PD-ABN-846

FINAL REPORT

Trade in Environmental Services and Technologies

Contract No. 386-0530-C-00-6134-00

Submitted to:
U.S. Agency for International Development

by:
Sanders International, Inc.
1616 P Street, N.W., Suite 410
Washington, D.C. 20036

January 31, 1997

SANDERS
INTERNATIONAL

Environmental Business Development & Consulting

January 31, 1997

TO: Richard Goldman - Director, Environment, Energy and Enterprise Division, USAID - New Delhi

FROM: Ed Sanders & Jeff Hallett

SUBJECT: TEST: Final Report and Lessons Learned

For your reference, we have gathered and organized the attached materials summarizing Sanders International's activities and accomplishments against each of the deliverables stipulated in the Technical Assistance Contract. The document in Tab 2 presents each deliverable and corresponding output with supporting documentation referenced under the appropriate tab.

Summary of Project Results

A review of the contract deliverables and outcomes and the overall project goals confirms that the test project has:

- increased the use of U.S. technology and equipment toward a reduced level of pollution in India;
- created more long-term relationships between Indian and U.S. environmentally oriented enterprises and;
- strengthened information networks linking U.S. suppliers and Indian users of environmental services and technologies.

Other significant deliverables and accomplishments under each of the four project components include:

Technical Assistance: the successful facilitation of 25 joint ventures, licensing arrangements, distribution agreements and other business linkages.

Information Networks: the creation of a Worldwide Web site providing information, contacts and linkages to other Internet-based environmental information resources to both suppliers and users of environmental services and technologies, and the creation of an environmental information node at ICICI in Mumbai.

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Tours: the organization and execution of 74 individual trade and investment tours to and from India, many of which have led to some kind of business linkage or relationship.

Promotion: TEST participation in 17 environmental trade events in the U.S. Over 400 U.S. companies informed about the TEST program, environmental business opportunities in India and the potential for U.S.-Indian environmental business linkages.

TEST: General Observations & Lessons Learned

The TEST project was structured in the right country, at the right time with an appropriate mix of services to accomplish its major goal of assisting Indian industry to address industrial pollution problems in India. From the standpoint of the technical assistance contractor, TEST also benefited greatly from the Mission's style of management and administration which encouraged energy and innovation while maintaining a central focus on and commitment to the original project goals and objectives.

The TEST Mid-Term evaluation, its conclusions and recommendations stands as the best and most objective document in terms of evaluating the overall effectiveness of the project and all of its components. The purpose of this paper is to highlight some key factors and conditions which we, at Sanders, believe were central in influencing the outcome of the project, both positively and negatively, and which may have some relevance for future program design and management in India and possibly in other countries.

1. Strategic intermediation services are critical in promoting business linkages especially between smaller Indian and U.S.environmental firms. Smaller and mid-sized environmental firms form the entrepreneurial backbone of India's environmental industry.

The TEST program structure has effectively brought businesses together that otherwise would not likely have found each other. Particularly in the last two years of the program, this facilitation process has become increasingly streamlined and efficient. It has worked particularly well in presenting small and mid-sized Indian firms to potential U.S. collaborators. When TEST's matchmaking and facilitation services have been complemented with US-AEP business exchange support, some kind of business linkage or substantive and ongoing commercial dialog has resulted in almost every case.

2. The Internet is emerging as an important tool for rapid and cost-effective business facilitation services

The emergence of the Internet in India has opened up new possibilities for even quicker, more efficient and less expensive facilitation services of this kind. Given these advances, we believe that, in the next few years, it will be possible for facilitation services to become commercially viable and self-sustaining.

However, neither the US-AEP nor FCS programs in India are emphasizing support to or strengthening of commercial intermediation services for environmental business linkages. To the extent that the Mission retains as a goal the desire to strengthen India's environmental

industry, we believe it imperative to provide support to the smaller and mid-sized Indian firms that have the capability but lack the resources to develop overseas business linkages which can provide them needed technologies, expertise and other resources. Supporting and strengthening Internet access through, for example, business associations, as well as strengthening dissemination of information on U.S. environmental technologies, firms and services will also help to strengthen India's environmental industry while creating business opportunities for U.S. firms.

3. Demonstration and Feasibility Study Resources

Given India's limited resources to deal with environmental pollution, we believe that innovative and low-cost environmental technologies must be encouraged in order to provide cost-effective solutions for Indian environmental problems. However, in many cases, these appropriate technologies have yet to achieve broad commercial acceptance in the West, due primarily to the U.S. market's focus on larger scale and technically more complex and capital intensive solutions.

We believe TEST could have been more aggressive in promoting experimentation and adaptation of innovative environmental solutions, particularly for air pollution control, wastewater treatment and mobile source emissions control. This could have been accomplished through a grant mechanism (i.e. non-repayable) to, at least, partially fund demonstrations of innovative technologies.

TEST's conditional grant program, while similar in intent, did not have the desired effect in terms of encouraging truly innovative approaches to environmental problems. As would virtually any commercial bank, ICICI proved extremely risk averse in evaluating new technologies. Furthermore, the effective interest rate for repayment of conditional grants was approximately the same as Indian commercial interest rates and thus not very attractive to prospective clients.

We believe that a small fund aimed at supporting a limited number of demonstrations in specific sectors, and implemented by grantees as part of complete business plans that diagram full commercialization of the technology, would have permitted TEST to make a greater impact on priority polluting sectors in India.

While this assertion inevitably leads to debate as to the market viability of technologies when the promoters are unwilling or unable to fund the initial demonstration, we believe that, particularly in the environmental sector, there is a rational and economically defensible argument for direct subsidies to prove the efficacy of new approaches to environmental problems to in order to provide a demonstration effect that the market may learn from and then replicate.

The reverse side of this phenomenon has been the promotion in India (frequently with World Bank or other donor support) of "conventional" (read accepted in the West) approaches to various environmental problems that are not appropriate or sustainable in the Indian context. The most telling example of this phenomenon has been the active support and subsidization of

conventional primary and secondary industrial wastewater treatment plants throughout India that depend upon large amounts of and reliable sources of electricity to maintain the viability of aeration ponds. Few, if any, of these plants are operating correctly due to frequent power outages and ongoing uncertainties about wastestream composition.

4. The Role of the Financial Institution

In the early stages of our involvement in TEST, ICICI's role and presence provided an important missing element in vouching for the credibility, financial strength and technical capabilities of Indian firms we promoted to U.S. firms. The existence of the financing component through ICICI was also important in surmounting the credibility gap with U.S. firms and persuading them to spend time exploring the Indian business opportunity. As more U.S. firms came to understand and appreciate the potential of the Indian market, we relied less on ICICI to sell the Indian business opportunity.

Another important development that affected the TEST project's implementation was the rapid opening and growth of India's domestic capital market. This opening was accompanies by large capital inflows from foreign institutional investors which also served to promote the greater awareness in the business community about India and opportunities there. These inflows, along with modest downward pressure on Indian interest rates in 1995-95 all served to reduce the significance of the financing component of the TEST project during the middle and later stages of the project. It should be noted, however, that now rates have climbed again and Indian business is confronted by an ongoing capital and liquidity crunch which has been exacerbated by instability in India's stock markets. As a result, during the last few months of the project, we noted a renewed interest in TEST financing from a number of Indian businesses.

Overall, we believe the accomplishment of development objectives in the environmental area through technology transfer and innovation and a banker's necessarily cautious approach toward technology and commercial risk are often at odds. We confronted this frequently in our dealings with ICICI. While our primary motivation was to facilitate as many deals/business linkages (including joint ventures, licensing distribution, representation and even teaming agreements) as possible, theirs was primarily to finance highly bankable equity joint ventures or licensing ventures. Not surprising, given the high cost of evaluating bank loan applications, there was a bias toward larger project sizes and loan amounts.

We believe this led ICICI to search out Indian businesses who were in the final stages of concluding these desired kinds of ventures with U.S. firms and to offer TEST's subsidized financing to them. In terms of the provision of technical assistance, Sanders was involved in only three of the eleven business linkages financed by the TEST Group. All the others were searched out by ICICI themselves without involving Sanders. For our part, we were involved in and counted more than fifteen business linkages concluded which did not involve ICICI or TEST financing. We usually did not even learn about the deals ICICI was financing until well after the loans were sanctioned and ICICI was often only marginally informed of our transactions.

Early in the TEST program, Sanders observed and ultimately concluded that most U.S. firms would insist on some kind of interim relationship with an Indian environmental firm, usually through a distribution or representation arrangement (collaborating on a project by project basis) before committing to an equity joint venture or licensing arrangement. ICICI would not consider using TEST funds to finance the start-up costs of a distribution arrangement, i.e. financing the importation of the product, setting up sales and service networks, etc.

We believe that TEST's overall effectiveness would have been improved had ICICI been led, encouraged, or directed to promote and assist Indian firms to access TEST financing for some of the more innovative technologies for small scale industrial pollution problems, distribution arrangements for new environmental products brought into India (e.g. bioremediation additives, environmental instruments, and for service-based joint ventures (e.g. environmental audits, impact assessments laboratory services). However, given the banking culture within ICICI, we recognize that this would be extremely difficult to accomplish. It may be appropriate to consider endowing an Indian grant-making foundation or institution with funds to administer and disburse for a purpose as outlined above.

5. Role of Tours and Trade Missions

As a component of TEST technical assistance and technology search services, individual company visits by Indian companies to the U.S. were a critical element in the successful facilitation of various kinds of business linkages.

Subsidized visits by individual U.S. firms to India proved less worthwhile. In almost every case involving successful efforts by Sanders to match a U.S. environmental firm with an interested, qualified and attractive Indian collaborator, the U.S. firm was willing and able to finance its own travel (generally as part of a trip to one or more other Asian countries) to visit the Indian firms Sanders located. During the times when the U.S. firms' visits coincided with the visits to India by Sanders staff, assistance by Sanders staff did prove to be extremely useful to the U.S. firms in insuring that the meetings took place, particularly when outside the major metropolitan areas.

Over the course of the project, Sanders organized two delegations visits from the U.S. to India and three delegation visits from India to the U.S. Despite considerable positive momentum that the delegations generated in both the U.S. and India, none of the trips resulted in any significant business linkages. Delegation arrangements tend to be very expensive, both in terms of staff time and associated expenses like large vehicle rentals, receptions, registration fees, etc. TEST delegation visits were useful in generating positive public awareness in India and the U.S. about TEST, USAID and about environmental issues and technologies.

6. Need For Focussed Efforts on Priority Sectors?

It is debatable whether TEST's impact and results could have been enhanced with greater focus of resources on a few polluting sectors. On the one hand, by allowing TEST technical assistance and finance to be market and demand driven, one can argue and -- prove with

project results -- that the resources did indeed flow to where they were needed. Furthermore, our efforts to conclude deals in priority areas like for tannery pollution and for Agra foundry emissions proved only partially successful.

Another important factor to consider in assessing this question is that, over the course of the project, The economic, political and environmental landscape in India changed remarkably. For example, when TEST began, one of its principal goals was to increase awareness of the U.S. environmental business community about India's economic opening and specifically about emerging environmental business opportunities. The TEST project document assumed, correctly, that, at that time, a significant amount of the project's promotion and information system efforts would be aimed at overcoming strong negative biases and predispositions by U.S. firms against doing business in India.

What happened, of course, is that awareness and interest by all U.S. business in looking at commercial opportunities in India grew tremendously in 1994 and 1995. While negative pre-dispositions did not disappear, they were replaced by a growing realization that the competition was there and so they had to be too. TEST no longer had to convince, but only had to provide introductions to qualified and capable Indian firms. Based on our experience and observations, we would estimate that at least 75 percent of major U.S. environmental technology and equipment suppliers (sales at $50 million per year and above) now have at least one Indian licensee or representative in place. This figure was probably less than fifty percent when the project started. TEST clearly played a role in facilitating this, but the primary drivers were the opening of the Indian market and increased GOI commitment to enforcing stricter environmental regulations.

It has been clear that TEST was well-timed to catch and contribute significantly to a modest environmental market development wave in India. While ongoing capital and liquidity shortages are currently playing a strong depressive role on all new business ventures in India, it is quite likely that this market wave will pick up again once the situation stabilizes.

In the second half of the project, when major U.S. environmental firms began to aggressively market themselves in India, it probably would have been more effective, in terms of impact on pollution problems per unit of project resources, to concentrate our efforts on one or two priority pollution areas like, for example, low cost industrial wastewater treatment solutions for tanneries, distilleries, food processors, etc.. This, however, would have necessitated some major adjustments both in terms of Sanders technical assistance activities, our promotional stance toward the U.S. public and of ICICI TEST Group's focus and efforts.

7. The World Bank, Foreign Firms, Foreign Development Programs

Despite considerable effort in Washington and in India, and apparent goodwill and support by contacts in the World Bank, TEST was never able to leverage any World Bank funding in support of TEST-supported projects. During the course of the project, the World Bank approved more than $150 million in environmental projects through its Industrial Pollution Control and Industrial Pollution Prevention projects. This funding was and is being disbursed through windows at ICICI and IDBI. To our knowledge, there was no coordination or contact

between the TEST Group and the World Bank window at ICICI. We believe this situation should be addressed at a high level in the Mission and at the Embassy. This is also part of a larger issue between the World Bank and the U.S. government (U.S. IDA contributions), and well beyond our ability to have any impact.

We have observed a much higher level of coordination, integration and collaboration between European and Canadian development agencies, business associations, and environmental firms. As indicated, foreign environmental firms have also been much more successful in accessing World Bank funding for projects in India than have their U.S. counterparts. There are numerous reasons for this which go beyond the scope of this memo. This problem should probably be a subject of study and a priority for the Embassy's commercial counselor.

We never developed a clear understanding of the environmental development aid programs administered by the Europeans and Japanese, except they existed and seemed to be funneling more money on more attractive terms to all of the major Indian business associations, environmental groups and research and technology organizations we dealt with. Throughout the project, we did feel a sense of competition with foreign development aid projects for the attention and efforts of Indian organizations involved with us in implementing TEST program activities. It may be appropriate to consider some kind of coordination council among the principal donors to deal with this problem and to limit opportunities by recipients to play one project and donor off of the other.

8. ***Need for a Sanders representative in India***

We would also strongly concur with the conclusion in the TEST evaluation that our contributions to the TEST program would have been more successful if we had had a permanent representative in India, and not relied only upon the Technical Coordinators periodic visits to India to manage problems and affairs there. Moreover, we had proposed for the "TEST Follow-On", we believe it is entirely feasible to build in a progressively larger cost-share element in any future environmental business facilitation services, ultimately leading to full privatization.

Conclusion

It has been our pleasure and privilege to work with the Mission and ICICI on the TEST project. We wish especially to acknowledge the critical role which the Mission's clear vision and consistent guidance to the contractor played in the project's success. We hope that the experience gained through the TEST program can be utilized by the Mission to continue to promote sustainable business linkages between U.S. and Indian environmental firms.

The reporting format for the semi-annual review/reports was changed by a USAID modification issued on October 13, 1994. This modification stipulated that all reports starting by the end of 1994 should be brief (from three to eight pages), and standardized in so far as the kind of information being reported and the way it is to be reported. It was also stipulated that these reports be submitted on a quarterly basis. Sanders has copies of quarterly reports submitted from October 1, 1994 to July 30, 1996. These reports have not been included in the binders as they provide a greater level of detail than what is required by the current evaluation. However, select copies of these reports have been included in the disk.

1.4. *Deliverable*: Other technical reports

►*Sanders Comment:* Sanders and its subcontractors have prepared a total of 21 reports assessing U.S. environmental technologies. Summaries of these reports are attached in the binder.

2.Contract Outputs

2.1 Technical Assistance Component

2.1.1 Advice to ICICI:

2.1.1. (a) *Deliverable:* Indian firms assisted in identifying appropriate and adaptable environmental services and technologies (ESTs) to meet their pollution control or abatement needs or to improve the reuse, recycling or conservation of resources.

►*Sanders Comment:* Almost all our activity on the contract is aimed at fulfilling this output. We have, in some way, assisted 397 Indian firms and have records of contact with all of these firms in the Telemagic database. In general, this assistance has taken the form of:
»providing information on the TEST program;
»providing information on U.S. environmental firms or technologies;
»responding to technology search requested by ICICI;
»organizing business exchanges, tours, delegation visits, etc.; and
»assisting in the negotiating or closure of a business relationship of some kind.

A contact list of Indian firms is attached in the binder.

2.1.1. (b) *Deliverable*: Advice on potential U.S. suppliers of Environmentally Sustainable Technologies (ESTs) or joint venture/licensing partners provided to 150 firms.

►*Sanders Comment*: As indicated above, we have provided information and/or advice on U.S. suppliers of ESTs to 397 as recorded in our database. In addition, we have organized numerous business exchanges to the U.S. by Indian firms and delegations, comprising of 50 individuals. Finally and most importantly, we have been involved in

the creation of 24 business linkages between U.S. and Indian firms. These business linkages include: joint ventures, licensing agreements, distribution agreements, representation agreements, and teaming arrangements.

2.1.1 (c) *Deliverable*: 25 licensing agreements or joint ventures created or activated.

►*Sanders Comment*: A copy of the Status Report (October, 1996) provides a summary of 25 joint ventures and licensing agreements created. This copy is attached under number 2.2.2

2.1.1. (d) *Deliverable*: Procedures in place for ICICI and the TEST group to respond to inquiries on EST availability and sources and to approve and monitor projects financed under the TEST technology fund on a sustainable basis.

►*Sanders Comment*: In collaboration with ICICI's TEST group, we have developed the TEST technical assistance checklist by which Indian firms can apply for technical assistance under the TEST program. The September, 1994, memo from Sanders International to TEST subcontractors lays out the revised and final procedures implemented to respond to these technical assistance requests. In addition, we developed a standardized format for approaching technical assistance tasks and estimating levels of effort and budget. A copy of the memo and a sample of the format for technical assistance tasks is attached in this binder.

2.1.1. (e) *Deliverable:* Assistance provided to ICICI in the review of up to 150 proposals for loan or conditional grant financing.

►*Sanders Comment:* ICICI has formally requested our assistance in reviewing proposals for TEST loan or conditional grant financing in only two cases. Copies of these loan applications are in our files.

2.2 Trade and Investment Tours Element

2.2.1 *Deliverable:* Participation in at least 10 trade and investment tours, involving at least four participants from the U.S. or four from India.

►*Sanders Comment*: In collaboration with the US-AEP or by ourselves, we have organized and assisted in the execution of 74 individual trade and investment tours. These included:

»50 Indian persons travelling to the U.S.
»24 U.S. persons travelling to India

This number includes:

Four Indian delegation visits to the U.S.
»The April, 1994, Indian Environmental Delegation visit (11 persons)

»The June, 1994, Indian Boiler Manufacturer's Association visit (six persons)
»The June, 1995, Indian Foundry Delegation visit (13 persons)
»The October, 1996, Indian Hazardous Waste Management delegation visit (six persons)

Two U.S. delegation visit to India
»The November, 1993, U.S. delegation visit (four persons from three firms)
»The February, 1995, Biotreatment delegation (four persons from three firms)

Written summaries of all the tours and delegations are attached in this binder.

2.2.2 *Deliverable:* A written summary of the outcomes of these tours in terms of business arrangements concluded, value of ESTs traded and likely impact on India's pollution problem.

►*Sanders Comment*: We have prepared and submitted reports on all delegation visits. Copies of executive summaries of select delegations trips are included in this binder. We have also recorded the outcomes of these tours in our Status Report (October 1996) as well as in a spreadsheet called "Test Cases". Copies of these reports are attached in the binder.

2.3 Information Networks Element

2.3.1 *Deliverable:* An up-to-date and comprehensive list of at least 200 U.S. sources of ESTs of particular interest to Indian companies.

► *Sanders Comment*: We have collected information on 1419 U.S. environmental firms that have expressed an interest in doing business in India. Detailed records of all these contacts are in the Telemagic database. In addition, we have created paper files on all these companies with company brochures and product and technology descriptions. We have forwarded information on 104 companies to ICICI. A copy of the contact list is attached in the binder.

2.3.2 *Deliverable*: A strengthened information network in place which provides for a continuous two-way flow of information to suppliers and purchasers of ESTs. In Information entering the system should reach a target audience of at least 2000 Indian firms on a regular basis.

►*Sanders Comment*: In response to this request, we have developed and put on the USAID Internet server, the TEST Worldwide Web homepage. We believe the TEST Web page will be the most efficient and cost-effective way of meeting this deliverable.Given recent growth of Internet access in India, we believe we are more than meeting the goal of reaching 2000 Indian firms on a regular basis. Unfortunately, the USAID Web server does not have the capability of tracking numbers of "hits", but we are confident we have more than met the project deliverable.

Our goal is to upgrade and improve the TEST homepage in order to meet the goal of providing a "continuous two-way flow of information to supplier and purchasers of ESTs. In a separate binder, we have included a draft paper copy of the TEST homepage. A copy of the press release announcing the TEST homepage is attached in this binder. The latest version of the TEST homepage can be located on http://www.info.usaid.gov/TEST/

We have also met this deliverable by sending a large number of environmental information resources (magazines, reference books, directories, journals, databases) to ICICI in order to strengthen their capability of providing useful information to their client firms. A list of resources sent to ICICI is attached in this binder.

2.3.3 *Deliverable*: A report on the feasibility of establishing a newsletter to apprise U.S. EST providers of opportunities in India.

►*Sanders Comment:* We concluded that the Internet was a more cost effective way of apprising U.S. EST providers about opportunities in India. Our memos and proposals to develop the Worldwide Web site stand as our report on the feasibility of a newsletter. A copy of one of these memos is attached in this binder.

2.3.4 *Deliverable:* An increased level of participation of U.S. EST providers in trade and technology fairs, industry association conferences, catalogue shows, etc. in India.

►*Sanders Comment:* We have organized trips and delegations around Indian environmental trade shows and other meetings to increase U.S. participation in these events. In addition, we have developed and distributed a quarterly calendar of major environmental events in the U.S. and abroad in order to make both U.S. and Indian firms more aware of these events. A sample copy of the latest quarterly calendar is attached in this binder. See list of events participated in by TEST at 2.4.4.

2.3.5 *Deliverable:* An increased number of Indian firms with knowledge of U.S. ESTs.

►*Sanders Comment*: We believe that through our continued efforts to contact and provide information and assistance to Indian firms, the development of the TEST Worldwide Web homepage, the transfer of large amounts of environmental information resources to ICICI, the development and distribution in India of both our environmental resources report and our Internet environmental resources handbook, we are meeting this deliverable. These reports are in our files, and Sanders would be happy to provide copies to the evaluation team if necessary.

2.4. Promotion Element

2.4.1 *Deliverable:* Attractive and informative promotional materials

►*Sanders Comment*: Throughout the program, we have prepared brochures, posters, and other promotional material. Samples copies of various brochures and other promotional material are attached in this binder.

2.4.2 *Deliverable*: A preliminary media campaign conducted which reaches over 250 firms in the U.S. and 500 firms in the U.S.

