms that are in the "valley of death" stage of their development. Each federal agency with an extramural research and development budget in excess of \$100 million must establish an SBIR program, under which it sets aside at least 1.5 percent of its R & D budget in 1993 and 1994, at least 2 percent in 1995 and 1996, and not less than 2.5 percent thereafter. Eleven agencies currently participate. The program has three phases:

- o Phase I awards are funded up to \$100,000 and are made for research projects to evaluate the scientific and technical merit and feasibility of an idea.*
- o Phase II awards are for the most promising Phase I projects, and are made to further develop the proposed idea for one or two years. Most of these awards are for \$750,000 or less.*
- o In Phase III, an innovation is brought to market by private sector investment and support. No SBIR funds may be used, but Phase III may include follow-on production contracts with a federal agency for future use by the government.*

The program is working well across the board. However, the flow of funds into the environmental technology industry has been rather small. Although precise estimates are difficult to make because there are no unique SIC codes for the environmental technology industry, SBA's Office of Innovation, Research and Technology estimates that government-wide in fiscal year 1991 only \$3.6 million out of \$483 million in total awards went to environmental technology. At the EPA, only 45 such awards out of more than 2,000 were made.¹⁸

Because of the importance of this industry both to the protection of our environment and to America's international competitiveness, we recommend that agencies whose research mandates include activities falling under the environmental technology umbrella, consider targeting more research topics and funds into this area. Since these budget allocations are normally made on a decentralized basis by each agency, Office of Management and Budget involvement may be necessary to realize a significant funding increase.

Technical Assistance Centers.

Lack of information by lenders is an impediment to the flow of capital into small environmental technology companies. If a lender is not comfortable with

his understanding of the amount of risk involved in a business, it is not prudent for him to make a loan.

There exist across the country many organizations that could be configured to provide technical assistance to lenders on various aspects of environmental technology. These would include, for developers, an assessment of the firm's technology (both the technology it is selling and the technology it uses to manufacture what it sells) and management. For users of environmental technology (discussed in the following section) the assessment would focus on the technology to be purchased by the firm, its technical feasibility and its effect on the firm's rate of return. Consider environmentally-friendly ink for the printing industry as an example. An assessment would answer such questions as "does it work, if so does it require more down-time to clean the presses, what effect does this have on profits, is there an alternative process that is as friendly to the environment but not so costly to the bottom line, etc.?"

Existing government-financed technical assistance networks include Small Business Development Centers, National Institute of Science and Technology Centers, and centers that are in the network of the National Coalition for Advanced Manufacturing, among others. Technical assistance could be provided via training courses, a national computer network or on a case-by case basis. The facility could be created initially with government funding and its ongoing expenses paid for as much as possible by fees charged to its customers.

Strategic Partnerships and Informal Investors

The study team encountered a great deal of support for developers bridging the financing gaps and obstacles mentioned earlier by joining forces with a "strategic partner." These partnerships may be with medium to large businesses, potential users, public sector groups, equipment manufacturers, larger environmental vendors, academia, R & D institutions, or some combination thereof. These alliances can various many forms, such as joint ventures and licensing agreements.

Strategic partnerships have already become so critical to environmental technology start-ups that small, entrepreneurial companies are hiring management consulting firms to create linkages into the marketplace, mostly through partnerships.

Strategic partnerships make sense as capitalizing upon unique aspects of American competitive advantages, joining small technology-based firms that are world-renowned as the most efficient producers of technological innovation and larger firms that are better at raising capital and manufacturing and selling a product.

Examples abound of how environmental technology developers have used strategic partnerships to their advantage - if only to stay alive. Unfortunately, out of an inability to secure sufficient financing or partnership agreements with domestic organizations, many environmental technology developers opted or were forced to develop partnerships with foreign companies and other investors. One of the consequences of this situation is that technologies that were originally developed in the United States - many with public R & D monies - are sent overseas to be manufactured into products that are exported back into the U.S.