►*Sanders Comment:* Between August and October, 1993, we conducted a mass faxing campaign and successfully contacted approximately 1500 U.S. environmental firms. Companies that responded then received a mailing that provided more details on the TEST program and its services. In the initial phase of the program, ICICI took the lead in promoting the TEST program in India. However, as a result of our organization and execution of the November, 1993, U.S. environmental delegation visit to India and their participation in the Indo-U.S. Joint Business meeting, we were able to promote the TEST program before a large number of Indian firms. See spreadsheet for firms who have received intensive technical assistance under TEST.

2.4.3 *Deliverable*: Outreach completed to at least 30 firms in the U.S.

►*Sanders Comment:* Through our efforts at promoting and responding to requests, we have made contact with and provided information and assistance to 1419 U.S. environmental firms. All these contacts are recorded in the Telemagic database, and an abbreviated printout of these contacts is attached in this binder. Through our involvement in the organization and execution of tours and delegation visits, we have provided detailed assistance to hundreds of U.S. firms who either were asked to meet with or host an Indian delegate, or, in a few cases, who actually travelled to India on an individual or delegation visit.

2.4.4 *Deliverable*: TEST Project promoted at a minimum of three trade fairs, conferences, workshops, etc. in India and in the U.S. each year.

►*Sanders Comment:* The TEST project was promoted at 17 environmental events in the U.S. and in India. Due to slowdowns in TEST funding and the questionable value of these events in terms of the creation of business linkages between U.S. and Indian firms, the 1995-1996 workplan indicates a very low level of efforts for this component.

»U.S. India Business Council, New Delhi, November, 1993
»San Jose Chamber of Commerce meeting, San Jose, California, April 1994
»Seattle Chamber of Commerce meeting, Seattle, Washington, April 1994
»Colorado Trade Office meeting, Denver, Colorado, April 1994
»Minnesota Trade Office, Doing Business in India, September, 1994
»Environment 95, New Delhi, February, 1995
»Environment Business 95, Washington, D.C., April, 1995
»Lessons without Borders, Seattle, Washington, April, 1995
»Air and Waste Management Association, San Antonio, Texas, June, 1995

»India-U.S. Business Exposition, Atlantic City, New Jersey, June, 1995
»Center for Strategic and International Studies, Washington, D.C., September, 1995
»Trade and Investment Working Group, Washington, D.C., September, 1995
»Florida Environmental Exposition, Tampa, Florida, September, 1995
»Ecoress, Bethesda, Maryland, October, 1995
»Superfund XVI Conference, Washington, D.C., November, 1995
»World Engineering Congress, Atlanta, Georgia, November, 1995
»8th International Ash Management and Utilization Conference, Washington, D.C., November, 1995

2.4.5. *Deliverable*:Information on the project provided in response to all inquiries, estimated at 90 per year.

►*Sanders Comment*: Sanders has provided information on the TEST project to all enquiries. These contacts, both U.S. and Indian, have been entered into the Telemagic database.

1.1

COPY

SANDERS
INTERNATIONAL

Environmental Business Development & Consulting

August 21, 1996

PPC/CDIE/DI, Acquisitions
Room 209, SA-18
U.S. Agency for International Development
Washington, D.C. 20523

Ref: Contract number 386-0530-C-00-3219-00

To Whom It May Concern:

Sanders International hereby submits two (2) copies of reports summarizing performance under the above-referenced contract, as directed under Section F.3.(a) Reporting Requirements. Pursuant to the modification issued by Marcus L. Stevenson, Director of USAID Office of Procurement, dated October 13, 1994, all reports submitted after the date of issuance of the modification are quarterly submissions.

Sincerely,

Amy Patterson

Amy Patterson
Projects Administrator

Enclosures

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8/3/93

EXPANDED TEST TECHNICAL ASSISTANCE WORKPLAN

BACKGROUND ON TECHNICAL ASSISTANCE TASKS

The Technical Assistance component is comprised of four interrelated tasks that will be tracked and managed separately. In addition, the contract provides for an "add-in" amount to cover promotion, trade and investment tours, and building a self-sustaining environmental information system. This document covers only the four technical assistance components of the RFP. The detailed workplan for the other components will be prepared once satisfactory momentum has been achieved on the four key technical assistance tasks described below:

Task 1: Information on U.S. companies. Under this task Sanders International (SI) will provide information and analysis of U.S. environmental equipment and service vendors in terms of their business capabilities (as opposed to detailed analysis of their technologies).

Task 2: Information on U.S. environmental technologies. SI will provide information on ESTs to Indian firms. In most cases additional information on the specific applications envisioned in India will be required before zeroing in on the best technologies. Thus, this task will be more labor intensive depending on the number of iterations between the U.S. and India.

Task 3: Facilitation of specific transactions. SI will work primarily with U.S. companies to help them evaluate the potential of specific business opportunities in India and to provide ongoing support to help them consummate those transactions.

Task 4: Advice to ICICI on loan and grant applications. SI will provide advice as requested by ICICI on specific applications for loans and conditional grants. The primary focus of these reviews will be to validate the claims made by the potential U.S. technology vendors or joint venture partners.

The level of SI effort for each task is likely to vary considerably from case to case, depending on the complexity of the request and the amount of similar projects already completed. For planning purposes we believe that it will be useful to segment the first two "information" tasks into several levels. This segmentation is important because ICICI will probably want to be able to tell potential Indian clients about how much each project will cost (perhaps priced on actual time spent by SI on a "not-to-exceed" basis). The proposed levels of effort for each task are described in more detail in the following section.

For the second task, each request for a separate technology is treated as a separate "project" because the search and presentation of results requires separate effort. The level of effort required to carry out each information project under tasks 1 & 2 depends critically on the number of firms for which information is sought (one versus many) and the degree of specificity with which a target technology can be identified in advance by the Indian firms (e.g., a technology to reduce a specific effluent or emission to a particular level versus a request for "water pollution technology").

The other two tasks are more likely to be characterized by a continuum of effort so have not been segmented in discrete levels of effort. The following sections provide a more detailed work breakdown for each task.

I. Task 1: Information on U.S. companies

A. Purpose: To provide Indian companies with information on potential U.S. EST vendors with the primary goal of increasing the number and quality of potential loan and grant applications for ICICI consideration and sustainable U.S. and Indian business relationships.

B. Strategy: To respond quickly to all requests for information forwarded by ICICI in the degree of detail necessary for the Indian company to decide whether it is worth proceeding to the next level of effort.

SI will attempt to build ICICI's Information Center capacity as quickly as possible to enable it to perform most of the Level 1 searches in order to save money and reduce the response time.

SI will undertake most of the Level 2 and 3 company searches with its own staff. Based on the initial visit to India, however, it appears that requests for pure company searches will be much less common than for technology searches under task 2 (in contrast to the assumption in the proposal that they would be about equally divided).

C. Assumptions: That Indian firms will specify the companies that they want information on and will provide accurate names and addresses to facilitate the initial identification and contacts. ICICI will screen all requests for assistance and forward only those that are serious. The information to be provided will primarily concern data about the companies bone fides (size, financial strength, reputation in the industry) and interest in doing business in India rather than an assessment of its technologies.

For costing purposes we are assuming that most requests will

only be for level 1 or 2 and will typically be undertaken for only a single firm as described in Sections D and F below.

D. Activities:

Level 1: Undertake Data Base Searches (i.e., no direct contact with company)

- D&B financial and company reports
- Corptech environmental data base
- Selected Buyers Guides
- SI files on individual companies

Level 2: Make Direct Contact with U.S. Company (i.e., contact the companies but do not try to independently verify claims)

- Ascertain interest in doing business in India
- Document any existing relationships in India
- Determine any exclusive or other limiting agreements
- Note any products or services they think would be of special interest in India
- Solicit information on the company for SI and ICICI files

Level 3: Undertake Independent Analysis of the Company (i.e., review literature, talk to other sources in the industry, trade associations, and follow-up on any specific questions raised by ICICI)

- Assess international capabilities and experience
- Evaluate financial strength
- Identify pending legal problems or other issues
- Other, as required

E. Deliverables: Reports to ICICI to pass on to its clients on the findings of level 1, 2, and 3 searches. Reports faxed with hard copy mailed.

F. Level of Effort: The level of effort will depend critically on the number of companies for which information is sought and the extent of search required (i.e., Level 1, 2, or 3). The level of effort will also presumably decrease significantly over time as the coordination procedures with ICICI are streamlined, ICICI assumes responsibility for more of the Level 1 searches, and information on additional companies is added to the SI and ICICI data bases.

SI will provide a "generic" level of effort estimate for each level of search but we assume that we will not be required to spend time making separate estimates for each search -- because making that estimate is in itself time consuming and

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requires some initial research. (If requested Sanders will provide an accounting of time for each search in order to allow ICICI to reduce fees to actual time spent if less than the standard "not-to-exceed" estimate).

The following estimates are very preliminary and subject to substantial change as operating experience is gained. The estimates reflect our current best guess as to the "productivity" that can be achieved by about the sixth month of the project -- beyond which we would not expect significant further gains. The level of effort includes the time spent in advance communication with ICICI and the time involved in writing up the findings. In general, we will start with the first step and proceed to level 2 and 3 only if the additional information is required. The hours for each level are additive, not cumulative.

Level of Effort
(in hours per company)

	single company	multiple co.s
Level 1	2	1 x x
Level 2	4	3 x x
Level 3	8	4 x x

G. Costs: Costs will depend on the level of personnel allocated to the project for these tasks.

Rough costs per hour (with all overhead included) are:

Project Manager (Hallett)	$94.04
Consultant (e.g., Harwit)	$57.81
Research Assistant (e.g., Gizaw)	$27.35

Until we get more operating experience, we are assuming that the time for company search will be allocated as follows: Hallett (20%); Harwit (50%); Gizaw (30%) for a weighted hourly cost of $55.93 on a fully allocate basis.

H. Other Assistance: As mentioned, the objective will be to build the ICICI Information Center Library over the first six months so that it can provide much of the level 1 search capability. For search requests forwarded to Sanders, ICICI will attempt to gather as much information on the company (address, parent relationships, etc) as possible to facilitate the start of the search.

II. Task 2: Information on U.S. technologies

A. Purpose: To provide Indian companies with information on U.S. environmental technologies and services with the primary goal of increasing the number and quality of potential loan and grant applications for ICICI consideration and sustainable business relationships between U.S. and Indian companies.

B. Strategy: To respond quickly and effectively to all requests by Indian firms that have been forwarded to SI by ICICI. To work closely with ICICI TEST Group to develop procedures for screening and pin-pointing needs in advance in order to help us focus on the most relevant technologies.

SI staff will undertake the initial communications with ICICI in order to raise any obvious questions about the request. We will then be prepared to provide information at three levels as in Task 1. At the first level, information will be developed primarily through data bases on technologies and other secondary sources. Most of this initial work will be performed by Sanders staff.

In those cases where more detailed or technical Level 2 or 3 information is required from the firms or industry sources, SI will rely primarily on engineers from the sub-contractor team to develop this information in the format and depth specified by the SI/TEST Group team and the ICICI client firms. In some of the cases, a Level 2 or 3 effort may require the technical consultants to make a short-term trip to India.

In virtually all of these cases, we assume that the Indian companies will also want to know the names of the vendors of the technologies and this information will be collected and provided as an integral part of the package. We will not, however, provide the more detailed information on the companies themselves which is a Task 1 function.

C. Assumptions: The critical assumption is that the technologies can be specified with sufficient clarity to allow a focussed search. It is very difficult to respond to generic inquiries about broad categories such as "air" or "water pollution"; it is even difficult to respond effectively to inquiries which are more specific such as "scrubbers" or "filters" which still encompass a wide range of products and vendors. Therefore, we assume that it will be possible over the next few months to refine the preliminary "checklist" in order to more directly focus on the key issues with a minimum of iteration between SI, ICICI, and the companies.

For costing purposes we are assuming that technology searches will be considerable more labor intensive because (a) there is

likely to be need for substantial iteration in refining requests, (b) most companies will want information on the alternative technologies available for a certain purpose (i.e., evaluation of more than one technology), and (c) the data bases on technologies are much less well developed and harder to access than those on companies.

D. Activities:

Level 1: Undertake Data Base and Literature Searches (i.e., no direct contact with companies).

- EPA data bases on innovative technologies
- NETAC data base on innovative technologies
- selected on-line data bases
- SI files on technologies

Level 2: Make Direct Contact with Companies (but do not try to independently verify company claims).

- Discuss appropriateness of technology for India
- Identify any special benefits or constraints
- Determine interest in India (per Task 1)
- Get any technical information to add to files

Level 3: Undertake Independent Assessment of the Technology

- Analyze the technical literature
- Compare technology with others in systematic way
- Evaluate application problems and benefits for India
- Analyze applicability in specific cases

E. Deliverables: Reports to ICICI to pass on to its clients on the findings of Level 1, 2, and 3 searches. Reports faxed with hard copy mailed.

F. Level of Effort: The level of effort will depend critically on the degree to which the technology required can be specified in detail in advance as well as the level of search required. As in Task 1, we anticipate that the level of effort will decrease significantly for the first six months or so as we streamline the process, refine the checklist, and gain more experience with the technologies of greatest interest in India.

We recommend the same "generic" estimate of the level of effort required as in Task 1 in order not to waste a lot of time in preparing specific workplans for each search. The following estimates are very preliminary and likely to change significantly with experience. The multiple technology category refers to requests to search for alternative technologies to achieve the same goal (e.g., rotary kiln

versus fluidized bed combustors for certain categories of hazardous waste or aerated piles versus digesters for composting municipal waste).

For costing purposes, we assume that most requests will be for Level 2 searches and most for single technologies rather than for multiple similar technologies.

Level of Effort
(in hours per technology search)

	single tech.	multiple tech's
Level 1	8	5 x x
Level 2	12	8 x x
Level 3	24	16 x x

G. **Costs:** Costs will depend on the level of personnel assigned to the task. For Sanders we assume that the allocation will be approximately Hallett (30%), Harwit (50%) and Gizaw (20%). We further assume that about 70% of this task will be performed by subcontractors. The weighted cost of SI personnel is $55.93 per hour and of subcontractors is estimated to be $75 per hour (which is higher because of the expectation of needing to use experienced senior engineers).

H. **Other Assistance:** ICICI will provide rapid and clear turn-around on requests for clarification about technology searches being conducted. As noted, subcontractors will provide most of the technical engineering support required to provide useful information to Indian firms.

III. Task 3: Facilitate Specific Transactions

A. **Purpose:** To provide practical assistance to U.S. and Indian companies to help them consummate specific transactions. The goal of this task is to help ICICI improve the number and quality of potential loan/grant applications and to enable SI to achieve the objective in the RFP of facilitating 25 joint ventures or licensing agreements over the course of the project.

B. **Strategy:** The initial strategy is to target U.S. and Indian firms that are already interested in joint ventures or licensing agreements and help them move quickly to complete them and build momentum for the project. The longer term strategy is to more systematically identify those environmental problems in India where U.S. technologies and corporate capabilities can play an especially important role

and to provide assistance to the U.S. companies in evaluating the potential in India, finding partners, and making the transactions occur.

SI will work very closely with ICICI staff in providing practical information on Indian and U.S. business and government requirements in order to help the companies. We will also work closely with other U.S. Government aid programs (such as WEC exchanges under the U.S. AEP) and with Indian organizations that can play useful multiplier roles.

The strategy will draw heavily on the Technical Coordinator's prior experience in facilitating business ventures in India in providing practical advice to U.S. companies and in stimulating their interest by using his network of contacts in the United States and India. Much of the strategy will be built around a "rifle-shot" approach to target those companies with the best potential rather than a "shotgun" approach of targeting the entire U.S. environmental industry (which probably has over 5,000 firms).

C. Assumptions: The ability of ICICI to offer loans and conditional grants to Indian firms will make the project much more attractive and should significantly enhance the attractiveness of TEST services. On the other hand, India is not well known in the U.S. business community, which could easily be turned off on the potential should there be major political violence or a reversal of the open economic policies of the current government.

D. Activities: The facilitation services will cover a broad array of services which do not lend themselves into levels as in Task 1 and 2. Among the more important activities will be:

- Advising U.S. companies on environmental developments
- Helping them understand the business opportunities
- Providing advice on how to do business in India
- Assist in finding and qualifying potential partners
- Linking them to other sources of support
- Following-up to solve problems

E. Deliverables: SI will attempt to generate at least ten joint ventures or licensing agreements suitable for ICICI financing which originate in the United States. In addition it will support ICICI in at least another fifteen such ventures which originate in India.

F. Level of Effort: The level of effort will vary over time depending on targets of opportunity. The Technical Coordinator will devote the bulk of his time to this task and will be supported by other SI staff and subcontractors as appropriate.

G. **Cost:** Costs (including all overhead items) for the Technical Coordinator are roughly $94.04 per hour. Other staff costs vary by level of experience.

H. **Other Assistance:** Substantial assistance from ICICI will be required to carry out this task. When the Technical Coordinator is in India, he will be able to provide at least some direct support to U.S. companies while they are in the area. During the rest of the time, ICICI will be called on to provide some assistance to the U.S. companies when they visit India, either directly or through other intermediaries.

IV. Task 4: Advise ICICI on Loan and Grant Applications

A. **Purpose:** To assist ICICI in making its loans and grants

B. **Strategy:** To respond quickly and thoroughly to all such requests from ICICI. Some may be in the form of requests to review completed memorandum prepared by the staff. Others may be to respond to specific questions which arise in the course of ICICI's initial reviews.

C. **Assumptions:** Most of the requests will be for projects for which the loan review has been completed and the memorandum prepared. For those at an earlier stage of review, the number and complexity of requests for more information will be relatively limited.

D. **Activities:** SI staff will look at a number of aspects of the prospective grants and loans, including:

- the technical claims in the proposals
- the credentials of the U.S. entities
- the cost realism of U.S. aspects of the venture
- the appropriateness of the technology for India
- other environmental considerations
- other specific questions from ICICI

E. **Deliverables:** SI will provide a summary report based on its review of the above items together with a recommendation whether to proceed based solely on the items it reviewed.

F. **Level of Effort:** We assume that most of the reviews will take less than one day (including reading the documents and preparing the summary report and SI recommendations). A few may be considerably more complicated and require much of the Task 1 or 2 types of inquiry.

F. **Costs:** Initially most of the reviews will be conducted by the Technical Coordinator or one of the SI principals (Sanders or Beauchamp) in order to assure high level attention. Other

staff will assist in any data gathering or more routine activities.

H. Other Assistance: Subcontractors may be called on to review more technical aspects of applications or memorandum.

8/13/93

TEST TECHNOLOGY SEARCHES
PROPOSED APPROACH

Purpose: The purpose of the technology searches is to provide ICICI and their Indian clients with a prioritized short list of U.S vendors of environmental services and technologies to in areas of interest. In order to provide the lists, the U.S. contractor is expected to provide:

1. A brief assessment of the leading American technologies for dealing with a specific problem (e.g., removal of color from wastewater from textile manufacturing) or in applying particular technologies (e.g., reverse osmosis or ultrafiltration) to environmental problems.

2. A short qualitative assessment of the speed with which the technology is evolving in the field and the length of time that the various technologies have been commercially successful in the United States.

3. A very brief evaluation of any special advantages (e.g., low energy usage, high use of unskilled labor) or problems (e.g., dependence on reliable electric power, need for complex maintenance) that would make the technology more or less suitable for application in India.

4. **A listing of the U.S. companies who are the technological leaders in the particular application of the technology, with contact points, any readily available information on the companies and their products, and a summary of the areas where an individual company may have a special comparative advantage (e.g., large versus small applications, or special applications versus low cost routine uses).**

5. **A summary of the degree of interest that the contacted companies have in exploring business opportunities in India plus any special factors (e.g., whether they have existing agreements or relationships which would preclude collaboration with other Indian firms).**

The Challenge: The primary challenge will be to very quickly sort through the technology analysis to identify the leading companies. The Indian firms are looking for partners to tie up with or for specific technologies to license. They are not looking for academic or analytical studies. The key deliverable, therefore, will be the information developed in steps 4 and 5. The analytical work in steps 1, 2, and 3 is primarily to help zero in on those companies that would be the best potential partners for Indian firms.

Suggested Methodology: We plan to use experts with a first hand knowledge of application of the technology in U.S. industry (with knowledge of international applications a plus). We anticipate that the information in the first three steps will be based primarily on personal knowledge rather than requiring staff research.

Sanders International staff will review its data bases and provide an initial list of companies in the areas in question. The expert should identify other appropriate companies. The most promising companies will be contacted directly in order to gather product information, clarify any questions about their technologies, and to determine their interest in doing business in India.

Standard Report Format: Each search is likely to entail some special requirements, so the following format is only illustrative:

I. Backgound (2-3 pages)

a. brief assessment of technology and primary alternatives.

b. assessment of the pace and direction of the technology in United States (including how long in commercial use).

c. special considerations affecting applications in India.

II Company Information (provide the following information for the top 5-10 prospects).

a. company name and address.

b. overall products and business lines (one paragraph)

c. summary of specific products in technology area of interest (one paragraph).

d. any comments about special benefits or problems for India (one paragraph -- optional).

e. any information about company's international experience, interest in India, and conditions to be met by Indian firms acquiring the technology (one paragraph).

f. name of the key contact person (with phone and fax) and any other relevant contacts made in the company.

g. copies (at least two) of promotional or informational materials on the products or services.

Level of Effort: The level of effort for each search will depend on the complexity of the technology, the number of firms involved, and the range of alternatives to be considered. As

a guess, a simple search should take 2-3 days while a complex search might take 5-10 days. As experience is gained with similar technologies or applications, the time required should decrease.

Tasking Approach: Upon receiving a request from ICICI, Sanders International staff will contact the subcontractor with pre-listed experts in the specific area. The subcontractor will then provide a preliminary budget estimate for the task, which will be approved by Sanders. As long as the requests are within the scope of the workplan and the subcontract, work can proceed without further AID approval.

If none of the pre-approved experts are available at the time or the company is not interested in performing the task, we will inquire whether anyone else has a consultant with the necessary experience that might be added to the pre-approved list of consultants. In these cases AID will have to approve the addition of the expert to the project and some delays will be incurred.

Optional Approach: If a subcontractor has an expert who knows the technology well but either does not know the companies (unlikely) or does not want to make the calls (more likely), we are more than willing to take the Part I analysis from the subcontractor and have our staff make the phone calls and prepare the Part II portion of the report.

TEST 1994-95 Workplan
Performance Period: August 1994-August 1995

I. Technical Assistance Component

A. **Purpose and Assessment of Technical Assistance Task**: To provide practical assistance, information and analysis to U.S. and Indian companies to help them consummate specific transactions leading to sustainable business linkages in priority environmental technology and service areas. The primary goal of this task is to help ICICI increase the number and improve the quality of potential loan/conditional grant applicants under the TEST program and to enable Sanders International (SI) to achieve the objective in the RFP of facilitating 25 joint venture or licensing agreements over the course of the project.