On future grants and contracts the government may wish to require that, if owners of technology financed in whole or in part by the U.S. taxpayer wish to sell to or form partnerships, etc. with foreign-owned companies, the government funds used to develop the technology be repaid with interest to the government. The repayment should be placed in a special fund at the Envirobank to finance environmental technology development and commercialization. Requiring repayment would help close a leak in the system in which the benefits of government-financed R & D are going to the competitors of American business.

Another source of financing that appears underutilized is the wealthy private individual investor, sometimes referred to as "angels" or "informal investors." Typically such individuals seek out investments not only for economic but for noneconomic reasons such as the excitement of working with bright young people in an exciting growth company, or satisfying their sense of social responsibility. They find out about deals informally, by referrals from friends or acquaintances in the banking, investment, legal or accounting communities.

"The private investor's resources are considerable, with their venture investment portfolios aggregating in the neighborhood of \$50 billion according to a study carried out by William Wetzel for the SBA in 1989. Acting alone or through a syndicate of friends and acquaintances, he can raise as much as \$1 million for a given deal. . . Occasionally the prospective individual investor participates in local groups like the MIT Enterprise Forum, where early-stage

entrepreneurs present their aspirations and problems. . . Such investors rely heavily on the advice of their friends and other backers when making investment decisions. Few make a detailed analysis of the situation, evaluating the company primarily on the basis of its management. . . The investments are usually straight equity. Thus, the entrepreneur needs only to find the right angel for his company. This is not easy. . . "¹⁹

The SBA or the EPA could provide or facilitate a mechanism to match environmental technology developers with potential strategic partners and informal investors. There was tremendous support for the idea. Small businesses do not have the resources to gain the necessary information and contacts to locate suitable partners. Thus, an inexpensive, efficient and neutral arbitrator for partner matching would be of great assistance to them. The SBA act could as a clearinghouse for a partnering system, with data collected locally or regionally and maintained in one central location. The Envirobank could also play a role.

The Commercialization Matching System (CMS) of the SBA's SBIR program might be adapted for this purpose. This system was designed to link potential sources of capital with high tech firms that are participating in the SBIR Program. This free service provides investors with a list of SBIR awardees, and provides awardees with the names of investors that would consider financing an SBIR company. Currently the 22,000 SBIR awards given during the last 11 years are on the system. Six hundred private venture capital firms are also listed.

Reliable sources of data will be needed. Over the course of this study, the SBA has encountered a number of organizations that might qualify as appropriate partners.

The SBA or EPA could also facilitate the expansion of the MIT Forum concept to other areas of the country in which the environmental technology industry is concentrated.

Please see the Appendix 2 for additional information.

Defense Conversion and Environmental Technology

The SBA and the Department of Defense are collaborating on the Defense Dual-Use Loan Program on a pilot basis nationwide. Pursuant to a Memorandum of Understanding with the Department of Defense (DOD) and utilizing funds transferred from DOD, SBA will guarantee loans made by its participating

lenders to defense dependent small business concerns. The purpose of these loans is to enable such concerns to diversify their revenue sources while retaining them in the national technical and industrial base for the DOD. Recipients of DDLP loans must be dependent on defense contracts as wither prime or subcontractors.a program to assist small defense contractors in adapting to the conversion from defense to civilian production.

We anticipate that some of these technology-based firms will be capable of adapting their know-how to the environmental technology industry. SBA will optimize the delivery of these services to firms going into environmental technology activities.

For Future Consideration: A Commercialization Loan Program.

There was considerable interest expressed in a dedicated loan program targeted specifically at environmental technology firms entering the commercialization phase of their development. With rare exceptions, SBA has not targeted its loan programs at a particular industry. Two exceptions are the Pollution Control Bond Program and the Energy Loan Program, in both of which SBA suffered heavy losses.

SBA's Energy Loan program provided loans and loan guarantees for small businesses for the design, engineering, manufacture, distribution, market, installation, or servicing of energy measures. SBA was authorized to take greater risks than it does in its other loan programs. The loss rate to date on this portfolio totals 44%.

These results indicate what can happen if, for whatever well-intentioned reason, the element of risk is under-represented in the credit decision. What begins at the outset as an exciting enterprise to further technology can wind up as a liquidating portfolio of mostly dead businesses, tremendous losses to the taxpayer, and little advancement of successful technology. If the risks are at commercially realistic levels, environmental technology firms can qualify for SBA 7(a) and 504 loans today.

In addition, we believe the alternatives discussed here should be considered as the highest priority. If well-implemented, they will provide the proper basis for attaching this problem, especially the Envirobank, which can offer an array of debt, equity, and hybrid financing tailored to the needs of the individual firm.

We recommend, therefore, that a commercialization loan program be deferred for further study, pending the outcome of the other alternatives.

Policy Alternatives for Financing Users

A nation's firms gain competitive advantage if domestic buyers are, or are among, the world's most sophisticated and demanding buyers for the product or service. Such buyers provide a window into the most advanced buyer needs. . . Sophisticated and demanding buyers pressure local firms to meet high standards in terms of product quality, features, and service. . . The presence of sophisticated and demanding buyers is as, or more, important to sustaining advantage as to creating it. Local firms are prodded to improve and to move into newer and more advanced segments over time, often upgrading competitive advantage in the process.

-- Michael E. Porter²⁰

The strategy set forth in these pages recognizes the interplay between technology developers and technology users. We aim not merely to facilitate the ability of small business users to attract capital for their purchases of environmental technology, but to help them become world-class consumers. "Buyers are demanding where the product needs in an industry are especially stringent or challenging because of local circumstances."²¹ There is no necessary conflict between stringent environmental standards and economic advance. Stringent domestic standards can help keep the American environmental technology industry world-class. Lender and small business education as set forth below are aimed at facilitating the growth of user and lender sophistication.

Environmental Protection Fund

In 1978, the SBA established a Pollution Control Bond Program to assist small businesses to prevent, control, or abate pollution or contamination. The program offered a 100% guarantee on tax-exempt industrial revenue bonds.

In its ten years of existence, the program guaranteed 263 loans that ranged from \$80,000 to the cap of \$5,000,000, and averaged \$1,200,000.

However, the program faced many difficulties. Its twenty-year repayment term was much longer than the life of most of the purchased equipment, allowing for technological innovations and new environmental laws to render the equipment obsolete. Thus, the equipment often lost its value as collateral early in the loan term.

The lengthy repayment schedule combined with liberal collateral requirements and high bond issuance transaction costs resulted in an excessive high-risk program for the SBA. This risk eventually was reflected in the portfolio's performance. Nearly a third of the loans have been charged off.

Other factors contributed to the program's failure. In the early 1980's, the program lost its tax-exempt status. Moreover, in an effort to reduce its portfolio risk, SBA's had to increase its collateral requirements. By the late 1980's, only two or three loans were guaranteed under the program per year.

In 1988, the program was replaced with the 7(a) Pollution Control Loan program. The Pollution Control Bond exists today only as a liquidating portfolio.

The Pollution Control Loan program authorizes SBA to provide financial assistance to eligible small business companies for the financing of the planning, design or installation of a pollution control facility. Applicants must meet the eligibility and credit criteria applicable to all 7(a) loans. Since regular 7(a) loans can be used for the same purposes, the only practical difference is that the guarantee maximum is \$750,000 for regular 7(a)'s and \$1 million if the loan is for pollution control purposes.

One way to address the concerns raised by small business users is to note that the imposition of environmental requirements will have the effect of internalizing the cost of production: production costs will rise more or less proportionately for all firms in the same industry; product prices will rise accordingly, and a new equilibrium will be established in which, depending upon demand and supply elasticities, prices will be higher and output smaller than before. Some firms will leave the industry, and resources will be freed for more productive uses elsewhere. That is the prediction of economic theory, and there is no reason to believe that this will not happen. The policy prescription following from this analysis is that no additional governmental action is necessary.

This is reinforced by the availability of SBA guaranteed loans that can be and are used for such purposes, provided that the risk is within acceptable parameters.