As envisioned in the 1993-94 TEST Workplan, the Technical Assistance component was divided into four primary tasks. These tasks included:

> **Task 1: Information on U.S. companies.** Under this task SI will provide information and analysis of U.S. environmental equipment and service vendors in terms of their business capabilities (as opposed to detailed analysis of their technologies). We will aim at recruiting at least 10 firms per month into the TEST program as well as respond to inquiries from U.S. firms.
>
> **Task 2: Information on U.S. environmental technologies.** Through technology and company searches, SI will develop and provide information on environmental services and technologies to Indian firms. In most cases additional information on the specific applications envisioned in India will be required before zeroing in on the best technologies. Thus, this task will be more labor intensive depending on the number of iterations between the U.S. and India.
>
> **Task 3: Facilitation of specific transactions.** SI will work primarily with U.S. companies to help them evaluate the potential of specific business opportunities in India and to provide ongoing support to help them consummate those transactions.
>
> **Task 4: Advice to ICICI on loan and grant applications.** SI will provide advice as requested by ICICI on specific applications for loans and conditional grants. The primary focus of these reviews will be to validate the claims made by the potential U.S. technology vendors or joint venture partners.

For 1994-95, we will retain the structure of last year's workplan. As expected, the manner and method of implementation of these tasks has and will likely continue to evolve as experience has demonstrated what types of efforts are effective in moving TEST clients

toward business linkages, what kinds of information are needed and not needed by both Indian and U.S. clients, labor requirements for each of the four components of the TEST program, as well as how SI and the TEST Group interact and complement one another's efforts in implementing and managing the program. An analysis of these efforts is given in the annual report.

An important adjustment from the initial 1993-94 workplan emerges from an earlier misunderstanding on the part of SI. We had mistakenly understood that labor executed for the information system, promotion and trade and investment tours components of the TEST program would be charged under those same respective categories. However, we have since learned that all labor is to be charged under the technical assistance component. For that reason, in the proposed 1994-95 workplan, we are showing planned labor for the information system, promotion and tours and missions components under the projected level of effort for the technical assistance component of the workplan.

A. Purpose and Assessment of Technical Assistance Task: To provide practical assistance, information and analysis to U.S. and Indian companies to help them consummate specific transactions leading to sustainable business linkages in priority environmental technology and service areas. The primary goal of this task is to help ICICI increase the number and improve the quality of potential loan/conditional grant applicants under the TEST program and to enable SI to achieve the objective in the RFP of facilitating 25 joint venture or licensing agreements over the course of the project.

B. Strategy

Based on guidance from ICICI's TEST Group, SI is concentrating most of its efforts for the remainder of calendar year 1994 toward the successful closure of commercial linkages between U.S. and Indian firms. Consequently, at least until the beginning of 1995, we will scale back efforts on the TEST information system. As the tours and missions component are an important ingredient in successful facilitation of commercial linkages, we are forecasting no reduction in our level of effort for tours and missions. We will also moderately increase our level of effort in the promotion element in order to begin to build the pipeline of deals for the second and third years of the project. Based upon the results registered by the end of the year, we will re-visit the workplan and decide whether a revised plan should be submitted for Mission approval.

Our strategy will be to carefully evaluate all new and existing TEST cases to determine which have the greatest likelihood of resulting in a TEST-financeable transaction, and to concentrate resources and efforts toward promoting and facilitating those cases. Both SI and the TEST Group have also agreed to re-visit all cases involving U.S. and Indian firms who have received some form of technical assistance from the TEST program to determine which have a good chance of resulting in a TEST-financeable deal. In addition, we will seek to develop other new business opportunities that have a reasonable chance for consummation before the end of the calendar year. Finally, based upon extensive discussions with the

TEST Group and follow-up meetings with TEST sub-contractors, we are re-casting the procedures for design and execution of environmental technology searches conducted by SI and TEST sub-contractors in order to insure that the efforts and resources expended on these reports are consistent with the requirements of the Indian clients and contribute toward a possible TEST-financed business transaction. See Annex I.

While SI acknowledges and will respond to the TEST Group's guidance to concentrate efforts on closure of deals in the short term, we also believe it is vital for us to significantly increase our level of effort to locate new TEST business opportunities which can be developed over the second year of the project and then brought to closure in the third year. We believe it is necessary to substantially increase volume of business contact through tours and missions, exchanges of company information, participation in trade events and active matchmaking efforts, in order to create a sufficiently large pipeline of promising ventures that will permit us to meet our end-of-project targets.

An important new element in realizing this goal and a new element in the workplan is the creation, administration and execution of purchase order tasks to be assigned to Indian consulting firms, business associations, and possibly research organizations. The major thrust of this new activity area is to develop a more pro-active way for U.S. environmental firms to be matched with Indian firms for the development of business linkages under the TEST program. Currently, we find ourselves unable to effectively respond to U.S. firms who approach SI to indicate interest in Indian environmental business opportunities. In addition, we intend to utilize purchase orders to secure informational products, e.g. analyses of Indian environmental enforcement efforts and an overview paper on Indian environmental problems, in order to both fill in some gaps in our current capabilities/knowledge and also strengthen environmental multiplier groups and other "strategic brokers" in India. We also hope to conclude purchase order agreements for active facilitation and logistical assistance of TEST-organized delegations to India. Administration of the purchase orders represents a new activity area which will necessitate additional expenditures technical assistance hours from SI staff. See Annex II.

C. Activities

--Work for the successful closure of TEST's best prospects before the end of 1994.

--Seek other TEST-qualified opportunities for Indo-U.S. business linkages that may result in TEST-financeable deals before the end of 1994.

--Put the Tata Risk Management purchase order in place.

Deliverables

--Assist ICICI in financing six additional project by 12/31/94

--Develop 20 new "deals in progress" by 8/31/95.

-- Advice to at least 150 U.S. firms over the remaining life of the project.

D. Level of Effort

As directed by USAID, all SI labor will be included in the Technical Assistance component even though some of the labor is oriented to the promotion, tours and information components (which are discussed in the following sections). More detail on the personnel allocation and budget are included in Section V. Projections are approximates based on percents of person years.

Senior Level	
Jeff Hallett:	90%
Ed Sanders:	13%
Mid-level:	
Emily Harwit:	65%
Swarupa Ganguli:	45%
Junior Level	
Catherine Eiff:	90%
Dagne Gizaw:	9%
Amy Patterson:	7%

II. Information System

A. Purpose and Assessment of Task: 1) To establish a permanent information network responding to Indian demand for technical information on U.S. environmental services and technologies and U.S. commercial interest in developing business opportunities in the environmental/industrial pollution sector in India. 2) To create and or strengthen networks whereby U.S. and Indian firms, associations and technology development organizations can learn of one another, exchange information on environmental problems, solutions, opportunities and events, match technology and service providers with importers and promote technology transfer arrangements that lead to sustained flows of U.S. environmental technologies into India for the resolution of industrial pollution problems. This is perhaps the most important component of the TEST program in that it is the structure that will be left in place at the conclusion of TEST program funding.

B. Strategy

Based on guidance from ICICI, we will postpone the planned fall 1994 installation and training on PC-installed environmental information resources, CD-ROM products, hard-disk mounted and dial-up databases. We will review this situation during the first quarter of 1995 and seek additional guidance from the TEST Group on their requirements in this component. Tentatively, we will plan on conducting this installation and training in February 1995. We also plan to explore the feasibility of establishing an Internet node for ICICI to disseminate information on TEST, environmental opportunities in India and to facilitate communications and matchmaking between U.S. and Indian environmental firms.

(1) SI will continue to evaluate and selectively acquire printed, computer disk, and CD-ROM environmental information resources and transfer these to ICICI's TEST Group for incorporation in the TEST Groups environmental library. This information supplements the materials on U.S. environmental firms that are being regularly sent to ICICI for incorporation in the TEST information system and library. TEST has been designed and implemented as a demand-driven project. The majority of SI's information gathering and evaluation activities to date have been in response to requests from potential Indian buyers of U.S.-sourced EST's for accurate information on U.S. environmental technologies, processes, vendors and technological trends. This has been and will continue to be the focus of SI's efforts in evaluating and meeting Indian demand for U.S. EST information resources.

Based on SI's experience evaluating various environmental information resources, we will as part of this workplan, issue a document of recommended information products that should form the core of any Indian business, technical, research or other multiplier organization's attempt to develop a commercially-oriented environmental library.

(2) SI will also continue its efforts to grow, improve and organize its own in-house database to meet TEST goals. This effort involves data entry, organization of data fields along environmental sector and technological lines, and integration with SI's physical corporate and technology files. Assuming ICICI concurrence, SI plans to transfer all non-proprietary portions of SI's in-house "Telemagic" database. Company and technology files are being and will continue to be transferred to ICICI during the period of this workplan.

As awareness of the TEST program and consequent interest in environmental opportunities in India grow, SI expects to be confronted with growing demand from U.S. vendors for specific information on all aspects of the environmental and general business situation in India. While current resources and in-house expertise permit SI to meet the majority of these demands to date, SI recognizes that the TEST program must have a capability to provide timely and accurate research and analysis on Indian environmental sectors, trends, policy, regulation, etc. This is one of the reasons we are developing the purchase order tasking relationships with Indian business organizations and other multiplier groups in order to fill in our information and knowledge gaps with products produced by these sources.

An important new component of the information system component of the workplan is to follow-up on our meeting with the National Environmental Engineering Research Institute (NEERI) in Nagpur in July 1994. At this meeting, NEERI and the TEST Group committed to establishing a memorandum of understanding outlining cooperation between the two organizations. Of particular interest is NEERI's involvement in a World Bank funded project to establish an environmental information network in India. At the meeting, it was agreed that the TEST information system would, to the greatest extent possible, seek to coordinate efforts and maximize synergies wherever possible. While SI must take its cue from the TEST Group on this, we consider this development an important potential factor in developing TEST's environmental information system.

C. Activities

--Prepare inventory and report evaluating U.S. EST information resources.

--Prepare report on reforms initiated in technology search analysis and reporting.

-- Pending ICICI concurrence, install and train ICICI on next set of commercial EST information products: e.g., CD-ROM databases, directories, technology/product catalogs.

--Continue efforts to shape and organize SI's in-house database to address TEST priorities for transfer to ICICI beginning February 1995. (We are making a major improvement to the database to make the technology designations more user-friendly and more easily used in conjunction with the physical company and technology files).

--Explore feasibility and, if so, establish link with Environmental Technology Exporters' Council for distribution of TEST information and promotional material on their E-mail and fax network by end of October 1994.

--Assuming ICICI and Mission concurrence, develop materials for demonstration of TEST information system display at Envirotech show in New Delhi February 1995.

--Conclude purchase orders with Indian entity to provide needed reporting and analysis on Indian environmental sectors, regulatory environment, business operating conditions and constraints.

D. Deliverables

-- Report on inventory of EST information resources by November 94;

-- Development of recommended core list of environmental resources by December 94;

-- Report on feasibility of establishing Internet node at ICICI by June 95;

-- Report on user-friendly Internet "front-end" software by April 95;

-- Continue to prepare monthly and distribute the calendar of environmental trade events.

-- Report on feasibility of newsletter for India by July 1995

III. Promotion

A. Purpose and Assessment of Task: To increase awareness of the services and opportunities provided by the TEST Project, and to encourage participation by Indian and American firms. An important element of this promotion is increasing awareness in the United States of environmental opportunities offered by the Indian market. Promotion is an important initial step in facilitating the linkages which lead to the financeable projects that are one of the major goals of the TEST project.

B. Strategy

Consistent with TEST Group guidance to place major emphasis on the closure of deals during the remainder of 1994, during the second year workplan SI will begin to augment efforts to promote and publicize the TEST program in environmental, business and trade journals in order to generate a significantly increased volume of Indo-U.S. business interaction. This increased level of interaction will be needed to meet our second year goal of a significantly expanded pipeline (containing at least 20 deals in progress). However, due to our inability to provide pro-active matchmaking assistance to U.S. firms that responded to our initial promotional efforts, the success of our second year promotional efforts will be heavily dependent on the effectiveness of the matchmaking services we hope to put in place with Tata Risk Management and perhaps others through the purchase order mechanism.

SI will seek to exploit contacts in national media including newspapers, trade press, television and computer bulletin boards to promote TEST as an innovative U.S. government program that delivers solid and measurable results in terms of the facilitation and financing of business deals, the transfer of useful environmental technologies and the improvement of India's environmental quality.

One factor that has measurably changed since SI began its TEST program responsibilities is the greater awareness among U.S. environmental firms about India's economic reform program, the potential size of the Indian market, etc. (iv) Concrete, detailed examples of successful environmental business ventures will remain the most important method of promoting the TEST program. (i) Provision of accurate, complete and timely information on India, its economy, business practices, regulatory structure and environmental sector will be another important tool in promoting TEST's credibility and insuring its success.

(iii) SI will expand upon and widen distribution of the "TEST Scorecard" describing successful TEST deals and other success stories.

SI will also expand earlier efforts to develop opportunities to make presentations at major environmental trade shows and exhibitions in the U.S. as well as to attend and network at these events to meet U.S. environmental firms and explain India opportunities to them.

C. Activities

--Late 1994, conduct another mass faxing with SI's updated Corptech database providing a progress report update on the TEST program and success stories.

--Seek opportunities for interviews with environmental, trade and national journals to describe successful TEST deals.

--Develop TEST presence and participation in U.S.-India Business Council meeting in Washington D.C. (October 6-7) and also at Envirotech show in New Delhi in February 1995.

--Press and other informational releases to be sent out on ETEC's fax and E-mail network as well as to environmental publications, newsletters and magazines.

--Continue to coordinate with the U.S. Embassy - New Delhi, US-AEP, TDA, OPIC, the Department of Commerce, the U.S. Chamber of Commerce and other private groups in supporting U.S. participation in missions, shows and exhibitions in India, as well as TEST presence at U.S.-based India events.

D. Deliverables

-- Develop plan for participation in at least 3 1995 U.S. and Indian environmental trade events.

-- Participate with TEST booth at one or more of the major U.S. trade events and at least one event in India in 1995.

-- Continue to prepare and distribute TEST Scorecard.

-- Publish articles and seek interviews in various journals, magazines and newsletters.

-- Send TEST information to at least 90 U.S. firms over the course of the workplan

IV. Trade and Investment Tours

A. Purpose and Assessment of Task: To enable Indian or U.S. environmental firms to meet potential buyers or sellers, or possible joint venture partners, to expose Indian

environmental business and government leaders to U.S. environmental technologies, business and regulatory practices.

B. Strategy

The Trade and Investment Tours element has proved to be a critical element in moving businesses, particularly smaller businesses where travel funds are a greater constraint, toward expeditious closure of business arrangements. We will attempt to further strengthen our working relationship with the new US-AEP environmental business exchange contractor in order to maximize the number of high quality environmental business exchanges that will lead to additional TEST-financed deals. In addition, we will continue to build on and systematize the "cost sharing" approach with which we have structured tours and exchanges over the past five months. In this arrangement, TEST has contributed primarily staff-time in organizing tours, recruiting companies and scheduling visits and US-AEP has funded travel and per diem expenses. In addition, we have required at least some contribution from the firms participating in the exchange.

In 1994-95 SI proposes to more rigorously apply the following criteria in screening requests for trade and investment tour support:

1. **Individual trips in support of specific transactions**: TEST will evaluate requests for support of trips for U.S. and Indian firm executives and technical persons to India and the U.S., respectively, and according to the following guidelines.

a. Does the product or technology address one of the identified priority environmental problems in India and would the transaction result in a sustainable business linkage between the U.S. and Indian firm, i.e., would there be transfers of technology, the possibility of downstream product and or technological upgrades, as well as mutual benefits to the U.S. and Indian environmental industries.

b. Is there a reasonable chance that a TEST-financed deal may eventually emerge from the trip.

c. Would the trip take place even without TEST support?

2. **Thematic missions**: Groups of qualified executives and technicians will be recruited for travel to and from India. These individuals will be selected based upon their interest and expertise in TEST priority areas, like distillery wastes, textile wastes, metal removal, etc., as well as on the prospect that their firms may be able to conclude a TEST-financed deal with one or more Indian firms. Non-transaction oriented activities scheduled in these kinds of trips would include seminars, workshops, training, factory assessments, technology demonstration projects, and meetings organized in conjunction with Indian business organizations or Indian government environmental agencies.

3. Support and assistance for other tours and missions travelling to India and the U.S. whose mission goals complement those of TEST. Organizing groups include: US-AEP, OPIC, the U.S. Chamber of Commerce, and Indian business organizations. The level of support and assistance TEST offers to these groups will always involve a measure of cost sharing by participants as well as on other types of cooperative arrangement, staff and financial support we can organize through groups like the U.S.-Asia Environmental Partnership, the International Executive Service Corps other environment business associations, etc.

C. Activities

--Continue to work closely with U.S. firms that are pursuing deals in India, assess whether TEST tours/mission element support is needed and merited.

--Maintain communications with Indian firms, directly and through ICICI in order to assess interests, needs, qualifications for Indian firms to visit the U.S.

--Working with USAID and the TEST Group, organize U.S. biological treatment delegation for participation in Envirotech show in February 1995 in New Delhi.

--Maintain contacts with other U.S. and Indian groups as other missions and tours develop to determine which can be and should be supported by the TEST program.

--Strengthen and systematize "cost-sharing" arrangements with US-AEP for the organization and execution of exchanges, missions, etc.

D. Deliverables

-- A 1994-95 plan for at least 10 trade and investment tours, involving at least four participants from the U.S. or four from India (with some participants to be fully self-supported). A written summary of the outcomes of these tours in terms of business arrangements concluded, value of ESTs trade, and likely impact on India's pollution problem.

V. Budget

An important adjustment from the initial 1993-94 workplan emerges from an earlier misunderstanding on the part of SI. We had mistakenly understood that labor executed for the information system, promotion and trade and investment tours components of the TEST program would be charged under those same respective categories. However, we have since learned that all labor is to be charged under the technical assistance component. For that reason, in the proposed 1994-95 workplan, we are showing planned labor for the information system, promotion and tours and missions components under the projected level of effort for the technical assistance component of the workplan. See attached table.

Trade in Environmental Services & Technologies

TEST

Proposed Workplan

Performance Period: September 1995 - August 1996

Submitted to USAID - New Delhi
By: Sanders International - Washington D.C.

September 25, 1995

TEST 1995-96 Workplan

I. Technical Assistance Component

A. **Purpose and Assessment of Technical Assistance Task**: To provide practical assistance, information and analysis to U.S. and Indian companies to help them consummate specific transactions leading to sustainable business linkages in priority environmental technology and service areas. The primary goal of this task is to help ICICI increase the number and improve the quality of potential loan/conditional grant applicants under the TEST program and to enable Sanders International (SI) to achieve the objective in the RFP of facilitating 25 joint venture or licensing agreements over the course of the project.

As envisioned in the original 1993-94 TEST Workplan, the Technical Assistance component was divided into four primary tasks. These tasks included:

> **Task 1: Information on U.S. companies**. Under this task SI will provide information and analysis of U.S. environmental equipment and service vendors in terms of their business capabilities (as opposed to detailed analysis of their technologies). We will aim at recruiting at least 10 firms per month into the TEST program as well as respond to inquiries from U.S. firms.
>
> **Task 2: Information on U.S. environmental technologies**. Through technology and company searches, SI will develop and provide information on environmental services and technologies to Indian firms. In most cases additional information on the specific applications envisioned in India will be required before zeroing in on the best technologies. Thus, this task will be more labor intensive depending on the number of iterations between the U.S. and India.
>
> **Task 3: Facilitation of specific transactions**. SI will work primarily with U.S. companies to help them evaluate the potential of specific business opportunities in India and to provide ongoing support to help them consummate those transactions.
>
> **Task 4: Advice to ICICI on loan and grant applications.** SI will provide advice as requested by ICICI on specific applications for loans and conditional grants. The primary focus of these reviews will be to validate the claims made by the potential U.S. technology vendors or joint venture partners.

B. Strategy

We intend to lay greater emphasis on concluding transactions with U.S. and Indian firms that have already received some sort of TEST technical assistance and less on recruiting new firms into the program. This will involve another systematic follow-up with all U.S. firms that had some initial contacts with Indian firms as a result of TEST technical assistance. Working with our TEST Group counterparts, we will continue to assess all new and existing TEST cases, including our existing pipeline of deals-in-progress, to determine which have the greatest likelihood of resulting in a successful transaction or business linkage, and to concentrate resources and efforts toward promoting and facilitating those cases.

As developed in previous years' workplans, one of the most important methods of developing TEST deals has been through technology search requests from Indian firms. Due to continuing difficulty in securing Indian company agreement to cost-share the technology search reports, we had been constrained in our efforts to respond to the Indian company requests which have been passed to us from ICICI. In fact, during the 1994-95 workplan, we were commissioned by ICICI to do only three technology search reports for Indian clients. To the extent that we have been able to develop new "deals in progress" this past year, it has been outside the technology search report mechanism, i.e. through the bio-treatment and foundry delegations and through initiatives undertaken by Sanders directly with U.S. or Indian firms.

We are pleased that ICICI agreed in July of this year to reduce the charge to Indian firms for the technical searches. This has already resulted in two new technical search requests which are currently underway. We are unable to forecast how many technology search requests we will conduct, both in-house and through sub-contractors, however we feel we may at least double the amount which were produced over the 1994-95 Workplan period. We feel there will be more "deals in progress" by the end of this new year as a consequence of new technology search reports.

As a priority we will seek to achieve significant measurable results in the "small/medium scale industry" focus area, specifically through the development of deals out of the contacts established during the February 1995 Biotreatment delegation; and through the organization and execution of the pollution prevention/tannery audit event.

We will aggressively pursue follow-up activities and opportunities developed from the June 1995 Indian Foundry Delegation and other opportunities to implement the Mission's MOU with the Agra Founders Association.

Based on guidance from the Mission and ICICI, we would also propose development of other initiatives focussed on priority polluting industries like pulp and paper, electro-plating, chemicals, distilleries, etc. in order to create other programmatic themes to supplement our transaction-oriented technical assistance efforts. While we will continue to pursue specific targets of opportunity for the development of Indo-U.S. business linkages for the transfer of

various appropriate and or innovative environmental technologies to India, we will also create a record of thematically organized deliverables, e.g. the foundry delegation, the tanneries pollution prevention event, etc.

Given continued high demand in India for information on U.S. technologies for making economic use of fly ash and other industrial slags, we propose to organize a delegation of U.S. firms representing various approaches to the conversion of these waste materials into products like construction bricks and blocks, aggregate, road bed material, jettees and artificial reefs. The delegation would visit India, possibly in conjunction with an Indian trade event sometime during the spring of 1996. In this context, TEST is partially supporting the visit of a senior consultant from RTP Environmental to meet with representatives of the Agra Iron Founders Association for foundry slag re-use in October, 1995. This is a direct result of the June Foundry Delegation visit to the U.S.

We will also seek opportunities to assist the Mission in the development and initial introduction of the Environmental Protection Initiative, specifically by directing more TEST resources and actitivities toward pollution prevention and cleaner technology initiatives and activities. We view the organization of the tanneries pollution prevention event as an example of this type of synergistic work.

Assuming continuing funding shortfalls for TEST's project loan and conditional grant component, we would propose that the Mission and the TEST Group consider using existing loan and conditional grant funds to help structure a TEST equity fund to attract investment in environmental projects in India from both Indian investors and abroad. TEST Manager K. Harinathan and Jeff Hallett had preliminary discussions with Chase Manhattan Bank on this topic and the Chase representative was very interested in working with us to carry out this project.

We intend to carefully evaluate the first year's results of the purchase order with Tata Risk Management to provide matchmaking services for U.S. firms that have approached the TEST program for assistance in finding qualfied and interested Indian firms with whom they can collaborate. We have been going through what seems to be an extended period of adjustment and further definition of the scope of services required under this purchase order. It is not clear whether we will recommend proceeding with this arrangement for a second year with Tata Risk Management, find an alternative service provider, or suspend the effort.