However, due to the existence of the lender liability problem and in an effort to help the market over a time of transition to more stringent environmental requirements, policy makers may wish to consider creating a fund for small business-dominated polluting industries, such as dry cleaners, printers, jewelry manufacturing, etc. All firms in the named industries would pay a small percentage of their revenues into the fund. Then they could receive financial assistance (grants, zero or low interest loans, etc.) to fund their purchases of pollution control or prevention technology. In this way, the industry and its customers would finance the pollution costs associated with the industry in the form of user fees. The industry's customers would thus finance the environmental preservation costs produced by the products they buy. The cost of preventing environmental damage would thereby be internalized to that industry rather than being paid by society at large.

Lenders would not be asked to fund investments that do not add to the bottom line or that subject them to potentially costly liability. All firms in the industry would be treated the same. This would be analogous to the fund to finance the cleanup of underground storage tanks in Texas and to programs in Germany, Japan, and Sweden.²²

Lender Education

We previously recommended the creation of a national network of technical assistance centers in conjunction with the National Coalition for Advanced Manufacturing (NACFAM) that would work with SBA, the EPA, private lending institutions, and certified development companies to qualify small environmental technology firms technically for loans.

These centers would also work with lenders and technology users. They would perform a technical assessment of the loan application to determine whether a firm's purchases of pollution control or pollution prevention equipment, software or processes would increase the firm's performance vis a vis the regulatory requirements and thus its ability to re-pay the loan.

Small Business Education

As Michael Porter noted, sophisticated domestic buyers of technology help producers become world class by demanding the best products. The Small Business Development Center (SBDC) program, sponsored by the SBA in a cooperative effort with the private sector, the educational community, and Federal, state, and local governments, is ideally suited to provide education to small businesses on how to buy and use environmental technology.

The 57 SBDCs provide management and technical assistance counseling services and training opportunities for present and prospective small business owners in over 960 locations nationwide. The SBDCs work with paid, private sector consultants, engineers, and testing laboratories to provide clients with specialized expertise.

The SBA and EPA are already looking into ways to utilize the SBDC network for educating small business owners on adopting environmental technologies. The FY 94 Environmental Technology Initiative funded four pollution prevention assistance pilot programs which will assist technology users to become, among other things, sophisticated buyers. A nationwide program delivered through the SBDC network is recommended.

In addition, at the initiative of the EPA Ombudsman, a government-industry working group will be convened in which the EPA, SBA, Internal Revenue Service, and the banking industry will discuss issues and recommend solutions to address the problem of businesses obtaining loans for the installation of pollution control equipment and for the employment of new technologies. Information gathered from these meeting can be disseminated through the SBDC network.

Policy Alternatives: A Final Word

We have attempted to suggest remedies built upon the complex and interrelated nature of the environmental technology industry: the interplay between regulators, developers, users, and sources of finance. Our points address each of these. It would be simplest to recommend freely available loans and grants, but funding on demand would not accomplish the goal of developing an ever more flourishing industry. Instead we stress the importance of improving the regulatory environment, using existing programs better to provide capital and management assistance to qualified developers, providing technical assistance to lenders in understanding environmental technology, promoting strategic partnerships and informal investors, providing a new and better source of financing to users, and educating small businesses to become world-class consumers of environmental technology.

This Report represents the analysis of SBA staff, and are not the official recommendations or policies of the SBA, the EPA, or the U.S. government. In the interest of improving small businesses' access to capital for the development and utilization of environmental technology, the SBA looks forward to further collaboration with the EPA to bring mutually acceptable ideas to fruition. It is SBA's understanding that funding for such projects and SBA's associated staffing requirements will be provided through the budget of the Environmental Technology Initiative.

Appendix 1

MEMORANDUM OF UNDERSTANDING

between the

UNITED STATES SMALL BUSINESS ADMINISTRATION

and the

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

on

ENVIRONMENTAL TECHNOLOGY AND SMALL BUSINESS

I. GOAL

WHEREAS, it is the mission of the U.S. Small Business Administration (SBA) to provide technical, financial, and management assistance to the small business community to foster job creation and economic growth, and the environmental technology industry is identified as a high-growth segment of the U.S. economy with enormous export potential;

WHEREAS, it is the mission of the U.S. Environmental Protection Agency (EPA) to exercise regulatory responsibility for the prevention, control and abatement of pollution in all media: to develop and disseminate technical information that will assist the private sector to achieve environmental compliance and improvement; and to provide leadership in developing voluntary cooperative programs with other Federal agencies and with the private sector to enable U.S. business to develop, demonstrate, evaluate, market and adopt cost-effective environmental (including pollution prevention) technologies and approaches to achieve environmental compliance.

THEREFORE, EPA and SBA agree to work cooperatively, through this Memorandum of Understanding (MOU), to ensure that the U.S. Government effectively encourages, supports and enables U.S. small businesses to develop, market and/or adopt cost-effective environmental (including pollution prevention) technologies to achieve economic growth and environmental compliance.

II. AUTHORITIES

Nothing in this MOU alters the statutory authorities of SBA or EPA. This MOU is intended to facilitate cooperative efforts by both agencies for mutual provision of technical, management, and financial assistance to small businesses developing or adopting environmental (including pollution prevention) technologies. This MOU does not supersede or void existing understandings or agreements between SBA and EPA.

III. OBJECTIVES

A. SBA and EPA will identify the management assistance needs of environmental technology developers and establish a program where those needs can be met utilizing the Small Business Development Center (SBDC) network, and other SBA resources.

B. SBA and EPA will identify the funding needs of environmental technology developers and determine if existing SBA programs satisfy this industry's requirements and, if not, what SBA can do to meet their needs.

C. SBA and EPA will develop a strategy, utilizing the SBDC network and other SBA resources, to provide multi-media pollution prevention technical and financial assistance to small business.

D. EPA will train SA and SBDC personnel on EPA regulations and develop a strategy to inform and assist small businesses with EPA regulations.

E. SBA and EPA will develop a strategy to encourage environmental technology developers to export.

F. SBA and EPA will work together to identify regulatory reform approaches to ease the burden on small businesses.

G. SBA and EPA will participate in joint conferences to provide both management and technical assistance to small business.

IV. RESPONSIBILITIES

A. On the Part of SBA

1. To designate appropriate Points of Contact to promote coordination and complementary funding, assist in arranging joint program and project planning, and assist in the creation of joint public-private programs.

2. To support selected EPA programs by providing SBA technical expertise, resources, and facilities.

3. To support the exchange of information between the agencies.

B. On the Part of EPA

1. To designate appropriate Points of Contact to promote coordination and complementary funding, assist in arranging joint program and project planning, and assist in the creation of joint public-private programs.

2. To support selected SBA programs by providing resources and/or technical expertise.

3. To support the exchange of information between the agencies.

C. On the Part of EPA and SBA

1. To authorize the Points of Contact designated by the two agencies to arrange for periodic meetings of appropriate management and staff from the two agencies.

2. To provide opportunities for personnel to better learn the policies, programs, and activities of both agencies and to efficiently use the mechanisms and experience of the other agency.

3. To support each other on policy and technical issues.

4. To reference this MOU in any supplemental understandings, amendments, or interagency agreements (IAGs) prepared to implement cooperative efforts carried out by the two agencies, Such IAGs may provide for the transfer of funds to pay for services, the use of facilities, the expertise of personnel, and the development of cooperative programs and projects, and will be subject to the laws regulations pertaining to the respective agencies.

5. To provide proposed press releases and other public affairs information related to joint efforts or projects under this MOU for review and concurrence of the other agency prior to release.

6. To seek to ensure sufficient funding by each agency to carry out projects that are mutually agreed upon under this MOU.

V. AUTHENTICATION

This MOU becomes effective on the dated of signature by both parties and continues for a period of five years. This MOU may be modified by mutual consent or terminated by either party with ninety (90) days advance notice.

This MOU is entered into on this 15th day of November in the year 1993.

Appendix 2

Strategic Partnerships Examples of joint ventures

Alternative Remedial Technologies Inc. (ART), a soil washing firm in Tampa, Florida is owned 50-50 by Geraghty & Miller (G&M) of Plainview, NY and Heidemij Realisatie, of Arnhem, the Netherlands. Soil washing has been used in Europe since the early 1980s to clean contaminated soils. G&M essentially bought its way up the soil washing technology curve by partnering with Heidemij Realisatie, one of the European leaders.