While the purchase order mechanism has proven to be a very efficient and effective way of sub-contracting for services, we are not planning addition of any new purchase orders with Indian organizations. If the 1995-96 budget permits continuance or addition of purchase orders that may contribute to the accomplishment of workplan goals, we will propose these as amendments to the workplan.

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C. Activities

--Work for the successful closure of the TEST pipeline's best prospects

--Seek other TEST-qualified opportunities for Indo-U.S. business linkages that may result in TEST-financeable deals before the end of 1995.

--Continue follow-up with 1995 Biotreatment Delegation firms to push for conclusion of deals before August 1996; work with 3i Systems on conclusion of its joint venture marketing company in India; continue to push for demonstration of Industrial Ecosystems' bio-remediation technology in India; followup with Central Leather Research Institute in Madras regarding a demonstration of DDH Enterprises sludge stabilization technology.

--Continue follow-up for Indian Foundry Delegation

1. Arrange for demonstration of EPR's cyclone technology in Agra by end of 1995.
2. Arrange for demonstration of Ogawa's passive monitoring devices in Agra by end of 1995.
3. Arrange for exchange visit for Skip White of MSI Engineering by the end of 1995.
4. Arrange for RTP Environmental to visit India in October for foundry slag re-use.

See the Annex which includes our July foundry trip report for additional activities.

--In cooperation with the Mission and US-EPA, organize and execute tanneries pollution prevention audit and report by end of September 1995.

--Assuming Mission concurrence, organize and execute Mathura Refinery pollution prevention audit and workshop by February 1996.

--Using results of the VOC control and recovery technology analysis and inventory database report which is currently under preparation by our sub-contractor Dyncorp, evaluate and, if appropriate, propose additional reports to be prepared to address specific critical Indian industry pollution problems, e.g. pulp and paper, tanneries, textiles, etc. We would propose that these technology supplier databases be made available free of charge to interested Indian firms, business organizations, academic institutions, etc. and be incorporated as part of the body of information resources included in the TEST Information System (see Annex II VOC Report outline).

--Explore feasibility and possibly initiate steps to create TEST environment/infrastructure fund with ICICI.

--Evaluate the Tata Risk Management purchase order in terms of accomplishment of objectives, recommend to Mission whether to renew.

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--Organize and execute by spring 1996 a U.S. coal ash/industrial slag industry delegation to India, possibly in conjunction with a major Indian trade event.

D. Deliverables

--By August 31, 1996, draft and submit 3-4 other industry-focussed technology analysis/inventory databases.

-- By November 1995, options paper on creating TEST infrastructure investment fund

--By November 1995, priority listing of deals in progress with an updated action plan

--By October 1995, VOC recovery technology analysis and inventory database and report

--By end November 1995, submit report on U.S. sources of financial support for environmental business.

E. Level of Effort

As directed by USAID, all SI labor will be included in the Technical Assistance component even though some of the labor is oriented to the promotion, tours and information components (which are discussed in the following sections). More detail on the personnel allocation and budget are included in Section V. Projections are approximates based on percents of person years.

II. Information System

A. Purpose and Assessment of Task: 1) To establish a permanent information network responding to Indian demand for technical information on U.S. environmental services, technologies and sources of financing, and U.S. commercial interest in developing business opportunities in the environmental/industrial pollution sector in India. 2) To create and or strengthen networks whereby U.S. and Indian firms, associations and technology development organizations can learn of one another, exchange information on environmental problems, solutions, opportunities and events, match technology and service providers with importers and promote technology transfer arrangements that lead to sustained flows of U.S. environmental technologies into India for the resolution of industrial pollution problems. This is perhaps the most important component of the TEST program in that it is the structure that will be left in place at the conclusion of TEST program funding.

B. Strategy

Systems Development

SI will continue to evaluate and selectively acquire printed, computer disk, and CD-ROM environmental information resources and transfer these to ICICI's TEST Group for incorporation in the TEST Group's environmental library. This information supplements the materials on U.S. environmental firms that are being sent to ICICI for incorporation in the TEST information system and library.

SI will also continue its efforts to further develop and improve the information system to meet the above objectives. Specific tasks include:

-- Implement Phase 2 Information System Development as outlined in our Memorandum (see annex X). This means exploring and developing Internet capabilities to 1) transfer large amounts of information to and from India, to 2) conduct business using Internet's live conversation channels, and 3) set up a TEST presence on the Internet by developing a World Wide Web (WWW) TEST Homepage and linkages.

-- Coordinate effort with USAID's plans to get on the information superhighway and create linkages to other USAID environmental and energy programs.

-- Develop information on other US government and private information networks, such as EP3's information clearinghouse and EnviroSense, the Global Network for Environmental Technology (GNET), the International Business Exchange (IBEX), and the Asian and Pacific Centre for Transfer of Technology (APCTT). As appropriate, incorporate into TEST homepage and develop sustainable relationships.

-- Receive and evaluate information products from CII commissioned under last year's workplan and determine future relationship and follow-up work. Integrate information into the TEST information system.

-- Receive and evaluate the VOC Technology Database commissioned from Dyncorp, and determine future assignments and follow-up work. Integrate into the TEST information system.

-- Develop information on public and private sources of financing for environmental projects and integrate into TEST information system.

Transfer of Resources and Training

We intend to work more closely with Dr. Jain and ICICI in terms of setting up their own in-house capability, subject to TEST Group's interest in managing and keeping up the information system after the TEST program funding. We will ensure that ICICI has the appropriate equipment and resources for the above stated goals. We will also transfer all relevant portions of SI's in-house "Telemagic" database.

Work with the Global Energy and Environment Network (GLEEN) in order to develop sustainable information systems capabilities in India at ICICI and other possible institutions and organizations if necessary.

At end of workplan year, summer '96, consider bringing over delegation from apex Indian business groups and ICICI for a week of training here, 2 days with us and 2-3 days of Internet and Dialog type seminars.

Information Dissemination and Promotion

We have reached a certain level of unique capability to find and evaluate environmental technologies using the TEST information system. We think that we can now promote the system as one of the major contributions of the TEST program that will remain after conclusing of TEST funding.

We will augment efforts to promote and explain the TEST Information System as a set of information resources and an approach to learning about environmental technologies and vendors.

We will develop a resource package that we can possibly offer to businesses, associations and Indian organizations. This could be done in print, electronically (on disk or CD-ROM), and/or by making the information available on the Internet. We will coordinate this effort with USAID and possibly GLEEN.

Revolving Fund

With USAID concurrence, we would like to explore the possibility of a revolving loan fund wherein qualified business, environmental or academica organizations could borrow money at attractive rates to buy some of these information resources, computers, etc. Interest and principal re-payments could go back to the fund for further lending. This would be another way to ensure the sustainability of the TEST information system. We would propose approaching U.S. multinationals active in India for contributions to start this fund.

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C. Activities

-- Update inventory and report evaluating U.S. EST information resources.

-- Implement Phase 2 Information System Development.

-- Coordinate Internet efforts with USAID programs.

-- Develop information on and build linkages with other USG and private information networks.

-- Develop information database from information products received from CII.

-- Integrate VOC Technology Database from Dyncorp.

-- Develop and integrate information on sources of financing.

-- Work with ICICI to transfer information and resources and implement Phase 2 development (this may necessitate trip to India (September 95). Explore possible cooperation with GLEEN.

-- Develop a complete information package for promotion and dissemination.

-- Organize an information training seminar for India delegation at the end of summer '96.

-- Explore feasibility of a TEST revolving fund.

D. Deliverables

-- Quarterly update on inventory of EST information resources by October 1995.

-- Updated report evaluating EST information resources, including Internet resources by October '95.

-- Purchase of equipment and implement testing of transfer of information by September '95.

-- Explore live conversation tools by November '95.

-- Develop complete information package for promotion and dissemination by December '95.

-- Report on feasibility of linkages with other USAID programs and information networks by January '96.

-- Report on feasibility of revolving fund by April '96.

-- Develop TEST Homepage with linkages to USAID and USG and private information networks by June '96.

-- Make TEST information resources available to businesses, associations, etc, by July '96.

-- Continue to prepare and distribute monthly calendar of environmental trade events.

-- Continue to send company information and new publications and information resources.

III. Promotion

A. Purpose and Assessment of Task: To increase awareness of the services and opportunities provided by the TEST Project, and to encourage participation by Indian and American firms. An important element of this promotion is increasing awareness in the United States of environmental opportunities offered by the Indian market. Promotion is an important initial step in facilitating the linkages which lead to the financeable projects that are one of the major goals of the TEST project.

B. Strategy

Consistent with TEST Group guidance to place major emphasis on the closure of deals during the remainder of 1995, during the third year workplan SI will continue efforts to promote and publicize the TEST program in environmental, business and trade journals in order to generate a significantly increased volume of Indo-U.S. business interaction.

SI will seek to exploit contacts in national media including newspapers, trade press, television and computer bulletin boards to promote TEST as an innovative U.S. government program that delivers solid and measurable results in terms of the facilitation and financing of business deals, the transfer of useful environmental technologies and the improvement of India's environmental quality. Execution of our work program for fuller development of the Internet and Worldwide Web as a method for promoting TEST and environmental business opportunities in India will be another focus of our strategy in this component.

One factor that has measurably changed since SI began its TEST program responsibilities is the greater awareness among U.S. environmental firms about India's economic reform program, the potential size of the Indian market, etc. Concrete, detailed examples of successful environmental business ventures will remain the most important method of promoting the TEST program. Provision of accurate, complete and timely information on India, its economy, business practices, regulatory structure and environmental sector will be another important tool in promoting TEST's credibility and insuring its success. Our purchase order agreement with CII to generate a flow this kind of accurate and updated

information on the Indian environmental situation will be an important instrument in implementing this part of the strategy.

SI will continue efforts to develop opportunities to make presentations at major environmental trade shows and exhibitions in the U.S. as well as to attend and network at these events to meet U.S. environmental firms and explain India opportunities to them.

Based on negligible results from last mass-faxing campaign aimed at Corptech database, we will suspend use of this method to promote the program.

C. Activities

--Seek opportunities for interviews with environmental, trade and national journals to describe successful TEST deals. See annex (paper submitted for Environmental Technology Exposition in Atlanta, Georgia for November 1995).

--Develop TEST presence and participation in U.S.-India Business Council meeting in New Delhi and possibly at Indian Foundry Industry convention in New Delhi in February 1996.

--Press and other informational releases to be distributed to environmental publications, newsletters and magazines.

--Continue to coordinate with the U.S. Embassy - New Delhi, US-AEP, TDA, OPIC, the Department of Commerce, the U.S. Chamber of Commerce and other private groups in supporting U.S. participation in missions, shows and exhibitions in India, as well as TEST presence at U.S.-based India events.

--Explore with USIS-New Delhi the organization of World Net events focussed on discussion of specific U.S. environmental technologies or processes to with Indian industry participants and environmental officials.

D. Deliverables

-- Develop plan for participation in at least three 1996 U.S. and Indian environmental trade events.

-- Participate with TEST booth at one or more of the major U.S. trade events and at least one event in India in 1996.

-- Continue to prepare and distribute TEST Scorecard.

-- Publish articles and seek interviews in various journals, magazines and newsletters.

-- Send TEST information to at least 90 U.S. firms over the course of the workplan.

IV. Trade and Investment Tours

A. Purpose and Assessment of Task: To enable Indian or U.S. environmental firms to meet potential buyers or sellers, or possible joint venture partners, to expose Indian environmental business and government leaders to U.S. environmental technologies, business and regulatory practices.

B. Strategy

The Trade and Investment Tours element has proved to be a critical element in moving businesses, particularly smaller businesses where travel funds are a greater constraint, toward expeditious closure of business arrangements. We will attempt to establish a working relationship with the new US-AEP environmental business exchange contractor in order to maximize the number of high quality environmental business exchanges that will lead to additional TEST deals. In addition, we will continue to build on and systematize the "cost sharing" approach with which we have structured tours and exchanges.

In 1995-96 SI will continue to apply the following criteria in screening requests for trade and investment tour support:

1. **Individual trips in support of specific transactions**: TEST will evaluate requests for support of trips for U.S. and Indian firm executives and technical persons to India and the U.S., respectively, and according to the following guidelines.

a. Does the product or technology address one of the identified priority environmental problems in India and would the transaction result in a sustainable business linkage between the U.S. and Indian firm, i.e., would there be transfers of technology, the possibility of downstream product and or technological upgrades, as well as mutual benefits to the U.S. and Indian environmental industries.

b. Is there a reasonable chance that a TEST-financed deal may eventually emerge from the trip?

c. Would the trip take place even without TEST support?

2. **Thematic missions**: Groups of qualified executives and technicians will be recruited for travel to and from India. These individuals will be selected based upon their interest and expertise in TEST priority areas, like distillery wastes, textile wastes, metal removal, etc., as well as on the prospect that their firms may be able to conclude a TEST-financed deal with one or more Indian firms. Non-transaction oriented activities scheduled in these kinds of trips would include seminars, workshops, training, factory assessments, technology demonstration projects, and meetings organized in conjunction with Indian business organizations or Indian government environmental agencies.

3. Support and assistance for other tours and missions travelling to India and the U.S. whose mission goals complement those of TEST. Organizing groups include: US-AEP, OPIC, the U.S. Chamber of Commerce, and Indian business organizations. The level of support and assistance TEST offers to these groups will always involve a measure of cost sharing by participants as well as on other types of cooperative arrangement, staff and financial support we can organize through groups like the U.S.-Asia Environmental Partnership, the International Executive Service Corps other environment business associations, etc.

C. Activities

--Continue to work closely with U.S. firms that are pursuing deals in India, assess whether TEST tours/mission element support is needed and merited.

--Maintain communications with Indian firms, directly and through ICICI in order to assess interests, needs, qualifications for Indian firms to visit the U.S.

--Working with USAID and the TEST Group, assess feasibility and, if agreed, work with American Foundrymen Society to organize a delegation of U.S. foundry technology firms to participate in Indian Foundry Industry Convention in February 1996 in New Delhi.

--Maintain contacts with other U.S. and Indian groups as other missions and tours develop to determine which can be and should be supported by the TEST program.

--Strengthen and systematize "cost-sharing" arrangements with new US-AEP contractor for the organization and execution of exchanges, missions, etc.

--By Spring 1996 organize and execute coal ash/industrial slag delegation visit to India.

D. Deliverables

-- A 1995-96 plan for at least 10 trade and investment tours, involving at least four participants from the U.S. or four from India (with some participants to be fully self-supported). A written summary of the outcomes of these tours in terms of business arrangements concluded, value of ESTs trade, and likely impact on India's pollution problem.

V. Budget

(see attachment)

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FACSIMILE MESSAGE

To: Felipe Mantiega

From: Jeff Hallett

Date: December 29, 1995

Total Pages (including cover):

MESSAGE:

Dear Felipe:

Thanks for your message of December 21 and all of your support through this chaotic time. Based on the present and expected budget constraints, as well as the Mission's strategic shift, we have developed a modified workplan, which we believe will achieve all of the Missions priority objectives and will conserve scarce funds. Table 1 summarizes our anticipated expenditures by month from January through the end of May.

TABLE 1
Forecast Expenditures January - May, 1996

Catagory	Jan 96	Feb 96	Mar 96	Apr 96	May 96	Total
Salaries	14,780	14,780	14,780	14,780	14,780	73,902
Fringe	5,040	5,040	5,040	5,040	5,040	25,201
Travel		3,100		3,100		6,200
Per Diem		1,696		2,310		4,006
ODC	4,781	31,241	5,341	1,241	1,241	43,845
Total	24,602	55,858	25,162	26,472	21,062	153,154
Ind Cost	18,654	22,526	18,723	18,885	18,215	97,003
Fee	2,561	4,636	2,598	2,685	2,325	14,805
Total	45,816	83,019	46,483	48,042	41,602	264,962

Technical Assistance Projections

Per your guidance, the bulk of the projected expenditures will be allocated to the technical coordinator, short term consultants in Sanders and overhead. We have assumed a steady level of personnel effort by month, with just a little over half time for Jeff, almost full time for Emily and Catherine, and about half time for Swarupa. The details are shown in the first Attachment with associated backup materials.

The only major other direct costs (ODCs) are for an estimated $30,000 for the TEST contribution toward the demonstration of EPR's technology at an Agra foundry, which also assumes a contribution of about $60,000 from the World Bank's demonstration project fund. Only two trips to India (one for Jeff and one for Catherine) are forecast through May. We will concentrate the bulk of our activities in the technical assistance area, providing matchmaking services to facilitate best prospect commercial linkages between U.S. and Indian firms as described below (attachment A).

Note that we have developed four categories for these prospects representing:

1. High profile, high return projects that are likely to happen within 6 months

2. Important projects likely to be finalized within 12 months with additional TEST technical assistance.

3. Important projects with a good prospect of being finalized within 12 months but which will probably require some travel support.

4. Good projects which have already received TEST and or USAEP assistance which have a good chance of closure witin 12-24 months or which represent important and path breaking environmental technology initiatives for India.

Project listed under categories 1 and 2 are also likely to take place regardless of the availability of subsidized financing. Projects in categories 3 and 4 are not yet reached a sufficiently developed state to estimate the importance of subsidized financing in moving both sides to closure.

Information System

We will continue to provide a moderate level of effort to further develop TEST's Worldwide Web home page. Due to the furlough, we have not been able to finalize arrangements with USAID Washington in order to put the home page up on the USAID server. However, we expect this to take place in early January. We have received excellent support and assistance from USAID Washington in developing the TEST Web page project.

Initially, the home page will be in what may be termed as a developmental stage. See attachment B for a representation of the home page and a description of the functions

which will be operational and under development over the course of this revised workplan. One of the critical contributions the TEST home page will make will be in the area of providing a forum for the exchange of information and further development of what we anticipate will be a lengthening list of TEST "deals in progress". Thus, after the conclusion of the technical assistance component of the program, we will have created a means for Indo-U.S. environmental business linkages to continue to be formed. The TEST pipeline of deals will have a means of moving toward closure.

Trade and Investment Tours

We have identified approximately 5-6 business linkage prospects that have a good chance of closure but will probably require some level of financial support for either travel to India or the U.S. We have met with the business exchange contractor for the USAEP (IIE) and have arrived at a general understanding that while TEST is not currently in the position to contribute cash to business exchanges, we do have a number of promising business linkage prospects whose chances would be helped with business exchange support. IIE has agreed to consider a modification to our prior "cost sharing" practice for joint support of business exchanges by accepting our staff support as TEST's contribution to the exchange. Attached at (C) please find a copy of the memo we propose to send to IIE describing the first set of exchanges we would like them to consider supporting. If possible, please provide concurrence for us to transmit the memo to IIE. Note: While IIE appears to be quite willing to make this change to accomodate our budget constraints, we believe it will be very important for the Mission to strongly advocate this change in TEST's working relationship with USAEP.

Promotion

The modified workplan essentially suspends all planned efforts and expenditure on promoting the TEST program or environmental business opportunties in India. On a case-by-case basis, we will consider seeking mission concurrence to address high quality environmental and or international business forums if no additional TEST expenditures for travel or lodging are required.

Charges Made to Various Components

With regard to the correctness of charges made to the different items, we have endeavored to rigorously follow Mission guidance on this. According to this guidance, we have charged all labor expenses to the technical assistance component regardless of whether the labor was expended for technical assistance to companies, promotion efforts, tours or information system development. We have received clear and repeated instructions from the Mission that this was the correct way of billing our labor expenses.

In response to your question and consistent with the above paragraph, we have not charged technical assistance costs to the Trade and Investment Tours component. Moreover, as you are aware, we have executed our contractual responsibilities according to annual workplans which have been reviewed and approved by both the Mission and

ICICI. The number, type of trade and investment tours has been set according to programmatic goals, i.e. the potential for these tours to contribute to sustainable Indo-U.S. environmental business linkages and not according to a specific budget.

According to our records, we will have spent $1,615,278 through December (assuming an expenditure of $55,000 in December). We understand that $1,700,000 has been allocated to Sanders to date and that you are planning another allocation of $260,000. At the forecast rate of spending through May, this combined allocation should result in a carryover of about $80,000 at the end of May -- an amount which should be sufficient for us to continue on through mid-July at the forecast expenditure rates.

In addition to asking for our forecast level of expenditures, you also inquired about how we have allocated our expenditures among the five "modules" in the contract (i.e., Technical Assistance, Support, Trade and Investment Tours, Promotion, and Information System). Throughout the contract, as directed by the Mission, we have included all Sanders' salary and related indirect expenses in the Technical Assistance module. Thus, for Trade and Investment, we have shown only direct costs associated with trade and investment tours (e.g., travel, per diem, entrance fees, etc.) in the T&I expenditures. We knew that we would be exceeding the budgeted levels for some of these modules because of changed priorities in the annual workplans.

Table 2 shows the original budget (column a) and our summary of expenses to date (column b) for each of the five modules. The figures include an estimated $55,000 for December. The December estimates will be finalized on or before the 10th of January when we close our books for the month and year. We will send you an updated forecast as soon as available. In addition, Table 2 shows the estimated allocation of expenses over the next five months (column c) in terms of the five modules. Finally, the Table shows our estimate of the amount of surplus (or shortfall) for each of the five categories in terms of the original budget allocations (column d).

Our figures for the original budget are somewhat different from yours because we have added in the G&A and profit for each of the "add-in" modules (as was shown in our original proposal). Thus for T&I tours we show $294,945 (versus $250,000). Based on these numbers, we are over the budgeted amount for Support, but still under on the otheres. The primary reason for exceeding the amount originally budgeted for Support is that the amount of logistical effort in managing the Trade and Investment Tours was much larger than we initially anticipated. As indicated in Table 2, we will have a substantial surplus over the amounts originally budgeted for Promotion and for Information Systems, primarily because all of our professional time has been recorded under the Technical Assistance category as directed by the Mission.

TABLE 2
Expenditures by Budget Module

Module	Budget	Inception thru Dec 95	Forecast Jan-May 96	Variance from Budget
TA	$1,320,206	$1,079,727	$173,463	- $67,016
Support	130,297	144,877	44,740	+ 59,320
T&I Tours	294,945	252,792	35,715	- 6,438
Promotion	235,956	81,502	0	- 154,454
Info System	235,956	56,380	11,044	- 168,532
Total	$2,217,360	$1,615,278	$264,962	-$337,120

* * * * *

Felipe, I hope that this information along with the attached information provides all the information that you need. We started to build a matrix which would show the expenditures by contract line item for each of the five modules. It turns out that this is difficult to do based on our records, since our accounts were not set up to track information by these categories. We could reconstruct the data along these lines if that would be useful, but it would take a couple of days of Fran's time to pull this together. We didn't want to spend this amount of time unless it is necessary for your planning needs. Please let us know if you do need this more detailed information and we will drop everything to prepare it.

ATTACHMENT - B

Date: December 27, 1995
Subject: TEST Internet Website
From: Catherine Eiff

1. TEST Website

Attached is a rough draft copy of the TEST Homepage with a menu of options for information on the TEST program and related environmental resources. Also attached is a rough draft copy of the "TEST Mission and Objectives" page, as a sample for how the other pages will look.