Catalytica Inc. of Mountain View, California is a developer of proprietary catalysts and processes to eliminate or minimize the formation of pollutants in industrial processes. Its technologies are principally directed at the electric power generation, gasoline refining and fine chemicals industries. Strategic partnerships with large industrial corporations are critical to Catalytica's business strategy. As of sixteen months ago, Catalytica's partners had collectively invested over \$40 million in joint projects. In 1992 about 80% of the company's \$9.6 million in revenues were from agreements with four collaborative partners. Conoco Inc., Finnish Oil company Neste Oy, and General Electric agreed to work with Catalytica on the development and demonstration

of specific products due to inabilities of their respective in house R&D departments to come up with the products on their own. Catalytica also has agreements with at least two large Japanese firms. One of them is a 10-year technical cooperation agreement with Mitsubishi Oil Co. Ltd. This agreement includes a \$10 million investment and the recent appointment of the Japanese company's president and CEO to Catalytica's board of directors. Catalytica's president Ricardo Levy said that "Japanese companies are 'more willing to invest research into... next-generation technology.'" "Ultimately, the strategic alliances will form the basis of joint manufacturing operations, and partners will participate in commercially licensing the process and profits from commercialization."²³

Zapit Technology Inc. of Santa Clara, California develops environmental applications for the electronic beam. "By pursuing an agreement with Raytheon Services Nevada, a subsidiary of Raytheon Corp., Zapit is hoping to enter the lucrative DOD/DOE markets. In return, Raytheon gets a leg-up in a niche technology."²⁴

The wind power industry consists of very small, undercapitalized, unsophisticated companies that compete "against large, independent power

developers in gas, coal and oil" for utilities' attention. "As a result, strategic partnerships between companies, utilities and fossil-energy producing competitors may arise. Already, FloWind has partnered with Kaiser Aerospace to manufacture turbines for AWT Inc...Kenetech has a strategic partnership with a subsidiary of Iowa-Illinois Gas & Electric Co. and a joint venture with a Texas utility. Zond has partnered with some smaller wind energy developers in the Midwest and Northeast to develop projects, and Westinghouse Electric recently gained a minority equity interest in New World Power."²⁵

What do environmental technology developers potentially have to gain from strategic partnerships?

- ***Demonstration facility***
- ***They can quickly move up the technology and manufacturing learning curves.***
- ***Manufacturing facilities***
- ***Credibility***
- ***Managerial assistance***
- ***Technical assistance***
 - ***Access to the larger organization's resources (administrative resources, outside contacts, financial institutions)***

- *Access to a manufacturers' marketing channels, including in the international sphere*
- *A first customer (a necessary ingredient in this industry for securing other customers)*
- *A source of funding not otherwise available*
- *A reduction in time to market.*

What do the partners potentially gain in return?

- *Some environmental consulting and engineering firms see access to cleanup technology as a means to differentiate themselves in a tough market.*
- *Solutions to in-house environmental problems*
- *Financial rewards from the success of a new technology*

Why might potential partners be reluctant to establish a relationship?

- *Environmental consulting firms may "eschew owning technology for reasons of objectivity." ("EC Firms Seek Out New Technologies,"²⁶*
- *For reasons of pride, managers and engineers may not want to adopt or nurture a technology that they did not invent themselves. This is known as "not-invented-here syndrome".*
- *When they have the necessary resources and know-how to develop technologies to solve their own environmental problems, companies may prefer to produce the technology themselves and sell it on the market.*
 - *Some businesses are reluctant to acknowledge publicly that they have any environmental problem.*
 - *In order to encourage competition among its suppliers and licensors and suppliers, a large company may prefer to purchase or license a product from an environmental technology developer rather than play a part in its development.*

The California Environmental Technology Partnership (CETP) recognized the significant benefits of strategic partnerships for the environmental technology industry and in 1993 proposed that the state "(i)nstitute a regular forum to bring together technology developers with strategic partners and other

investors."²⁷ In its "1994 Strategic Plan for Promoting California's Environmental Technology Industry," CETP said that even with the state's regulatory and permitting reforms "there remains the need to attract private sector financing into the final stages of technology development and early stages of commercialization. This can be accomplished by sharing risk through financial and strategic partnerships." To this end they are pursuing a number of strategic partner avenues, including developing "a trade association or other nonprofit umbrella group to function as a regular forum to identify strategic partners" and organizing environmental technology conferences both to attract potential customers on a worldwide bases and to bring together stakeholder for potential partnerships.