We would also like to note that the **Confederation of Indian Industries (CII)** has its own website (see attached copy of CII Homepage). Where appropriate we have made links to their site and will work on further coordinating our respective Internet efforts.

Implementation of the TEST website will be in 3 phases as described below. **Phase 1 is near completion and as such will be uploaded on the USAID server during the week of January 3rd. Phases 2 and 3 will be completed during the next three to six months.**

Phase 1: -- Overall design; TEST program information

The **TEST Homepage** is designed to include the USAID logo and reflects USAID formatting standards. The TEST logo will appear on related TEST Website pages, and each page will include a "menu bar" allowing the user to go back to a specific point of interest at all times. (See "menu bar" at the end of "TEST Mission and Objectives" page). Where appropriate, links are active to the USAID website.

The following links will be active:

- **Mission.** Describes the TEST program objectives, services and lists contact information.
- **Projects.** Lists and describes TEST environmental business exchanges, delegations, and other initiatives.
- **Success Stories.** Provides TEST case profiles, and a list of completed and pending ventures and business collaborations.

- **Financing.** Lists and describes U.S. and multilateral financing organizations relevant for projects in India and where available provides links to the appropriate homepages.
- **Related Government Programs.** Lists and describes other U.S. government programs active in India which focus on environmental technology cooperation and transfer as well as export promotion programs to India.

- **Upcoming Events.** Lists environmental technology conferences in the U.S. and in India, including a link to CII's calendar of events.
- **Information Resources.** Lists the Internet resources that were originally identified in the "TEST Environmental Services and Technology Resource Guide" and which are continuously being updated to include such new sites such as the CII website. Depending on USAID approval, we will make the links active where appropriate.
- **Related Business Networks.** Lists and describes other networks that relate or are complementary to the TEST program and provides links where possible.

Phase 2: -- Update existing information; information on India

a) **Update** existing information and making additional links active in existing text as appropriate and if approved by USAID.

b) In addition to the links described in Phase 1, the following links will be active:

- **Market & Business Information.** Makes available CII's "Environmental Management and Business Opportunities in India" report and refers to other Indian market and business information resources available on or off the Internet.
- **Regs, Laws and Policy.** Lists India's key environmental legislation, provides other relevant policy articles and reports, and refers to other relevant information sources.
- **Technologies.** Provides information on India's technology needs.
- **Indian Buyers and Contacts.** Lists Indian companies interested in collaborating with U.S. environmental services and technology providers. Lists Indian associations and chambers of commerce, and provides links where possible (i.e. such as CII's website).

c) Activate **e-mail** link so that users can pose questions and comments to TEST program officers.

Phase 3: -- Update; information on U.S; Internet tools

a) **Update** existing information, complete as necessary and establish links where appropriate.

b) Activate **U.S. Technology Providers** link by providing list of U.S. companies, associations, etc. Add information under other menu options as appropriate on U.S. environmental market and business practices, technology developments, etc.

c) Set up **FTP site** to upload and download both U.S. and Indian company brochures. Create links from "U.S. Technology Providers" and "Indian Buyers & Contacts" menu options.

d) Develop and activate **Chat Forum** for users to converse directly with interested parties.

2. Marketing and Evaluation of TEST Website

To ensure that as many users as possible will take advantage of the TEST website we propose to market the site as follows (budget will determine whether to use only some or all options):

Register with Internet Search tools, such as Yahoo, Web Crawler, etc.
Ensure that other related USAID programs with Internet sites create links to TEST homepage.
Attend USAID e-Trade Conferences, and other related conferences and present the TEST website.

a) Coordinate with other U.S. Government Agencies, such as DOC, DOE, to publisize the TEST website as appropriate.
   - Conduct a TEST broadcast fax mailing.
   - Advertise in major environmental magazines.
   - Advertise in major Internet newletters and magazines.

   Print the TEST Internet address on all TEST promotional material, including i) write TEST brochure insert updating information system and describing the TEST website, ii) include TEST Internet address on all TEST business cards and letterhead.

All during implementation of the TEST website, we will evaluate its effectiveness and make changes accordingly.

1.3

U.S.Agency for International Development
Bureau for Management
Office of Procurement
Washington, D.C. 20523-1422

October 13, 1994

SANDERS INTERNATIONAL
1616 P Street N.W.
Washington, DC 20036

Dear Sir or Madam:

REF: 386-0530-C-00-3219-00
EUR-0028-C-00-2048-00

As Director of the USAID Office of Procurement, I hereby issue this universal, unilateral modification, effective this date, to modify all cost-reimbursement and requirements contracts exceeding $200,000 in expenditures in a calendar year, entered into by your organization and the U.S. Agency for International Development (USAID) world-wide. (This does not include fixed-price contracts.) A copy of this letter should be placed in all existing contract files for your permanent record.

Pursuant to the authority contained in the Foreign Assistance Act of 1961, as amended, and Executive Order 11223, the U.S. Agency for International Development hereby modifies all existing technical and professional services contracts (as specified above) regarding the submission of performance progress reporting. Effective immediately, contractors shall submit, at least quarterly, progress reports which focus on standard information pertaining to contract performance, administration, and accomplishments. This requirement supersedes other performance reporting requirements as stated in existing contracts.

This revised reporting requirement is an attempt to simplify the process and, at the same time, provide USAID with sufficient information to monitor performance of, and otherwise administer service contracts. The reports are to be brief, from three to eight pages, and standardized in so far as the kind of information being reported and the way it is to be reported. The requirement also complies with the guidance of the Office of Management and Budget (OMB) and the National Performance Review (NPR) to monitor performance and to gather and use performance information.

Contractors shall prepare the performance reports on all active technical or professional service contracts. These reports will focus on the major activities in progress during the

quarter in terms of quality, timeliness, and cost-effectiveness. Contractors shall submit the reports to the cognizant Project Officer who is the Contracting Officer's Technical Representative (COTR), as specified in the contract document. The Project Officer shall comment on the Contractor's report and send the report, with comments, to the cognizant Contracting Officer. Attached hereto is sample guidance for quarterly performance report preparation.

For any questions concerning the above, please contact Gary Kinney, M/OP/OD, at (703)875-1204.

Sincerely,

Marcus L. Stevenson
Director

Attachment: a/s

U.S.

Agency for International Development

Guidelines

for

Contract Quarterly Performance

Reporting

Prepared by:
Office of Procurement

For Information Call:
M/OP/OD, Gary Kinney
(703) 875-1204

SAMPLE GUIDELINE
FOR
QUARTERLY PERFORMANCE REPORTS
(for technical or professional services contracts)

Contractor_____
Contract #_____
Reporting period: _____ to _____

Section I- CONTRACTOR'S REPORT

Section I, which the contractor prepares, consists of two parts. The first part is a narrative of progress on major activities and the second part requires data entry only.

A. Narrative:

The narrative should cover each of the five elements described below. Element #1 should not exceed a paragraph. Element #2 may require a short paragraph to summarize each expected result. For element #3, a sentence on each activity should be sufficient to describe what is in process during the quarter. (Distinguish among core, buy-in and sub-contracting activities) Element # 4 is the essential part of the report. Of particular interest are issues regarding timeliness, technical quality and cost-effectiveness of each of the activities or delivery orders in progress. Element # 5 provides the opportunity to draw attention to possible problems or to adjustments which would enhance the delivery of the services being provided.

1. Background: Describe briefly the overall contract final objective in terms of level of effort, if appropriate, and total estimated cost needed to accomplish objective.

2. Expected Results: Summarize the specific results expected at conclusion of contract

3a. Current core activities: Describe briefly each of the major activities in process during current quarter as found in work plans and/or contract.

3b. Current buy-ins: Summarize objective of each active delivery order under companion contract.

3c. Current subcontracting activities: Describe briefly each subcontracting activity and identify the subcontractor.

4. Performance: For each of the activities described in number 3a (core), b (buy-ins), and c (subcontracting) above, state whether on-target or not, and comment, particularly in terms of comparing actual accomplishments with the objectives, deliverables, or requirements established for the period, and explain reasons why objectives, deliverables or requirements were not met, as appropriate.

5. Statement of Work: Comment as to whether circumstances have changed which would require modification in any elements of the statement of work.

> Level of effort data should be expressed in person months and needs to be furnished on level of effort contracts only. Financial data may be an estimated amount and can be rounded to the nearest thousandth.

B. Administrative Information:

Contract Data: Total level of effort* _____ p/m
Total estimated cost $_____

1. Level of effort* (last three months): _____p/m
2. Cumulative level of effort* _____p/m
3. Unused level of effort* _____p/m
4. Expenditures (last three months): $_____
5. Cumulative expenditures to date: $_____
6. Remaining unexpended balance: $_____

*Applies to level of effort contracts only

Section II - PROJECT OFFICER'S COMMENTS

> The cognizant project officer, acting in his/her capacity as the contract officer's technical representative as specified in the contract agreement, will complete section II and pass his/her comments on to the cognizant contracting officer. The project officer will acknowledge receipt and provide feed-back, as appropriate, to the contractor using established communication channels.

1. Comment on contractor's technical performance (quality of technical assistance, professional services, and/or products) and provide examples, if appropriate.

2. Comment on contractor's administrative performance (timeliness in meeting schedules and/or delivering materials/products) during the quarter and give example(s), if appropriate.

3. Comment on contractor's management (cost-effectiveness, quality of communication with staff and with USAID for the quarter and provide examples as appropriate.

4. React to contractor's assessment of performance regarding any of the activities/deliverables described in section IA, number 4 above.

5. Note areas for potential contractor improvement regarding management/provision of any services related to the activities/deliverables and/or specific contract results.

Project Officer/Office Symbol. _____ Date _____

Section III - CONTRACT OFFICE'S COMMENT

The cognizant Contract Office personnel will complete Section III in consultation with the cognizant project officer and mutually agree on any actions that need to be taken. Feed-back should be given to the contractor within five working days.

1. Comment on any areas of concern particularly regarding Contractor's response to questions 4 and 5 in Section I above and Project Office's response to question 3 in Section II above.

2. Identify actions to support, correct, or improve contractor's performance (show-cause notice, cure notice, contract modification, incremental funding, technical direction to contractor, approvals and/or clearances, interpretations of statement of work or adjustments in work plans, feed-back to contractor regarding performance and/or deliverables) that need to be taken and indicate action officer and due date.

Contract Officer/Office Symbol_____ Date _____

Annex I

September 6, 1994

TO: Mr. Paul Keller
DynCorp Meridian

Ms. Jeanne Maltby
KBN Engineering

Ms. Azita Yazdani
Pollution Prevention International

Mr. Dan Bradbury
Sheladia

FROM: Jeff Hallett
TEST Project Manager

Subject: Assessment of TEST Technology Searches and Plans for 1995

Background

Since assuming management responsibilities for the TEST program in August 1993, Sanders International (SI) has, on behalf of ICICI's TEST Group and its Indian clients, commissioned thirteen technology search reports. Twelve of these reports were drafted by Sanders International sub-contractors. Table 1 shows the subjects of the reports and the firm responsible for their preparation.

Given the high demand perceived by TEST project designers for timely and accurate information on U.S. environmental firms, their products, technologies and services, the technology search portion of TEST's technical assistance component has been recognized as one of the most important service areas the TEST program offers. From the outset of the program, this area has also been recognized by both the Indian and U.S. sides of the TEST program to contain some of the most difficult tasks. This is due to: the variety and complexity of environmental technologies, widely differing operating conditions and regulatory environments, different technical and business approaches to resolution of pollution problems, and the need to provide highly specific "street smart" information at low cost.

In August 1993 kick-off meetings with ICICI's TEST Group, Sanders project management spent the bulk of the time discussing the TEST Group's understanding of the nature of

demand among their clients for technology search data, as well as the problems and short comings of the technology search information provided to ICICI by TEST's interim contractor. As a result of these meetings, SI's analysis of the problem and synthesis of the TEST Group's input, SI drafted and circulated the Annex A document "TEST Technology Searches Proposed Approach" as an annex to the 1993-1994 TEST Workplan. SI circulated the "Approach" document to TEST sub-contractor firms for use as a general guide in preparing the technology search reports.

ICICI Comments on Technology Search Reports and Approach

Based on discussions with ICICI TEST Group members and a meeting with one of the Indian firms that had commissioned a technology search for automotive catalytic converter technologies, the general reaction to the TEST technology searches by ICICI's Indian clients has been that they have not been useful. While the information has been of general interest, the reports have not played a significant role in moving the Indian clients toward business linkages with U.S. firms. Both SI and the Test Group agreed it would be a top priority to review and improve the technology search procedures and output.

After considering all comments from and discussions with Indian clients, SI and the TEST Group agreed that the reports have been insufficiently focussed on the technical problems or issues of greatest concern to the Indian firms. One Indian manager stated that he believed that he could have gathered most of same information provided in the report by sending one of his employees to do research in the U.S. consulate's commercial library. While perhaps an overstatement, the observation is indicative of an inadequate accounting on TEST's part of the existing knowledge base and technological sophistication of the Indian firms.

One fundamental problem seems to be that the Indian firms' underlying questions or problems have not been sufficiently isolated and defined. For example, the firm that commissioned a report on automotive catalytic converter technology was really only interested in finding a U.S. firm that could transfer technologies for the manufacture of metal monoliths. An Indian firm that requested a report on recovery and re-use technologies for rice husk ash was really only interested in new processes for the recovery of industrial-grade silicon from the ash. Neither of these points emerged clearly until some months after the initial technical assistance request had been made. Before technology searches are commissioned, efforts must be made to draw out the Indian firms' true priorities in order to avoid wasted effort and cost and the reporting of unneeded information. This will be the responsibility of SI and the TEST Group.

A second fundamental problem is that most of the information in the technology search reports seems to have been drawn largely from generally available sources like magazines, company brochures, textbooks and association contacts, rather than the professional know-how and experience of the report drafter or contacts with expert individuals involved in the specific industry technology area. The kind and quality of "street smart" information we need in the technology search reports can, realistically and economically, can only come be provided by true industry/technology experts and not from basic research efforts or literature searches.

Therefore, the individuals that conduct these searches must either possess the required knowledge and experience or be able to draw upon personal networks of individuals that have this expertise.

Finally, ICICI's policy of collecting a fee from their Indian client firms amounting to 25% of the U.S. costs of the searches has highlighted another problem with respect to TEST's technology search efforts. While the first dozen reports were done on a no-fee basis, since the beginning of the year, ICICI has not commissioned any reports without first having the Indian firm's commitment to pay the technical assistance fee. To date, only two Indian firms have agreed to pay the technical assistance fee out of ten pending technical assistance requests. In order to execute the technical assistance component of the TEST program, SI and the TEST Group agreed that we must not only improve the quality and utility of the technology searches, but also bring down the costs to a level that the Indian firms will be more willing to pay. This requirement underscores the need to put the technology search questions to individuals that can quickly provide information required without extensive and prolonged research efforts.

1995 Goals

By intensively focussing the questions and problems before submitting tasks to the subcontractor firms, SI and the TEST Group hope to **increase the number of technology search reports that can be done, reduce turnaround time for the reports and reduce the costs of the reports.** To put it in another way, we will not be able to do technology searches unless the Indian firms agree to pay for a portion of them. The Indian firms will not agree to pay unless the reports are cheaper and clearly of value to them. The reports will not be cheaper unless they are much more narrowly defined and able to be completed very quickly by very knowledgeable U.S. experts.

1995 Actions

1. In light of the past year's experience and the reaction of the Indian clients to our efforts, the **technology search approach in Annex A will be modified** to provide a narrower band of guidance.

2. SI and the TEST Group have agreed to **re-double efforts to better focus and clarify future technical assistance requests**. This means the TEST Group and SI will conduct a more intensive iterative effort to help the Indian client define what it is they are really seeking. In so doing, we hope to be able to offer an information product to the Indian client firm that will be of sufficient quality and value that he or she will be willing to pay the technical assistance fee, and more importantly, that the results will have a better prospect of leading to a TEST-financed commercial transaction.

3. **Future reports will be designed on a case-by-case basis consistent with the modified technology search approach**. An outline and cost estimate for each report will be prepared by SI and submitted to the TEST Group for client approval. Conference calls involving the

Indian clients, sub-contractor personnel, the TEST Group and SI will be arranged to insure full understanding by all parties about what information is required. Additional calls may be arranged, as needed. Sub-contractor costs in this project development stage will be billed separately from the technology search itself.

4. Prior to beginning work on technology search reports, SI would like a manager/supervisor from the subcontracting firm (in collaboration with SI) **to assess the clarity of the task assigned and confirm, either verbally or in writing to SI, understanding of the exact nature of the final report desired.** If additional information of any kind is required, the manager/supervisor should work with SI to secure what is needed.

5. **Technology search reports should not contain verbiage explaining deficiencies in the presentation of the task, lack of background information, or other rationale.** We will resolve such deficiencies prior to drafting of the report.

6. Subcontractor personnel who execute the technology searches must have a high level of expertise and industry knowledge in the technology areas assigned. Prior to commissioning sub-contractor reports, **SI would like subcontractors to designate the personnel nominated to do thereports and, in not on file with SI, submit their curriculum vitaes.** For specialized requests that may exceed the in-house capabilities of subcontractor firms, SI may suggest technical experts to be engaged for these tasks or the subcontractor may propose experts from their own sources.

Additional guiding principles for future technology searches

1. Future technology search reports should assume an expert-level of knowledge by the Indian client of the technology area under study. Most of the Indian clients dealt with to date are already in business in the technology area or a related technology area under study or evaluation. We can assume they know what all the current treatment processes are and generally how they work.

2. However, the Indian clients are very **interested in details of the treatment processes that might either recommend them for or against use in India.** Ideally, individuals conducting technology searches will possess and be able to communicate detailed knowledge on the intricacies of various treatment processes.

3. The Indian clients are especially **interested in metrics that will help them compare different technological approaches**. Our efforts should be aimed at **defining differences among technological or treatment alternatives and ways of quantitatively demonstrating these differences**. Metrics include but are not limited to: acquisition, operating and maintenance costs, energy costs, treatment costs per unit, and efficiency measurements of various sorts.

4. **Cost is an issue. If it's cheaper it's better**.

Table 1
TEST Technology Searches
August 1993-August 1994

Air Pollution Control Equipment	KBN Engineering	September 1993
Reverse Osmosis Technologies	KBN Engineering	September 1993
Removal & Re-use of Chromium in Tanneries	Pollution Prevention International	September 1993
Anaerobic Sludge Digestor Technologies	KBN Engineering	September 1993
Treatment of Coke Oven Wastes	Sanders International	September 1993
CNG Conversion Kits	Dyn-Corp/Meridian	September 1993
Reactor Clarifiers	KBN Engineering	September 1993
High BOD Removal Systems	KBN Engineering	September 1993
Catalytic Converter Technology	Dyn-Corp Meridian	September 1993
BOD Reduction in Distillery Wastes	Pollution Prevention International	January 1994
Metals Removal from Wastewater Streams	Sheladia	February 1994
Solid Waste from Caustic Chlorine Plants	Dyn-Corp/Meridian	July 1994
Treatment of Cyanide-Bearing Wastes with Hydrogen Peroxide	Dyn-Corp/Meridian	July 1994

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

Air Pollution Control Equipment for Controlling Particulates and Acid Gases

Prepared for:

The Industrial Credit and Investment Corporation of India

September 1993

TEST Prime Contractor:
Sanders International, Inc.
1616 P Street, N.W., Suite 410
Washington, D.C. 20036

Sub Contractor:
KBN Engineering and Applied Sciences, Inc.
1034 NW 57th street
Gainesville, Florida 32605

**TEST is funded and administered by the U. S. Agency for International Development
New Delhi, India**

1.0 BACKGROUND

1.1 OVERALL PERSPECTIVE

This study is aimed at providing ICICI with a resource list of United States vendors of environmental services and technologies in the area of air pollution control (APC) equipment. The type of equipment or abatement process reviewed in this study were electrostatic precipitators (ESP), mechanical collectors (cyclones), and wet/dry scrubber systems. The technology review includes a brief description of each type of APC equipment and the associated advantages and disadvantages. Advantages and disadvantages of each APC technology are described with respect to technical applicability.

Currently, there are numerous installations of ESP, cyclones, and other particulate control device, namely the fabric filter, in India. Such installations are applied to electric power generating plants and other manufacturing industries in India that include aluminum smelting, phosphate fertilizer manufacture, steel production, synthetic organic chemical manufacturing, and cement production. However, existing applications of either the wet or dry scrubber system for acid gas removal do not appear to be as prominent as application of APC equipment for particulate removal.

Potential markets for APC equipment in India are projected to be growing steadily during the next several years in view of future economic growth and the trend towards private ownership of large-scale industries in India. More restrictive domestic regulation concerning acid gas emissions along with the India government's commitment towards a cleaner and better global environment will result in higher market potential for the acid gas treatment process.

1.2 SCOPE OF APC TECHNOLOGY REVIEW AND VENDOR RESEARCH

The scope of this study is focused on providing background information on these APC technologies and preparing a list of major United States vendors for each technology. In this report, each APC technology and vendors are evaluated with respect to the utility industry because such application is commonly found in this segment of the major industries. Also, a typical application in the power generation area is usually on a larger scale than an industrial

process [i.e., a wet flue gas desulfurization (FGD) system for a coal-fired boiler is much larger than a wet scrubber system designed to control acid mist from a synthetic organic batch production].

The four types of APC equipment evaluated (i.e, ESP, wet FGD scrubber, spray dry absorber, and cyclones) are complementary control techniques. The vendors usually carry all of this APC equipment in their product line.

A general description of each APC technology is presented in Section 3.0. Typical cost comparison for each APC system is presented in Section 4.0. Vendor information is presented in Section 5.0. The vendor lists for each APC technology are presented in Appendix A. Copies of available vendor brochures are included in Appendix B. The literature also contains additional information regarding industrial application, for each APC technology.

TECHNOLOGY REVIEW AND VENDOR RESEARCH ON REVERSE OSMOSIS

Prepared For:

Sanders International
1616 P Street, Suite 410
Washington, DC 20008

Prepared By:

KBN Engineering and Applied Sciences, Inc.
1034 NW 57th Street
Gainesville, Florida 32605

September 1993
13063B2/R2

1.0 BACKGROUND

1.1 OVERALL PERSPECTIVE

The objective of this study is to provide ICICI with a series of reports containing information and resource lists on various wastewater treatment technologies in the United States that have potential for application in India. The current report concerns reverse osmosis. The technology review includes a description of the process and equipment, its history of use and current status in the United States, and evaluation of its potential for use in India.

1.2 SCOPE OF REVIEW AND VENDOR RESEARCH

Literature sources including current periodicals were reviewed to obtain information on the technology and compile a list of vendors. The vendors were contacted by telephone to discuss their particular products and their interest doing business in India. In many cases, the company was already aware of the potential of the Indian market and actively engaged in business with Indian customers.

2.0 GENERAL DESCRIPTION OF TECHNOLOGY

Reverse osmosis (RO) is a process in which high pressure is applied to water that contains high levels of dissolved solids to produce a higher quality treated water and a reject brine. The process is used in desalination plants as well as for the treatment of wastewater and reuse water.

RO systems operate by directing a high-pressure feed stream that contains the solute to be removed against a salt-rejecting membrane located inside a closed container. This semi-permeable membrane restricts the passage of solutes and allows relatively pure water to pass through. A pressure greater than the osmotic pressure is applied to the solution to reverse the natural osmotic gradient and drive solute from the solution side of the semi-permeable membrane to the pure solvent side.

RO requires pretreatment of the feedwater stream prior to its delivery to the pressurized portion of the system. Pretreatment consists of the removal of turbidity and suspended solids, pH control, scale inhibition, disinfection, and organics removal. The product water also requires stabilization (pH adjustment and degasification) before it can be used.

Disposal of reject brine usually is not considered to cause significant impacts if discharged to a saline water body.

A variety of semi-permeable membrane types and support module configurations are available for RO. The most common membrane types are cellose-based, but polyamide (nylon) membranes and composite membranes are also available. The most common module types are spiral-wound and hollow fiber; less commonly used are tubular and plate-and-frame modules. The modules differ in their susceptibility to plugging from scale deposition and/or biofouling. The selection of a module/membrane combination is based on pre-treatment water quality (e.g. suspended materials, ionic content, presence of chemical additives, feedwater temperature, Langlier saturation index, pH, and solubility product). The most commonly-used and cheapest membrane types are cellulose-acetate, although cost differentials are declining as other membrane types become more widely available.

Electrodialysis is similar to reverse osmosis in that it is a membrane separation process, but the membrane process is combined with exposure of the feedwater to an electrical field that attracts cations to a negatively-charged electrode and anions to a positively-charged electrode. Membranes that allow the passage of either cations or anions are placed between the electrodes in an alternating arrangement (first the anion-specific, then the cation-specific membrane). Spacer sheets between the membranes permit water to flow along the face of the membrane. As water flows through the membrane stack, concentrated and dilute solutions are formed in the cells between alternating membranes. A membrane stack may have several hundred cell pairs (one cell for treated water and one for brine).

In electrodialysis reversal (EDR), the treated water cells are identical in construction to the brine cells. During operation of the EDR unit, the polarity of the electrodes in the system is reversed, and simultaneously the membrane stack internal flows are altered so that the product cell becomes the brine cell and vice versa. The product water is then discharged. This reversal process is performed three or four times per hour, and helps to remove scale, slime, and other deposits in the cells. Reversal also greatly reduces the need for pretreatment chemicals and minimizes fouling of the membranes.

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

Removal and Reuse of Chromium from Tannery Industry

Prepared for:

The Industrial Credit and Investment Corporation of India

September 1993

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Sub Contractor:
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TEST is funded and administered by the U. S. Agency for International Development
New Delhi, India

1.0 BACKGROUND AND PROBLEM STATEMENT

The manufacture of leather from animal hides involves a number of pollution producing processes. Tanning of hides and skins to convert them into leather has often been accompanied by odors and pollution. However, as environmental issues in the tanning industry have gained importance, various environmental technology and tools have in turn gained sophistication and power.

The following technology assessment addresses the chromium contaminated wastes generated in the tanning process and presents a number of alternative technologies to recover and reuse this waste stream.

A list of potential U.S. companies interested in providing these technologies is also provided.

1.1 Problem Statement

Various wastes are produced in leather manufacturing as part of routine daily operations. Although significant waste is often generated from nearly all leather manufacturing processes, this document will only concentrate on wastes from tanning applications resulting from the use of chromium applied to animal hides to convert them to leather. In addition, we only address the use of trivalent chromium (hereinafter chromium) in formulations used to treat animal hides. It is Pollution Prevention International, Inc.'s (PPI) understanding that in India trivalent chromium is utilized more extensively than hexavalent chromium in tanning applications.

Chromium is the most common chemical agent used in tanning operations to stabilize the collagen structure of the hide thereby preventing decomposition and converting the hide into a durable, stable leather product. Chromium salts (usually chromium sulfate) are dissolved in sulfuric acid and depilated hides are then soaked in this tanning bath.

Chromium wastes result from the dragout of the chromium tanning solution, discharge of chromium laden rinse water, and discharge of spent tanning bath. Based on the client's request, this report, focuses only on recovery options for chromium wastes discharged from spent tanning solutions. Various other measures are available for the individual facilities to prolong the life of their tanning baths and recycle chromium wastes from the dragout and from rinse solutions. These on-site measures will not be discussed in this report.

1.2 Current U.S. Practices

Recovery of chromium is not widely practiced in the U.S. tanning industry, since U.S. tanners mostly treat this effluent using conventional wastewater treatment technologies and subsequently dispose of their chromium contaminated sludge in hazardous waste landfills. In the U.S., end-of-pipe treatment has been a common practice since the 1970s, when manufacturers first began to implement treatment technologies to comply with the Clean Water Act and subsequent local regulations.

1.3 Special Considerations for India

Chromium recovery can promote both economic and ecological benefits for India. Economic benefits arise from the recovery of valuable chromium product for subsequent reuse, whereas ecological benefits include the elimination of chromium from wastewater and sludge.

PPI understands that the Indian Client Company is interested in the recovery of trivalent chromium from tanning effluents from individual tanneries in a centralized recovery facility. It appears that the tanning facilities in India consist of numerous small manufacturers located throughout the country.

1.4

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

Anaerobic Sludge Digestion

Prepared for:

The Industrial Credit and Investment Corporation of India

September 1993

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1.0 BACKGROUND

1.1 OVERALL PERSPECTIVE

The objective of this study is to provide ICICI with a series of reports containing information and resource lists on various wastewater treatment technologies in the United States that have potential for application in India. The current report concerns anaerobic sludge digestion systems, including large units with floating covers. The technology review includes a description of the process and equipment, its history of use and current status in the United States, and evaluation of its potential for use in India.

1.2 SCOPE OF REVIEW AND VENDOR RESEARCH

Literature sources including current periodicals were reviewed to obtain information on the technology and compile a list of vendors. The vendors were contacted by telephone to discuss their particular products and their interest doing business in India. In many cases, the company was already aware of the potential of the Indian market and was already doing business with Indian customers.

2.0 GENERAL DESCRIPTION OF TECHNOLOGY

Anaerobic sludge digestion, generally preceded by thickening and followed by air drying on sand beds, is a biological treatment process in which microorganisms convert organic compounds to methane, carbon dioxide, hydrogen sulfide, and water in the absence of air (Table 1). In addition, a considerable reduction in indicator bacteria occurs. Primary sludge is most easily digested by anaerobic proceses, and produces the greatest amount of methane gas per pound of sludge applied.

Anaerobic decomposition is a three-stage reaction consisting of hydrolysis, acetogenesis, and methanogenesis. Hydrolysis is the conversion of suspended organic solids into soluble organic compounds. Hydrolysis is especially important for certain wastes (such as municipal wastewater treatment sludges, waste pharmaceutical cells, and some food waste) and can even be the rate-limiting reaction.

Acetogenesis is the second stage of anaerobic decomposition and consists of the conversion of soluble organics to volatile fatty acids. Acetogenesis is accomplished by a general class of microorganisms known as the volatile acid-formers. The products of the acid-forming reaction are the acid salts of short-chain fatty acids, primarily acetic, propionic, and butyric acid. This reaction can occur over a broad range of environmental conditions, including pH and temperature.

The third and final step in the series of anaerobic digestion reactions is methanogenesis, or the conversion of the volatile fatty acids into methane and carbon dioxide. For most organic wastes, methane and carbon dioxide are formed from the decomposition of acetic acid. The methane-forming bacteria are more sensitive to environmental conditions such as pH, temperature, and inhibitory compounds than the acid-forming bacteria.

Anaerobic bacteria exist in three temperature ranges, those being thermophilic (heat loving), mesophilic (moderation loving), and psychrophilic (cold loving). Normally, anaerobic systems are operated in the mesophilic temperature range (20 to 40°C). Bacteria existing in the thermophilic temperature range (45 to 75°C) are sensitive to small temperature changes and are not as widely used in anaerobic treatment systems. Mesophilic systems have a higher cell yield, shorter start-up time, and can tolerate greater variations in loading than thermophilic systems.

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TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

Treatment of Coke Oven Wastes

Prepared for:

The Industrial Credit and Investment Corporation of India

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TEST Prime Contractor:
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Washington, D.C. 20036

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INTRODUCTION:

Steel mills generate a variety of waste products from the various processes associated with steel making. This report focuses on coke oven wastes, including an outline of the coking process, current methods employed in the U.S. to control coke waste, a short discussion of new technologies for coke treatment and clean coal technologies and contact information of U.S. firms interested in working in India.

COKE OVEN WASTES:

Coal is heated in a process called "carbonization" in which a blend of two or more bituminous coals is baked in the absence of air to produce coke and other products. The heating process in production emits a gas from the quench tower, where hot coke is flooded with water. The coke gases or dust primarily produce tar and ammonia. By-products of the coke phase in steel production are emitted from the ammonia still, the final cooler and the pure still where effluents such as: NH_3, phenol and cyanide and suspended solids are emitted. Table 1 provides a breakdown of coke-plant wastes.

Cyanide wastes and phenols are classified as hazardous wastes. Cyanides generate toxic fumes, gases and vapors in dangerous quantities, and if allowed to enter the environment untreated, can be deadly. Phenol is a chemical containing the benzene ring, or $C6H_5OH$, and is highly toxic as well. Skin absorption of phenol is rapid and can result in death within 30 minutes to a few hours.

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CURRENT U.S. TREATMENT OF COKE PLANT WASTES:

The primary method of treating by-product coke wastes is to use recovery and removal units with high efficiencies. Phenol is the main contaminant that is recovered; the BOD can be reduced by approximately one-third by recirculation and reuse of contaminated waters; and recovery of some of the by-products can be used for profit in such materials as ammonium sulfate, crude tar, naphthalene, coke dust, coal gas, benzene, toluene and xylene.

Phenols may be removed either by conversion into nonodorous compounds or recovery as crude phenol or sodium phenolate, which can have some commercial value. The conversion may be biological (activated sludge or trickling filters) or physical (ammonia-still wastes used to quench incandescent coke, evaporating the NH_3).

Certain concentrations of phenols (0 to 25 ppm) may be handled by biological units, otherwise, dilution of this waste with municipal sewage is a good idea, as this method provides a buffering and diluting medium. The Koppers dephenolization process, a physical conversion, lowers the phenol content by 80 - 90% in ammonia-still wastes. This is essentially a steam-stripping operation, followed by mixing in a solution of caustic soda and renewing pure phenol with flue gas.

Another waste treatment process is sedimentation: used very effectively to treat flue dust. This process is followed by a thickening of the clarifier overflow with lime. This encourages flocculation, a process which increases the overall total of solids removed, and has been most effective in removal of oxides and silica. 90 - 95% of suspended solids settle easily, within a one-hour period. The resulting effluent has less than 50 ppm suspended solids. Primary and secondary (lime-coagulated) thickened sludges are also produced, which are then lagooned without being harmful.

A modern-day clean coal technology, used to capture ammonia, can make coke plants both cleaner and simpler. In a new (1992) clean coal project, ammonia is captured from coke oven gas and used to scrub hydrogen sulfide from the gas. Then, using special catalysts, the ammonia is chemically changed into nitrogen and water vapor, and the hydrogen sulfide is decomposed into elemental sulfur, a salable byproduct. More than 80% of the hydrogen sulfide and 98% of the ammonia can be removed, along with benzene and other pollutants.[1]

Davy International has developed a new Ammonia Destruction Process as well, which has some similarities to the above process. This is a proprietary technology, whereby the ammonia is scrubbed from the coke oven gas and "cracked" into nitrogen and hydrogen. These gases can then be recycled into the coke oven gas stream.

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[1] Clean Coal Technology, The New Era; US Department of Energy; Washington DC; 1992, p.31.

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OTHER TECHNOLOGIES:

Another, very new technology is currently being researched by S.R.C. Corp. in Latrobe, Pennsylvania. Although this technology is not used directly in the coke process, this technology could be very important in the coal industry world-wide.

This firm's technology involves pre-combustion cleaning of coal to reduce sulfur content by 70%. Typically, pre-combustion cleaning can only reduce sulfur by 30-50%. S.R.C. has established a five-step process to desulfurize the coal. Following a sulphur content analysis, to determine the type and quantity of chemicals to be used, the coal is screened to remove non-coal debris and crushed. It is then treated with special chemicals to actually remove the sulfur. Then the coal is neutralized and finally put through the stabilization process.

Only 5% of the coal is lost in this process compared to the estimated 40% loss in traditional cleaning methods. At the same time, the coal's energy efficiency increases to about 14,000 to 16,000 Btus. In addition, this method allows S.R.C. to recycle its water and chemicals. The remaining sulfur can be sold for use in agricultural chemicals; and the fine particle matter can be used to produce charcoal briquets.

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TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

U. S. Manufacturers of CNG Conversion Kits for Small Automobiles and Other Vehicles

Prepared for:

The Industrial Credit and Investment Corporation of India

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TEST TECHNOLOGY & COMPANY SEARCH:

U.S. Manufacturers of CNG Conversion Kits for Small Automobiles and Other Vehicles

1. Background of Technology

1.1 Technology Assessment and Primary Alternatives

U.S. CNG conversion kit technology for both gasoline and diesel combustion engines is rapidly increasing in complexity in order to keep pace with the advanced technologies exhibited in new vehicle electronic (computerized) systems and Original Equipment Manufacturer (OEM) components. The majority of the CNG conversion kit manufacturers offer both high and low level technology systems which allow them to market carburetor as well as fuel injection system conversion kits. Incorporating fuel injection system technology into automobiles provides increased fuel economy and lower exhaust emissions resulting in increased utilization of such systems relative to carburetors. It is crucial that conversion kit manufacturers offer both levels of technology while continuing to introduce more sophisticated systems since automotive technology varies within, as well as across, countries.

Implementation of the 1990 Clean Air Act Amendments (CAAA) and the Energy Policy Act of 1992 (EPAct), coupled with the Alternative Motor Fuels Initiative (AMFI) of 1988, have provided the stimulus for increased interest in alternative fuels in the U.S., particularly CNG. The primary alternatives to CNG would include Reformulated Gasoline (RFG), alcohol fuels (ethanol and methanol), Liquified Petroleum Gas (LPG or Propane), and Biogas (renewable, biological energy sources such as agricultural crops, forestry/woody crops, etc.). However, emissions tests conducted by the American Gas Association (AGA) and the U.S. Environmental Protection Agency (EPA) using Federal Test Procedures (FTP), have concluded that CNG vehicles surpass both Federal and California Air Resources Board (CARB) standards in all categories. In fact, CNG even meets CARB requirements for classification as an Ultra Low Emissions Vehicle (ULEV)[1]. Furthermore, research to develop CNG dedicated catalytic converters (converters optimized for CNG vehicles) show promise to further reduce emissions in the near to mid-term.

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[1] Refer to attached table which illustrates Exhaust Emission Standards for Clean-Fuel Vehicles in the California Pilot Test Program.

1.2 Assessment of Technology Pace and Direction in the U.S.

CNG conversion kit technology has existed since the conclusion of World War II and has recently achieved a commercialization level at which it is considered economically feasible in the U.S. With the exception of the oil price decline experienced in late 1985 and 1986, CNG vehicles have been competitive with conventional vehicles for more than a decade (based on per gallon equivalency and life-cycle costs). Currently, CNG prices are approximately 40% cheaper than regular unleaded gasoline with the costs of converting a dedicated gasoline combustion engine to a bi-fuel gasoline/CNG engine ranging between approximately $1000 to $3000. Based on such data, payback periods have been reduced to one and one-half to three and one-half years, or less. This has provided CNG conversion technology the opportunity to break its niche market characteristics (large fleet operations) and start being utilized by private companies and small fleet operations.

As U.S. automobile manufacturers have increased the level of electronic/computerized system sophistication, CNG conversion kit manufacturers have been forced to adapt to such advanced technologies. Conventional technology consisted of carburetor driven combustion engines from which technological advances brought about fuel injection systems. Each new model year seems to introduce a greater level of sophistication as computer chips and electronic equipment become cheaper, faster, smaller, and more powerful. CNG's adaptation has been and continues to be maintained at these accelerated levels of sophistication. In fact, some companies have, or are currently developing, systems which further enhance vehicle operation beyond OEM components. It is important to realize, though, that as more advanced technology is applied to automobiles, there will continue to be a need to retrofit conventional carburetor engines (existing vehicles) to meet legislative environmental goals. Consequently, most CNG conversion kit manufacturers maintain a product line to meet these conventional demands. The demand for conversion kits since 1990 has increased substantially. Currently, several state governments are considering the conversion of hundreds, and eventually thousands, of fleet vehicles to CNG as well as OEM purchases as the auto industry makes them available (e.g. Chrysler is the first to have an OEM CNG vehicle ready for commercial marketing). Furthermore, development of safety standards (last year) and detailed engineering criteria and specifications (due out later this year) will enhance the safety, quality, and efficiency of U.S. CNG conversion kit technology (for more information contact the Natural Gas Vehicle Coalition, NGVC, at 703-527-3022). It is quite likely that as the demand for conversion kits advances, economies of scale will be reached which may reduce overall kit costs in the next few years.

1.3 Special Considerations Affecting Applications in India

The most important considerations affecting CNG conversion applications in India is assessing the current, and expected, automobile population and its related levels of sophistication. This is of utmost importance since this factor alone will determine the cost and type of conversion kit necessary to meet the country's goals. Carburetor technology can be replaced with gaseous fuel injection system technology thus creating either a dedicated CNG or bi-fuel (CNG/gasoline) vehicle. Obviously, the costs associated with such a conversion are much greater than retrofitting with a CNG, carburetor compatible, conversion kit. Therefore, when contacting U.S. CNG conversion kit manufacturers, Indian firms should establish and/or provide the intended goals and objectives (e.g. increased environmental/society welfare, decreased oil dependency, enhanced technological base of automotive industry, etc.) of a CNG conversion program. In so doing, U.S. firms can better assist India in determining the various type(s) of kits that will maximize its benefits at the least cost to consumers and Indian society.

U.S. firms also demonstrated concerns associated with foreign competition related to unfair bidding. This stems from the rigorous safety standards to which U.S. CNG conversion kits and fuel tanks are held (by the U.S. Government) thus justifying the greater cost while foreign manufacturers experience no such requirements by their governments. As a result, foreign companies can provide a product which is much more inexpensive but whose safety is certainly questionable.

Other potential problem areas mentioned include servicing of equipment, technical knowledge of Indian firms/personnel, and infrastructure. The required technical knowledge of Indian firms is directly related to the quantity of servicing that will need to be provided by U.S. firms. This will impact any contracts or ventures sought between U.S. and Indian firms since the level of U.S. servicing intensity will be extremely dependent upon India's technical abilities. Infrastructure concerns include the availability of compressed natural gas, CNG refueling stations in India, and more specifically, compatible nozzle and fuel tank linkages. Many U.S. firms mentioned that they do not have sufficient information to assess India's CNG infrastructure; although the impression seems to be that the current status is inadequate to accommodate any substantial CNG conversion initiative. More detailed infrastructure information maybe useful in encouraging U.S. CNG industry interest.

Finally, the U.S. CNG industry expressed concern regarding commitment levels and teaming problems, due to past experiences of some firms when conducting international ventures. Gaining some sense of guaranteed partnership with potential Indian firms and the quantities of conversion involved will help U.S. firms assess India's

market potential and their requirement levels necessary to ensure successful completion of such an undertaking (e.g. personnel expertise, equipment capabilities, training extensiveness, etc.).

1.4 Industry Overview and Prioritization of Included Companies

The current U.S. CNG conversion kit industry is composed of 43 companies involved in either the manufacturing, distributing, and/or installing phase(s). There are basically six distinct manufacturers with several others providing a variety of components, developed by these six, mixed together as a kit. These six companies:

- Stewart & Stevenson Power, Inc.;
- IMPCO Technologies, Inc.;
- Automotive Natural Gas, Inc.;
- MESA Environmental;
- NGV Technologies Company; and
- Over-The-Hill-Gang (OHG);

manufacture a broad technological range of CNG conversion kits. Based on information received via telephone conversations and company/product brochures, the first two companies listed above (Stewart & Stevenson and IMPCO) seem to provide the broadest range of conversion kit technology and dominate the U.S. market. Both of these companies were mentioned several times in discussions with, and review of, distribution companies' personnel and materials. Five of the six companies listed are included in this report with OHG being excluded. OHG was excluded due to: their relative "newness" to the market; the fact that they basically provide an IMPCO based kit (OHG is composed of former IMPCO personnel); lack of identification by distribution companies; and an inability to obtain a location/telephone number from several AGA sources.

1.4

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

Reactor-Clarifiers

Prepared for:

The Industrial Credit and Investment Corporation of India

September 1993

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1.0 BACKGROUND

1.1 OVERALL PERSPECTIVE

The objective of this study is to provide ICICI with a series of reports containing information and resource lists on various wastewater treatment technologies in the United States that have potential for application in India. The current report concerns reactor-clarifiers. The technology review includes a description of the process and equipment, its history of use and current status in the United States, and evaluation of its potential for use in India.

1.2 SCOPE OF REVIEW AND VENDOR RESEARCH

Literature sources, including current periodicals, were reviewed to obtain information on the technology and to compile a list of prospective vendors. The vendors were contacted by telephone to discuss their particular products and their interest doing business in India. In several cases, the company was already aware of the potential of the Indian market and engaged in business with Indian customers.

2.0 GENERAL DESCRIPTION OF TECHNOLOGY

Reactor-clarifiers combine three processes to soften and remove dissolved materials from wastewaters: chemical mixing, flocculation, and sedimentation. These devices are used for secondary treatment, since the wastewater must undergo primary treatment for solids removal before entering a reactor-clarifier. A common combination of technologies is activated sludge treatment followed by final clarification prior to wastewater discharge. Reactor-clarifiers are also less commonly used to produce potable or process water from raw water (surface water or groundwater).

A typical reactor-clarifier is housed in a large cylindrical tank. Rectangular clarifiers are also available. The tank's internal configuration includes a basin with a raw-water inlet and distribution duct, a primary mixing and reaction zone, draft tubes that form the secondary mixing and reaction zone, a rotor-impeller for mixing and pumping, an effluent channel, and concentrators that accumulate and remove slurry. The primary mixing and reaction zone is typically located in the lower part of the tank below the secondary mixing and reaction zone, and the rotor-impeller is located between the two zones.

The wastewater is introduced into the primary reaction zone of the clarifier tank, where it is mixed with lime or caustic soda (for precipitation of phosphate), soda ash (for calcium reduction, in combination with lime), and a polymer (to enhance coagulation). The actual chemical treatment methods and reagents that are used in the reactor-clarifier vary according to the characteristics of the wastewater, and the desired characteristics of the effluent.

The precipitates and colloids that form in the primary reaction zone settle and concentrate in the tank, for subsequent removal by scraping or by siphon drainage to a thickening tank for dewatering. Recirculation is used within the tank to continuously return reacted precipitates to the primary reaction zone. This enhanced particle contact during chemical reaction accelerates the reaction rate, and results in formation of larger, heavier floc particles that settle more readily.

Large reactor-clarifiers may be equipped with a traveling bridge that is connected to sludge-scraper blades. The sludge-scraper moves sludge from the bottom of the tank to a sludge well,

where it is drained from the tank. The purpose of the bridge is to allow more convenient removal of scraper blades for cleaning and repair.