Partners

The Center for Environmental Policy, Economics and Science in Ann Arbor, Michigan has proposed to develop an Environmental Capital Network that will link private informal and corporate investors with environmental entrepreneurs. The knowledge, information, and interests contained in this organization may make it suitable for, and amenable to, broadening its services to include a full-scale partner matching system or to providing the SBA with data. Other organizations that we have learned of have already developed extensive databases; the SBA might want to consider means by which to cooperate with those organizations. For example, the National Environmental Technology Application Corporation (NETAC), a nonprofit organization in Pittsburgh, Pennsylvania, has a database that contains information on over 1500 new technologies. Consultants pay NETAC a nominal fee to gain information on new technologies that might apply to a specific environmental problem.

A database now being developed at the University of Massachusetts. called "Envirotech On-Line" is advertised as the "Global Electronic Information System for Environmental Business and Technology." For a fee it "will make information about a company, government agency or organization easily accessible to thousands of others looking for environmental technologies, services and partners." Envirotech On-Line will gain its information from "millions of reports, newsletters and contacts generated by banks, business associations and government agencies."²⁸ It remains to be seen whether this database can provide the information that investors, technology users, and the developers themselves require.

The immediate idea of the matching system is to link parties that are already searching for partners. With time, obstacles to broader acceptance of strategic partnerships - such as corporations' liability concerns - could be addressed.

Appendix 3

Acronyms

CERCLA Liability Act	Comprehensive Environmental Response, Compensation
CETP	California Environmental Technology Partnership
CDC	Certified Development Company
CEBO	California Environmental Business Opportunities
CFR	Codified Federal Register
DOE	Department of Energy
EPA	Environmental Protection Agency
MOU	Memorandum Of Understanding
OECA	Office of Enforcement and Compliance Assurance
OIRA	Office of Information and Regulatory Affairs
P2	Pollution Prevention
PEFCA	Petroleum Environmental Cleanup Fund Act
PLP	Preferred Lending Program
PRP	Potential Responsible Parties
RCRA	Resource Conservation Recovery Act
R & D	Research and Development
SBA	Small Business Administration
SBIC	Small Business Investment Companies
SOP	Standard Operating Policies
UST	Underground Storage Tanks

ACKNOWLEDGEMENTS

The study team would like to thank the following individuals, companies, and organizations for their invaluable assistance:

Tom Aarts, Johnnie Albertson, James T. Allen, Ph.D., Allan Barr, Allison Bird, David Bradley, Barry Butler, Ph.D., James Cabot, Diana Coats, Scott Copitts, Francis J. Conley, Jr., John Diaz, David Doherty, Scott Dougherty, Judith Dunn, Roxanne Elder, Environmental Business Council of New England, Mark Forest, Micke Gallagher, Glenn P. Harris, Darryl K. Hairston, Jeffrey S. Heimerman, Gail Humphreys, Tom Ingram, Ron Huntley, Heidi Jacobi-Mandel, Amy Karlen, Ph.D., Walter W. Kovalick, Jr., PhD, Stephen A. Lingle, Barbara H. Manning, Loch McCabe, Patrick McGowan, John McLennon, Stephen Miller, Molten Metal Technology, Scott Morris, Terry Nelson, Norm Peters, Michael E. Porter, Tamra-Shae Oatman, Paul V. Oliva, James Robbins, John H. Robison, Mary Jean Ryan, John T. Schofield, John Shedd, Jane Slater, Robert D. Stillman, Martin A. Spitzer, Don Steele, Chris Stinson, Ph.D., Cathy Douglas Stone, Synthetica, Chris Webb, and Edward Weiler.