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

High Bod Removal Systems

Prepared for:

The Industrial Credit and Investment Corporation of India

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1.0 BACKGROUND

1.1 OVERALL PERSPECTIVE

The objective of this study is to provide ICICI with a series of reports containing information and resource lists on various wastewater treatment technologies in the United States that have potential for application in India. The current report concerns high-BOD removal systems. The technology review includes a description of the process and equipment, its history of use and current status in the United States, and evaluation of its potential for use in India.

1.2 SCOPE OF REVIEW AND VENDOR RESEARCH

The present technology review included the activated sludge process, trickling filters, and rotating biological contactors (RBCs).

Literature sources including current periodicals were reviewed to obtain information on the technology and compile a list of vendors. The vendors were contacted by telephone to discuss their particular products and their interest doing business in India. In many cases, the company was already aware of the potential of the Indian market and was already actively engaged in business with Indian customers.

2.0 GENERAL DESCRIPTION OF TECHNOLOGY

The use of secondary treatment technologies for the removal of organic material from wastewater did not become widespread in the United States until the 1970's, when new and more stringent regulations on wastewater discharge were implemented by the Environmental Protection Agency. In the past two decades secondary treatment has become standard for municipal treatment plants, and numerous variants of biological oxidation processes are now available. The three most widely used of these processes are discussed in this report.

2.1 ACTIVATED SLUDGE PROCESS

In the activated sludge process, raw wastewater is settled in a primary tank prior to aeration. After aeration, the sludge drops out in a final clarifier. A portion of the sludge is returned to the inflow point, usually a maximum of 25 percent of the total flow volume. The contents of the aeration tank are known as the 'mixed liquor.'

The age of the sludge is an important factor in the activated sludge process. A long aeration time will eventually lead to the complete decomposition of the sludge. The development of this concept in the last couple of decades has resulted in a number of modifications to the process. One modification, known as 'contact stabilization', provides a separate tank for the aeration of the sludge only. Another modification, termed 'extended aeration', provides a longer aeration time for the wastewater, thus reducing the amount of sludge to be disposed. Extended aeration is the basis for design of small, factory-built activated sludge plants (known as package plants) that are suitable for use in situations where connection with a regional sewage treatment plant is not feasible.

The choice of the aeration system used in the activated sludge process depends on local conditions, including waste characteristics, available land, and local energy considerations. Compressed air systems may be used by introducing air through submerged diffusers made of various types of porous materials, or through nozzles on a pipe grid placed in the contact tank. Low-pressure air may be introduced through a multi-valved pipe laid transversely across the tank bottom. Aeration may also be obtained through the use of paddles or impellers, a process known as mechanical aeration.

Air being discharged into wastewater must be finely dispersed in order to benefit from the greater surface-to-volume area offered by a large number of small air bubbles. This can be achieved by passing the air through porous plates or tubes, by combining the air and wastewater under jet pressure, or by impingement. Diffuser plates built into the tank are generally set over an air channel in holders made either of pre-cast concrete or corrosion resistant metal. Each holder contains a row of several plates, thus allowing for cleaning and replacement. When pre-cast concrete is used in contact with the plates, the plates must be saturated with water to prevent absorption of water from the concrete.

Several alternative types of mechanical aerators are available, including horizontal paddle, vertical turbine, vertical draft tube, and horizontal aspirators. The horizontal paddle type, a modification of the Kessener brush system developed in the Netherlands,

consists of a paddle wheel (or brush) attached to a horizontal shaft revolving partly submerged in the wastewater.

The vertical turbine types may operate partially or completely submerged in the wastewater. When the turbine is partially submerged, it is termed a surface aerator. Both fixed and floating models are available. In the vertical draft tube aerator, wastewater is drawn up or down through a central vertical tube by a revolving impeller, providing the aeration. Horizontal aspirator aerators draw air though a hollow shaft and inject it beneath the wastewater surface. These aerators use horizontal mixing to reduce energy consumption, and can operate in cold climates.

PURE OXYGEN APPLICATION

The use of pure oxygen under controlled conditions with agitation is now being employed in a number of plants in the United States. The microorganisms in activated sludge require oxygen, which can be supplied in the form of air, or which can be introduced as pure oxygen. Increased efficiency of the decomposition process can be obtained by using pure oxygen instead of air, since theoretically superior oxygen transfer and therefore more rapid decomposition results when pure oxygen is applied to the system.

Pure oxygen can be supplied using the different types of diffusers discussed previously.

2.2 TRICKLING FILTERS

A biological filter is a solid or fixed surface placed in contact with the waste stream to provide locations for the decomposition of the organic portion of the wastewater. The oldest type of biological filter is the trickling filter, also known as a packed bed reactor. Though these filters do not mechanically remove solids, they provide a reacting medium that results in biological decomposition of the organic solids in the presence of oxygen.

The fixed surfaces may also be in the form of discs slowly rotating in a channel on a shaft, a relatively recent development known as the RBC. This technology is discussed in more detail in section 2.3.

Trickling filters fall into low- and high-rate classifications. Low-rate trickling filters are only rarely used in contemporary designs, since a low-rate trickling filter can achieve a degree of treatment comparable to a high-rate trickling filter only by employing multiple stages. High-rate filters generally require increased hydraulic loadings to flush the slough through the filter to avoid anaerobic conditions developing due to filter clogging.

The main components of a trickling filter are the filter media, the drainage system, and the distributor. Normally, the trickling filter is preceded by some form of primary treatment. Wastewater is most commonly applied to the filter media using a system of rotary distributors. The filter media are often in the form of prefabricated plastic modules that rest on a floor provided with a drainage system. The drainage system collects wastewater that has passed through the filter media, and conveys it to a final settling tank. The filter media become coated with a layer of aerobic bacteria which decompose organic material in the wastewater.

Filter media were originally made of crushed rock, slag, or field stone due to the durability of these materials. Sizes for this type of filter media range between 2 inches

and 4 inches. Today, blast furnace slag is not difficult to obtain in the United States, and offers a high proportion of surface area to volume due to its vesicular surface compared to other types of rock. However, the present trend is to use manufactured plastic media. The plastic media have many advantages over the rock-type media including their light weight, resistance to chemicals, high ratio of surface area to volume, and lower area requirements.

The underdrain system provides ventilation of the filter to ensure aerobic conditions and provide adequate drainage of the effluent. Underdrain systems made of clay can be fabricated by manufacturers of clay products.

Rotary distributors are the most common type of distributor used for trickling filters because of their reliability and ease of maintenance. Rotary distributors consist of a hollow vertical center column carrying two or more radial pipes or arms. Each pipe or arm contains a number of nozzles for discharging sewage onto the packed bed reactor. These nozzles all point in the same direction and are at right angles to the pipe or arms. The reaction force of the spray from the nozzles against the filter media causes the distributor to rotate around the filter media.

2.3 ROTATING BIOLOGICAL CONTACTORS

The RBC is an attached growth process where the media are rotated through a basin of wastewater. The microorganisms are attached to large-diameter synthetic discs mounted on a horizontal shaft and placed at about 40 percent submergence in a contoured-bottom tank. When rotated out of the tank, air enters the spaces while the liquid trickles out over films of biological growth (microorganisms) that develop on the discs. Alternating exposure to the organics in wastewater and oxygen in the air is similar to dosing a trickling filter with a rotary distributor. Excess microbial solids are scoured from the media and carried out in the process effluent for gravity separation in a final clarifier. Attributes of the RBC are its low power consumption and good process stability.

The usual design process is to have two to four stages in series, with the first stage having the heaviest growth. One modification of this technique is known as the SURFACT process, and is licensed by Envirex Inc. In this process, the biological rotating discs are placed in a tank supplied by diffused air, with return of sludge produced.

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

U. S. Manufacturers of Catalytic Converters for Small Automobiles and Other Vehicles

Prepared for:

The Industrial Credit and Investment Corporation of India

September 1993

TEST Prime Contractor:
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TEST is funded and administered by the U. S. Agency for International Development
New Delhi, India

TEST TECHNOLOGY & COMPANY SEARCH:

U.S. Manufacturers of Catalytic Converters for Small Automobiles and Other Vehicles

1. Background of Technology

1.1 Technology Assessment and Primary Alternatives

Automotive exhaust emissions catalysts are designed with certain parameters in mind in order to meet the requirements of a specific application. Catalytic converters are available in three distinct forms:

- Oxidation catalytic converters
- Three-way-plus-oxidation catalytic converters
- Three-way oxidation/reduction catalytic converters

Oxidation catalytic converters first became standard equipment on U.S. automobiles in 1975, but currently experience very limited usage. These converters were considered highly efficient at the time for reducing emissions of hydrocarbons (HC) and carbon monoxide (CO). Oxidation converters use platinum and palladium to oxidize unburned HC and CO into water (H_2O) and carbon dioxide (CO_2), respectively. However, oxides of nitrogen (NO_x) remain unaffected by oxidation. As a result, three-way-plus-oxidation converters were introduced using secondary air injected between the reduction catalyst (rhodium) and the oxidation catalyst (platinum and palladium), which are connected in series. The first catalyst reduces NO_x emissions to oxygen (O_2) and nitrogen (N_2) gases, while the second oxidizes HC and CO. However, problems can arise due to an improper air/fuel ratio at the reduction catalyst, which converts NO_x to ammonia (NH_3). Secondary air can cause this ammonia to be re-oxidized to NO_x.

Current technology has introduced three-way catalytic converters to the market which carry out oxidation and reduction reactions on the same catalyst using a combination of platinum, palladium, and rhodium. This type of converter can dramatically eliminate all three emission components from the exhaust. When used with a closed-loop lambda control (air/fuel ratio control system providing a stoichiometric or "chemically correct" air/fuel ratio with engine sensor feedback), the result is the most effective pollutant-reduction system currently available. Many automobile manufacturers worldwide, and especially in the U.S., are including this technology as original equipment on production vehicles. These catalytic converters have been on the market since the mid to late-1980's. Nevertheless, research continues to further enhance their efficiency.

It is important to note that the use of catalytic converters on a vehicle necessitates the utilization of unleaded gasoline. Lead poisons the catalyst and leaves it inactive.

Alternatives to catalytic converter utilization lie primarily in enhancing

combustion efficiencies and optimizing the fuel injection systems' operations. In order to meet regulations mandated by the U.S. Federal Government, it is highly unlikely that production vehicles will be able to adhere to such mandates without installing catalytic converter technology. Theoretically, combustion engines should emit water and CO_2, however, cost-effective technology to achieve these optimal conditions in combustion engines remains a goal for the automotive industry. Fuel injection systems help to provide the optimal air/fuel ratio for stoichiometric reactions. However, other variables that are more difficult to control such as timing of spark firing, can disrupt ideal conditions and result in excess emissions.

Additional alternatives include utilizing alternative fuels such as compressed natural gas (CNG), liquid petroleum gas (LPG), fuel cells, reformulated gasoline (RFG), and alcohol fuels (ethanol and methanol). Although these fuels reduce most emissions relative to conventional gasoline, the majority of tests performed have been conducted with the use of catalytic converters. Furthermore, some emissions actually increase when utilizing alternative fuels (e.g. methanol increases ozone forming emissions and formaldehyde). It is generally accepted that in order to maximize emission reductions from alternative fuels, optimizing catalytic converters for alternative fuel-vehicles is a necessity.

1.2 Assessment of Technology Pace and Direction in the U.S.

The catalytic converter market structure consists of three levels:

- Precious metal supplier and substrate producer;
- Washcoater; and
- Canner.

The substrates (either ceramic or metal) and the precious metals (sold at market value) are bought by the washcoater. Precious metals (platinum, palladium, and rhodium) of specific masses and ratios are mixed in a washcoat and affixed to the substrate (usually in the form of pellets or a honeycombed monolith) to produce a catalyst. The catalyst is then canned by the washcoater or by a canner to produce the catalytic converter. A company that cans the catalyst is responsible for ensuring that the converter is certified to all Environmental Protection Agency (EPA) and/or California Air Resources Board (CARB) standards. An original equipment manufacturer's (OEMs) catalytic converter receives certification when the OEM vehicle utilizing their equipment passes the mandatory exhaust emission requirements established for that vehicle by EPA and/or CARB after 5 years or 50,000 miles, whichever comes first. An aftermarket converter must meet the emission standards set for it by EPA and/or CARB after 25,000 miles in order to become certified.

As environmental regulations become more stringent in the near future (e.g. 1990 Clean Air Act Amendments', CAAA, requirements taking affect in

1995 and 1997), greater advances in catalytic converter technology are virtually guaranteed. For instance, it has been determined that the majority of emissions occurring in a 30-minute testing period are realized in the first 8-minutes of engine operation before the catalytic converter can get up to its ideal operating temperature of 400°C to 800°C. As a result, pre-heated converter technology has come to the forefront of research and development efforts in order to get the catalyst up to its "light-off" temperature of about 250°C. This is the temperature at which a catalyst begins to appreciably convert pollutants. Another converter emissions reduction possibility includes a pre-catalyst along with a main three-way oxidation/reduction converter. The pre-catalyst is small and situated close to the engine's exhaust manifold so that it can absorb as much heat as possible during vehicle start-up and reach its light-off temperature sooner than the main converter.

1.3 Special Considerations Affecting Applications in India

One of the primary suggestions stated by U.S. catalytic converter manufacturers pertained to the Indian Government establishing and implementing environmental pollution standards/requirements. Without such a mandate, it would be practically impossible to successfully retrofit the current vehicle population of India. Once standards have been set, it will be much easier for U.S. manufacturers to work with Indian firms in assessing the proper converter systems to optimize emission reductions. In addition to a directive from the government, the use of unleaded gasoline with the catalytic converters is mandatory in order to expect any positive results from the program.

Due to the structure of the U.S. catalytic converter market, which is generally fragmented except for the more vertically integrated operations at Ford Motor Co. and the General Motors Corporation, India must determine the extent to which it wants to play a role in the development of catalytic converters. Since three levels exist in the production of U.S. catalytic converters, it may be possible and/or desirable for Indian firms to intervene at a given level for purposes of alleviating certification requirements or to provide India with various high technology industries.

It should be noted that U.S. companies manufacture their catalytic converters to the high standards set by EPA and CARB. These high quality standards affect the price of U.S.-made converters, which may not make them as financially attractive as the foreign competition. However, it must be understood that if India decides to purchase complete, market-ready, converters from U.S. manufacturers, these converters meet the most environmentally stringent requirements in the world utilizing the best available technology at a reasonable cost. U.S. catalytic converter manufacturers are uniquely capable of providing India with catalytic converter technology that will make the most beneficial environmental impact.

Information related to the Indian vehicle population for both production

vehicles and existing vehicles (e.g. engine displacement, vehicle weight, fuel management system, etc.), must be provided to U.S. firms so that the correct and optimal converters for retrofitting and OEM will be supplied.

1.4 Industry Overview and Prioritization of Companies Included

The largest manufacturers of certified OEM and aftermarket catalytic converters found were Ford Motor Co., General Motors Corporation/AC Rochester, Walker, and Arvin Industries, Inc. Ford and GM have become either partially or fully vertically integrated in order to streamline production by purchasing their precious metals and substrates from suppliers; and then performing their own washcoating and canning. Other manufacturers have on-going contracts with lower-level contributors to supply precious metals, substrates, and washcoats, thereby increasing the efficiency and technological capabilities of the production process. Companies such as Allied-Signal Automotive Catalyst Company and United Emission Catalyst are more heavily involved with washcoating and catalyst research and development. It was felt that these companies would be appropriate to include in the following company profile section.

1.4

BOD REDUCTION IN DISTILLERY EFFLUENT

Prepared for:

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January 1994

1.0 INTRODUCTION AND PROBLEM STATEMENT

Industrial effluents from distillery processes often generate wastewater with a high Biochemical Oxygen Demand (BOD). BOD levels provide an analytical measure of effluent pollution by measuring the depletion of dissolved oxygen content in the wastewater effluent resulting from biodegradable matter.

The following technology assessment addresses BOD reduction technologies available for distillery waste and provides an overview of these technologies based on initial and desired effluent BOD content. The following assessment does not address other possible contaminants associated with distillery wastes.

A list of U.S. vendors that provide these technologies is also included in this report.

1.1 Problem Statement

Although other significant wastes are generated by distilleries, this report focuses only on BOD content in wastewater effluent.

It is PPI's understanding that the client's goal is to reduce BOD levels in effluent from 8,000-10,000 milligrams per liter (mg/L) to 30 mg/L for discharge to inland surface waters or to 500 mg/L for land disposal. The following evaluation considers various reduction technologies for this distillery wastestream.

1.2 Current U.S. Practices

Simple primary treatment processes, which include screening, settling and filtration, are no longer considered adequate treatment technologies in the U.S. Combined primary and secondary treatment technologies involving biological treatment are now predominantly used to reduce BOD content by 85 to 95 percent. Such processes use carefully controlled microorganism populations to degrade organic matter contributing to the BOD content. Gases such as methane are formed as a byproduct of this treatment and organic solids remain. Following secondary treatment, providing that

discharge limits are met, the effluent may be discharged to inland surface waters or to land.

1.3 Special Considerations for India

Reduction in BOD content of effluents can promote ecological benefits for India distilleries. Various treatment processes currently available, although effective, are often costly. Ecological benefits include the reduction of BOD in effluent discharged to land or waters and consequent oxygen depletion in receiving soils and waters.

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

Metals Removal and Recovery from Wastewater Streams

Prepared for:

The Industrial Credit and Investment Corporation of India

February 1994

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TEST is funded and administered by the U. S. Agency for International Development
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OBJECTIVE

Removal of metals from wastewater streams is required. Recovery is desirable, but only if it makes economic sense. The Indian clients are manufacturers who need flexible processes, equipment that can be configured to deal with different metals and various flows. The electroplating industry is the main focus of this search. The clients are particularly interested in package plants for treating electroplating wastes. Metals of interest include nickel, cadmium, copper, chromium and zinc. Lower priorities would be gold and silver. The clients are also interested in detoxification processes for cyanide.

PREFACE

This report contains analyses of water treatment technologies applicable to the metal electroplating industry. Although the wastes generated in this industry are similar to those encountered in the kindred industries of metal finishing and printed circuit board manufacture, the specific needs of these related industries were not addressed in this report. The steps in conventional wastewater treatment usually include: reduction of Cr VI to Cr III, cyanide oxidation, precipitation of metal hydroxides, clarification or filtration and sludge drying. The technology, equipment, treatment chemicals and all the know-how is readily available in India, hence no efforts have been made to contact a manufacturer in the United States.

After a brief overview of conventional technology, the report will consider alternatives that offer a qualitative improvement in performance.

1.0 ASSESSMENT OF TECHNOLOGIES

At present there are more than 27 technologies for removing heavy metals from wastewaters. Depending on their level of development and commercialization they are classified as conventional technologies, alternative technologies, innovative technologies and emerging technologies.

Conventional technologies are mature technologies. Alternative technologies are commercialized technologies considered to be superior to the conventional technology at least in one respect. Innovative technologies are treatment technologies that lack well documented costs and performance data under various operating conditions (especially overseas conditions). Such recent technologies lack the documentation necessary to make them acceptable as a standard. Even so, many innovative technologies have removed metal contaminants and reduced effluents toxicity. Once the treatability studies of the innovative technology are performed and data for scale-up is available, it is called an emerging technology. The emerging technologies described in this report are not yet ready for field applications, however, they hold considerable promise and bear watching.

The technologies reviewed in the specific categories are;

1. Conventional Treatment Technologies
   - Hexavalent Chrome Reduction
   - Cyanide Oxidation
   - Metal Hydroxide Precipitation
   - Clarification and Filtration

2. Alternative Treatment Technologies
   - Sulfide Precipitation
   - Co-precipitation and Encapsulants
   - Insoluble Starch Xanthate

3. Material Recovery Technologies
   - Sodium Borohydride Reduction
   - Absorption
   - Ion Exchange
   - Evaporation
   - Electrodialysis
   - Reverse Osmosis, Ultrafiltration and Microfiltration
   - Electrochemical Recovery

4. Innovative/Emerging Technologies
   - Biotechnologies
   - Freeze Crystallization

2.0 EVOLUTION OF TECHNOLOGY

The conventional technologies described in this report have been in wide use in some form since the time of the Pharaohs. The standard protocol of alkali precipitation, clarification and sludge disposal is effective by most gross measures. Unfortunately, it requires large expenditures of time, space, reagents and equipment. As environmental regulations in the US have become increasingly strict both in scale and scope, these rather heavy handed measures have begun to lose their utility. Our current regulatory climate, characterized by NPDES, pollution prevention requirements, RCRA and a heightened awareness of health and safety considerations has driven the technology towards some of the techniques described in the "alternative" or "emerging" sections of this report.

Although the alternative and emerging technologies differ widely in their specific techniques, they share the approach of reducing the quantity and toxicity of waste generated. In several cases, the technologies outlined here approach a closed loop system of recycle and reuse. Similarly, these technologies tend to lower energy requirements compared to conventional treatment technologies. This is particularly apparent when the life cycle costs of reagent preparation, raw metal extraction and disposal are considered.

As the metal plating industry demands more cost-effective waste control measures, the rate of new product development is increasing dramatically. With the exception of the Forager Sponge which is in the pilot stage, all of the alternative processes described here have at least three years of commercial use. The best of the technologies described in this report are highly sophisticated in conception but elegantly simple in execution.

3.0 APPROPRIATENESS OF TECHNOLOGIES FOR INDIA

Although conventional treatment techniques are well established in India, substantial improvements in process efficiency, worker health and safety and cost effectiveness can be realized. Before adopting any new treatment technology, source reduction through waste minimization techniques should be considered. Methods such as spray, countercurrent or reactive rinsing coupled with dragout recovery can dramatically reduce the quantity of water requiring treatment. Once cost effective waste minimization measures are in place, additional benefits may be gained by considering the alternative technologies presented in this report. Several of the newer technologies do not require extensive operator training and have modest energy demands.

In the small and cottage industry sectors such as photodevelopers and precious metalsmiths, the generators will likely continue to dispose of their wastes to sewers unless some financial incentive is offered. This situation is particularly acute in small towns and villages. This can be addressed by a milk-run collection of either the process wastewater or the spent waste treatment media. Similarly, individuals could opt for simple batch treatment techniques for the recovery of the metals.

Regardless of which specific technologies are chosen, environmental, economic and health considerations are driving metal plating industries worldwide to integrate metal removal and recovery into their processes.

1.4

TEST TECHNOLOGY & COMPANY SEARCH:

Proven, Commercialized U.S. Technologies for the Treatment of Cyanide Bearing Liquid Waste with Hydrogen Peroxide

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July 1994

TEST TECHNOLOGY & COMPANY SEARCH:

Proven, Commercialized U.S. Technologies for Treatment of Cyanide Bearing Liquid Waste with Hydrogen Peroxide

1. Background of Technology

1.1 Technology Assessment and Primary Alternatives

Regulations proposed and enforced by the U.S. Environmental Protection Agency (USEPA) to clean up contaminants in water are becoming more and more stringent. New and conventional technologies are being employed to meet these mandates. Conventional methods for cleansing wastewater, such as air stripping, granular activated carbon, liquids/solids separation, reverse osmosis, and biotreatment, are effective, but also have several undesirable side effects and a limited number of applications. Oxidation techniques using hydrogen peroxide to treat toxic organics, including cyanide, overcome many of the problems associated with the more conventional treatment systems. These other processes emit toxins into the atmosphere or capture other wastes which still need disposal. However, hydrogen peroxide treatment destroys the cyanide and produces little more than carbon dioxide and water. Oxidation techniques have been applied and perfected in the U.S. since the early 1970s.