In addition, we would like to thank the following banks who spoke to us about their experience with this industry: The Union Bank, Morrisville, VT; Bank of Boston, Waltham, MA; Prestige State Bank, Flemington, NJ; Citibank, N.A., Long Island City, NY; First National Bank of Pennsylvania, Hermitage, PA; Bank of Mississippi, Tupelo, MS; The South Shore Bank of Chicago, Chicago, IL; Centennial Bank, Olympia, WA; First National Bank of Oklahoma, Tonkawa, OK; National Bank of California, Los Angeles, CA; Key Bank, Salt Lake City, UT; Bank One West Virginia Huntington, N.A., Huntington, WV; Norwest Bank of Iowa, Fort Dodge, IA; FirstTier Bank, Lincoln, NB; West One Bank, Boise, ID; First Interstate Bank of Arizona, Phoenix, AZ; Commercial Bank of Georgia, Atlanta, GA; Valley Bank, Appleton, WI; Pioneer Bank & Trust, Bell Fourche, SD; and Bank of the West, Irving, TX.

Notes

Curtis Moore and Alan Miller, *Green Gold: Japan, Germany, the United States and the Race for Environmental Technology*, Boston: Beacon Press, 1994, p. 23.

Technology for a Sustainable Future: A Framework for Action, White House Office of Science and Technology Policy, p.

See Moore and Miller, *op. cit.*

Remarks by The Honorable John H. Gibbons, Assistant to the President for Science and Technology, "Technology for a Sustainable Future" Spectrum '94 Hyatt Regency Hotel, Atlanta, Georgia, August 15, 1994

Environmental Business Journal, May 1994, p.1)

Environmental Business Journal, April 1994, p.1

Environmental Business Journal, May 1994, p.1.)

Environmental Business Journal, May 1994, p.3)

Wall Street Journal, September 6, 1994, p. 3.

Although not otherwise discussed, Section 311 of the Clean Water Act also imposes liability for any discharge of oil or a hazardous substance into navigable waters. 33 U.S.C. § 1321.

EPA Region III, "Pollution Prevention Financing: The Banking Outreach Project," Philadelphia, November 1993.)

U.S. EPA Region III, "Pollution Prevention Financing: The Banking Outreach Project," Philadelphia, November 1993, p.9

Executive Order 12866, September 30, 1993

Interview with Michael Curley, consultant, Baltimore, MD.

The White House, Office of Science and Technology Policy, 1994.

Ibid, page 51.

Moore and Miller argue that Japan is number one in solar photovoltaics, that Siemens of Germany produces the world's least-polluting and most highly efficient electric turbines, that Germany has overtaken the United States in the development of hydrogen as a fuel, that Germany and Japan are both ahead of the U.S. in add-on pollution controls to cut power plant pollutants that cause acid rain, that Germany and Japan are ahead of the United States in developing zero-polluting electric and hydrogen vehicles, and that both countries are ahead in small, energy-efficient household appliances. See Moore and Miller, *op. cit.*, pp. 21 - 23, 33.

The following technical strings were used: chemical and biological measurement, particulates and aerosols, pollution abatement and environment control, water monitoring and characterization, water treatment, water management and utilization, soil measurement and manipulation, and nuclear, chemical biological waste management.

Edward B. Roberts, *Entrepreneurs in High Technology*, Oxford University Press, 1991, pages 132, 133.

Michael E. Porter, *The Competitive advantage of Nations*, New York, the Free Press, 1990, page 89.

ibid, page 89

See Moore and Miller, *op. cit.*, pp. 26, 38, 194.

Environmental Business Journal, May, 1993, p. 4.

Environmental Business Journal, May, 1993, p. 2.

Environmental Business Journal, February, 1994, p. 5.

Environmental Business Journal, May, 1994, page 5.

CETP Financing Barriers Technical Working Group, "Preliminary Report and Meeting Minutes," July 16, 1993

Environmental Business Council of the United States, Inc., Advertising brochure for the 1994 Environmental Industry Summit Meeting in Washington, D.C.