Waters contaminated by organic compounds have long been treated by oxidation with chemicals such as potassium permanganate, chlorine, and chlorine dioxide. Oxidation processes that employ iron-catalyzed peroxides and chlorine compounds have been in favor due to their low-cost, in comparison to other treatment methods. Unfortunately, these methods can only neutralize a narrow array of organics. Ozone treatment, while being very clean, also suffers from the same problem.

1.2 Assessment of Technology Pace and Direction in the U.S.

The technology required to treat cyanide bearing wastewater with hydrogen peroxide is fully commercialized in the U.S. and several companies offer proven systems that deal with this application. The commercialization of these technologies has been ensured with the implementation of tougher standards by USEPA which address the concentration of contaminants in water.

1.3 Special Considerations Affecting Applications in India

The most important aspect of cyanide detoxification is the classification of the effluent to be treated. There are three major aspects which need to be

known about the cyanide waste stream in order to select and evaluate the appropriate technology. These aspects are:

1. Which cyanide species are present and in what ratio?

2. Which metals are present and at what concentration?

3. Are there any organics present in the waste stream?

Once a ratio between free cyanide, weak acid dissociable cyanide, and total cyanide is known and the concentration of at least copper, nickel, and iron is determined, a meaningful treatment proposal can be developed.

1.4 Industry Overview and Prioritization of Companies Included

Five companies which are either directly or indirectly related to the removal of cyanide from liquid waste were identified and contacted for this task. Four of the companies -- ULTROX; Peroxidation Systems, Inc.; Degussa Corporation; and Wastewater Treatment Systems, Inc. -- market the equipment to build treatment systems on-site. The fifth company, Solvay Interox, produces hydrogen peroxide for distribution around the world for the oxidation of cyanide, as well as other applications. Solvay Interox promotes the use of hydrogen peroxide and the development of peroxygen technologies, however, they do not sell any "off-the-shelf" systems for treating cyanide with hydrogen peroxide.

The largest company contacted for this task is, by far, the Degussa Corporation. It is also believed to be the only company which is foreign-owned.

TEST TECHNOLOGY & COMPANY SEARCH:

Proven, Commercialized U.S. Technologies for the Economic Utilization of Non-mercury Bearing Solid Waste from Caustic Chlorine Plants

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TEST TECHNOLOGY & COMPANY SEARCH:

Proven, Commercialized U.S. Technologies for the Economic Utilization of Non-Mercury Bearing Solid Waste from Caustic Chlorine Plants

1. Background of Technology

1.1 Technology Assessment and Primary Alternatives

Several types of chlorine plants exist, including membrane cell chlor/alkali plants, diaphragm cell chlor/alkali plants, mercury cell chlor/alkali plants, etc. Chlorine could also be recovered from liquid waste streams as well as from lean gas streams for air pollution control purposes.

All these caustic chlorine plants generate a large amount of waste including barium sulphate ($BaSO_4$), calcium carbonate ($CaCO_3$), magnesium hydroxide ($Mg(OH)_2$), sodium chloride (NaCl), and other insolubles. There is an increasing demand worldwide for process technologies that are efficient and environmentally acceptable. A high priority for the chemical industry is the replacement of waste treatment by waste prevention: the goal is to move towards waste reduction and the maximization of limited resources. Several individuals have indicated that there are many strategies for dealing with waste from caustic chlorine plants, including:

- minimizing the amount of waste by-products in chlorine production,
- safe and effective disposal of wastes, and
- economic utilization of some of the waste by-products.

In order to locate the information on proven, commercialized U.S. technologies for the economic utilization of these wastes, several contacts were made with the Chlorine Institute, the Chemical Manufacturers Association, the Chemical Marketing Reporter (a magazine that tracks the chemical and chlorine manufacturing industry market), several chlorine consulting firms, and other sources.

From these contacts, it appears that there are no magic technologies that separate this waste mixture into its individual constituents. However, electrochemical technologies exist which could be used to treat some constituents of the waste mixture (such as the barium sulphate). These processes have the potential to reclaim acid and alkali from waste streams containing barium sulphate. In addition, these electrochemical processes enable the recovery of significant amounts of valuable acid and alkali which can be recycled back into the process, while relieving many industries of the problematic and increasingly expensive task of waste disposal.

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1.2 Assessment of Technology Pace and Direction in the U.S.

The utilization of electrochemical technologies to reclaim acid/alkali from waste streams is a proven and commercialized practice. These technologies were introduced in the U.S. in 1981, and their application has been successful since then. Worldwide, more than 30 chlor/alkali manufacturing facilities have selected these electrochemical technologies to satisfy their waste stream treatment needs.

1.3 Special Considerations Affecting Applications in India

The single greatest constraint to the conduct of this task is the lack of information due to the way the task is described. Indeed, the information provided in the description of the task is fragmentary. Most of the organizations contacted expressed their concerns about the actual composition of the waste mixture. The description of the task was limited to a qualitative composition. The knowledge of the quantity of each individual constituent in the waste mixture would have helped considerably to determine quickly what technology could be transferred in the most cost-effective way.

Depending on the respective amount and economic value of each component of the waste mixture, some technologies that are cost-effective in the U.S. may not necessarily be cost-effective in India. Similarly, technologies that are not cost-effective in the U.S. could be cost-effective in India. Since the quantitative composition of the mixture is missing, it is difficult to draw a final conclusion.

However, the electrochemical technologies proposed here present a real challenge, with the perspective of a successful application in India for dealing with the waste stream from caustic chlorine plants. These technologies enable a "low value" waste stream to be converted into valuable products. Key benefits to be expected in India include:

- waste production minimized;
- raw material purchases minimized;
- high strength acid and alkali recovered;
- low capital/operating costs; and
- the electrochemical processes are highly robust and based upon well-proven technology.

1.4 Industry Overview and Prioritization of Companies Included

Of all the companies contacted, ICI Chemicals & Polymers Limited, through its North American Representative (Electrosynthesis Company Inc.), is the one that stands out, having successfully developed and owned an electrochemical technology, namely the FM21 electrolyser, for reclaiming acid/alkali from waste stream from caustic chlorine plants. ICI electrochemical technology was introduced commercially in 1981. Today, more than 30 chlor/alkali manufacturing facilities use the FM21 electrolyser to satisfy their requirements. More detailed information on ICI, including their statement of capabilities, will be given in Section 2 of this report. A package of promotional material is enclosed.

In addition to ICI, the two other consulting firms often mentioned by the Chlorine Institute, the Chemical Manufacturers Association, and others as potential U.S. candidates for addressing this task are Carson Engineering and Consulting Resources Corporation. Carson Engineering has a dozen years of experience consulting to the chlorine industry on process engineering and pollution control. Consulting Resources Corporation has considerable expertise in tracking the chlorine market worldwide. More detailed information on these two companies will be given in Section 2 of this Report. Packages containing statements of capabilities and promotional materials of both companies are enclosed.

In addition to the three organizations mentioned above, several other companies were contacted, but, as of this writing, no information on them or their products has been received. As such, only the company name and contact information is provided in Section 2. Any materials subsequently received, will be forwarded accordingly.

1.4

TEST TECHNOLOGY SEARCH

DINITROBENZENE WASTEWATER TREATMENT

TASK ORDER NO. 93-6-B.2

CONTRACT NO. USAID/INDIA 386-0530-C-00-3219-00

Prepared by:

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SANDERS INTERNATIONAL

January 19, 1995

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1. PREFACE

Under India Trade in Environmental Services and Technologies Project (TEST), contract USAID/India 86-0530-C-00-32M-00, environmental technologies have been assessed and their suitability for transferring to India has been explored in the category of 'technology trade' of the project. Technology owners, providers and equipment suppliers were searched, contacted and their credentials and interest sought to arrange a joint-venture partnership in sharing the technologies

The scope of this project, however falls within the 'environmental services' area. Hindustan Organic Chemicals Limited (HOCL), a Government of India Enterprise, requested a Data Search (Level 1) for treatment of effluent originating from dinitrobenzene plant.

Therefore the report submitted here includes documentation of the preliminary search of technical literature and information stored in computer data banks on treating toxic dinitrobenzene effluent. It is intended to provide a methodology for economic evaluation and process selection so that their 'site specific' applicability and cost effectiveness can be checked as Level 2 efforts before project inception.

1.4

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

Air Pollution Control Technologies

Phase I Report

Prepared for:

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and
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Sanders International, Inc.
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September 1995

I. Background and General Description of Technical Search.

Ventair, an air pollution control engineering design and manufacturing company in Madras, India is seeking a partnership with a U.S. firm for technology transfer via a technology licensing. Their current product line includes: industrial fume extraction and absorption systems; dust extraction and collection units and exhaust and ventilation systems. They are interested in a collaboration to expand and upgrade their existing product line and expand their market in India and develop markets in other areas of Southeast Asia, the Middle East, and the Far East.

Ventair provided TEST with a list of some eighteen companies with which they had had correspondence in early 1995. Phase I of the technical search conducted by Sanders International (SI) involved:

- contacting the list of companies suggested by Ventair;
- making additional calls to companies not on that list: EPR, Emtrol, Joy Environmental; and
- providing an additional group of U.S. air pollution technology firms interested in doing business in India in the TEST database, with whom Sanders has had previous contact.

II. Assessment of Technology firms and Phase I results.

Of the eighteen firms we contacted initially, *four of these companies are interested* in further contact with Ventair, and in doing business in India in general. These companies are Nikro Industries Inc., Bohn Bio Filter, Vanaire, and Beltran Associates Inc. SI contacts with these will be discussed in greater detail in section III. Of the four interested firms, we would like to note that not all of these companies may have the precise technologies sought by Ventair. For example, upon receiving summary sheets on Nikro, we found that their vacuum filtration systems seem to be applicable more to residential and commercial building applications, as opposed to industrial usage. We will await feedback from Ventair before proceeding further with these firms.

One of the eighteen listed, Advanced Industrial Technology may be interested in talking further with Ventair. Initially they were not interested (see section IV of the report, but it seems from their letter they may change their opinion with further correspondence). In addition to the above firms, we have already sent materials to Ventair on EPR, a firm with a very low-cost technology for particulate & dust collection. Finally, we include in section III information on twelve other firms with whom we have had previous direct contact and who have shown interest in doing business in India.

We found that 13 of the 18 companies were not relevant for the following reasons: they are engineering, not technology firms; they are not interested in India at this time; they may only represent foreign-owned technologies (which cannot be supported by USAID); or they are no longer in business. These are profiled in Section IV of this report: List of Other Producers.

1.4

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

VOC Control & Recovery Technologies

Phase I Report

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September 1995

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Background. R.J. Shah & Co. Ltd. is a civil engineering and construction firm which has specializes in underground works and has recently moved into building water purification plants. R.J. Shah is interested in manufacturing pollution control equipment by way of further diversification. It was agreed, based on information provided by R.J. Shah, that Sanders International would conduct a technology search focusing on VOC control and recovery technologies (see Attachement A for the agreed upon report outline).

What follows is Phase 1 of the technical report for R.J. Shah.

A. Overview

As indicated in our proposed outline, we first followed-up with the two U.S. companies identified by R.J. Shah. We found that Celgene Corporation sold its biotreatment systems division to Sybron Chemicals Inc., and that ARI Technologies was acquired by Wheelabrator Clean Air Systems. We contacted both Sybron and Wheelabrator and have included their contact and product information below.

We then searched our database of approximately 50 U.S. companies which specialize in VOC control or recovery technologies, and selected 11 companies which offer a range of technologies that we believe would be of interest to R.J. Shah. To select the companies, we used the following criteria:

- U.S. company only
- indicated recent interest in doing business in India
- VOC and solvent recovery technologies primarily for chemical and petrochemical industry applications
- small and medium sized company only
- minimum of three years experience
- some international experience

Section C lists these companies with contact information and a brief description of their technologies and capabilities. Brochures and other relevant information for each company is included in the ANNEX. We have also included some relevant articles discusssing VOC technologies in Attachment B.

B. Summary and Recommendations

The companies and technologies we have selected are only illustrative of the range of VOC technologies available in the United States. All selected companies have indicated an interest in working in India and are looking for a partner to market their technologies (and provide after sales services), or for a partner who can in part manufacture the technology and function as a licensed distributor. We understand from some of our discussions with the U.S. companies, that they are mostly interested in partners who have demonstrated access to the end user market for the technology in question, or who have the demonstrated technical expertise, such as manufacturing expertise of large sheet metal, high pressure vessels or large reactors. We believe that it is essential that R.J. Shah responds to these requirements.

Before we begin Phase 2 of the report and engage in further discussions with any one company, it is essential that Sanders has a clear idea of what type of relationship R.J. Shah would like to pursue and what technical capabilities are available to R.J. Shah. It would also be useful to receive any information on the size of the market for VOC technologies and R.J. Shah's access to the proper channels for entering this market.

We thus recommend that R.J. Shah review the enclosed information on the selected companies and provide Sanders with the following information:

- A list of the top five companies that R.J. Shah is interested in. In this case we need to know why they were selected and what type of relationship R.J. Shah would like to pursue with each company. Sanders would then conduct detailed conversations with each selected U.S. company. If one of the companies does not want to engage in discussions further down the line, Sanders would search for alternative companies, in order to make 5 final recommendations.

- Alternatively, if none of the selected companies appeal to R.J. Shah, R.J. Shah may want to simply specify a specific VOC technology, and provide us with the reason why the technology was selected. Sanders would then go back and identify additional companies which offer the selected technology and conduct detailed interviews with U.S. companies to provide 5 final recommendations.

- Should R.J. Shah determine that, based on the information provided, VOC technologies do not fit R.J. Shah's ultimate diversification objectives and capabilities, Sanders would work with R.J. Shah to determine what other environmental technology would be suitable, and based on that, conduct a search for relevant companies. This may require altering the scope of Phase 2 of the report.

Based on R.J. Shah's feedback, Sanders will begin Phase 2 along the lines suggested above.

TRADE IN ENVIRONMENTAL SERVICES & TECHNOLOGIES

Air Pollution and Water Quality Monitoring Systems

Prepared for:

The Electronics Corporation of India, Limited
and
The Industrial Credit and Investment Corporation of India

Sanders International, Inc.
1616 P Street, N.W., Suite 410
Washington, D.C. 20036

A. Background. The Electronics Corporation of India, Limited (ECIL) visited the United States in July and August of this year in order to conduct business with established U.S. partners (outside of the TEST program) and to meet possible environmental technology partners for air and water monitoring & analysis capabilities. Mr. J. S. Bhatia, General Manager of the Instruments Group at ECIL met with Sanders International (SI) on July 29 in Washington D.C. The primary purpose of the meeting was to specify, in greater detail, the technology research that was requested by ECIL, through ICICI in 1994. Secondly, Sanders International wanted to discuss the outcome (and possible follow-up) of meetings arranged with Horiba Instruments, Thermo-Environmental and SAIC for air & water pollution monitoring tie-ups with ECIL. Finally, SI wanted to determine what meetings TEST could organize for ECIL while Mr. Bhatia was still in the U.S. in August.

Outcome of July 29 meeting, other U.S. meetings, and planning of more detailed technology search for ECIL. SI discussed with Mr. Bhatia his priorities for working with U.S. companies on air & water pollution monitoring equipment. These talks helped SI provide the framework for a revised technology search report outline. The following Outline was agreed upon:

I. General Description. Sanders International will provide a report of U.S. technologies and vendors for (1) EPA approved ambient air and toxic gas analyzers for gases such as carbon monoxide, carbon dioxide, sulphur dioxide, hydrocarbons, etc. (2) technologies for stack/source continuous emission monitoring systems (CEMs) - both insitu and extractive types.

ECIL's five priorities are in the following areas. The goal is to be able to begin working at the lower levels and cooperate with a U.S. technology firm to achieve the highest level of technical expertise (system design):

- system design;
- system integration;
- instrument manufacture;
- installation of equipment;
- maintenance of existing pollution monitoring equipment.

Sanders will also attempt to locate U.S. firms who provide monitoring systems for water quality, such as dissolved oxygen, conductivity, turbidity, BOD, pH, etc.

II. **Priority Producers.** Description of the top few U.S. companies interested in working with ECIL. Included is information on all contact information and other product lines of interest. Detailed company information/brochures will be included in an annex.

III. **List of other Producers.** Report on those companies who were contacted, but not interested in India at this time; or whose technology does not apply.

IV. Summary and Recommendations.

A copy of the technology search will be sent via telefax to ECIL and ICICI. Any report annexes and company statements of qualification or brochures will be sent to ECIL via express mail under separate cover.

Other U.S. meetings with technology suppliers. The outcome of the meetings held with Horiba Instruments and Thermo Environmental was that there would be no follow-up at this time. Horiba Instruments has a large office in California, but the decision-making on technology transfer of electronic components is made principally by the Japanese parent corporation. Thermo Environmental was interested in meeting with ECIL, but currently has an exclusive distributorship arrangement with another company in India.

SAIC met ECIL at Sanders International and is interested in talking further with ECIL on joint manufacturing of FTIRs for air pollution monitors. One of SAIC's strong corporate capabilities is in the supply of software for the FTIRs. They would also assist in locating the hardware suppliers for these units. SAIC would also like to provide consulting services to find other partners for ECIL in air pollution monitoring devices. This company has sent ECIL a proposal letter for technical collaboration. ECIL is currently reviewing this proposal.

Finally, SI arranged for ECIL to meet with two other companies while in the New York City area. They were:

- Cegelec, in New Jersey
- Calibrated Instruments, in Hawthorne, NY

Feedback from ECIL and both companies suggested that there would not be a need for TEST to follow-up on these leads at this point. Each may be interested in providing engineering services to ECIL, but neither seemed to fit the five priority categories of ECIL.

In mid-August, SI began work on an extensive technology search for electronic air monitoring and water quality devices as listed in the search outline. The results of this search follow.

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

SAND RECLAMATION TECHNOLOGIES
TECHNOLOGY ASSESSMENT REPORT

prepared for
SOLAPUR CHEMICALS PVT. LIMITED
AND
THE INDUSTRIAL CREDIT AND INVESTMENT CORPORATION OF INDIA

Sanders International, Inc.
1616 P Street, N.W., Suite 410
Washington, D.C. 20036

June 1996

I. Background and General Description of Technical Search

Solapur Chemicals Pvt. Ltd. (Solapur) manufactures resin coated sand to make molds for ferrous castings. The coated sand is used as raw material by foundries producing iron, steel and ferrous castings. The company uses silica sand and adds phenolic resin as a raw material for its castings.

The company is interested in installing a sand reclamation plant. This plant will be the first of its kind in India and will allow Solapur to reduce the consumption of new silica by recycling once-used sand. Initially, Solapur would like to buy sand reclamation equipment directly from a U.S. manufacturer. Subsequently, however, they would like to acquire a technology license to design and manufacture sand reclamation equipment for end users in other parts of India.

Solapur provided the TEST program with a list of 20 companies specializing in sand reclamation systems. Sanders International (SI) used its environmental technology databases to contact these companies to determine whether they had the appropriate technology. In addition to this, based on past work with foundry related products companies, SI contacted an additional 28 companies to assess if they had sand reclamation technologies that may be of interest to Solapur Chemicals.

II. Summary of Technology Search Results

Based on the initial list of 20 companies provided by Solapur, SI found that *eight* companies claimed they had sand reclamation technologies that could treat chemically bonded sand. These companies are:

1. GMD Environmental Systems, Inc.
2. Dependable Foundry Equipment
3. Simpson Technologies Corporation
4. Ward Automation
5. Kloster Corporation
6. Consolidated Engineering
7. Carpco, Inc./Humphreys
8. Svedala Industries

Of these eight companies, *two* companies, GMD Environmental Systems, Inc. and Dependable Foundry Equipment, expressed a strong interest in working with Solapur. The presidents of these companies called personally called SI and told us they were confident their technology could meet Solapur's sand reclamation needs. They are waiting for us to respond to them regarding Solapur's interest, and we highly recommend Solapur follow up with them.

One company, Simpson Technologies, told us they have a pneumatic/mechanical scrubbing technology that could treat chemically bonded sand and would be a cheaper alternative to thermal reclamation. We recommend Solapur follow up with this company.

Three companies, Ward Automation, Consolidated Engineering, and Kloster Corporation claimed they could treat chemically bonded sand. We recommend Solapur follow up with these companies.

One company, Carpco, Inc., told us their technology had never been tried on chemically bonded sand, but they were open to treating this type of sand. They were, however, keen to have further discussions with Solapur. We recommend Solapur follow up with Carpco's technology if is of interest to them.

One company, Svelada Industries, had the technology of relevance to Solapur. They did not indicate an interest in having further discussions with Solapur, and we do not recommend any follow up action with them.

The following provides details on the feedback we received from the other companies in Solapur's list

One company, Palmer Manufacturing had mechanical sand reclamation equipment. Mechanical sand reclamation is usually not suitable for reclaiming chemically bonded sand, and we do not think Palmer's technology is appropriate for Solapur.

Two of the companies we had contacted, Eirich Machines and ALB Klein Company, told us they had discontinued the manufacture of sand reclamation technology. *One* company, Modern Equipment, had licensed its sand reclamation technology to a German manufacturer. *Four* companies, Simplicity Engineering, Inc., Wolverine Foundry Supply Co., IMF North America, and Otto H. Rosentreter, were U.S.-based distributors of foreign companies. Two companies, Quiptec Inc. and Gudgeon Brothers, were Canadian companies, and, therefore, they were not contacted. *One* company, Vulcan Engineering, did not manufacture sand reclamation technologies, but said they would represent companies that did the actual manufacturing. *One* company, Palmer Manufacturing & Supply, Inc., made mechanical sand reclamation equipment that was not designed to treat chemically bonded sand. *One* company, George Fischer, had recently formed a joint venture with Disa, and they were not sure how the sand reclamation manufacturing capabilities would be reassigned to a new division as a result of this reorganization. *One* company, Didion Manufacturing, claimed they manufactured sand reclamation equipment but were not responsive to our request for further discussion or any product information. Finally, *one* company, Metwaste Alternatives, could not be located.

SI also performed a company search from its environmental technologies database and in-house contacts. In this search process we found all the companies in Solapur's original list. In addition, we also found two companies that are described above, Carpco, Inc. and Consolidated Engineering, that produce sand reclamation equipment. The remaining companies, however, only produced foundry related sand handling equipment.

As a result of our search, three issues were highlighted. First, we found that in general, thermal reclamation is considered to be the most efficient way to treat chemically bonded sand. It is, however, relatively costly, and the cost-effectiveness must be taken into account when assessing this technology vis-á-vis an alternative technology. Second, Solapur should consider the relative efficiency of the batch treatment process versus the continuous treatment process. Third, if Solapur is ultimately interested in a licensing arrangement with a U.S. partner, it must convince the U.S. company of the benefit of such an arrangement. Solapur needs to address these issues when it decides to follow up with the U.S. companies.

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

SCRUBBER TECHNOLOGIES AND OTHER AIR POLLUTION CONTROL EQUIPMENT

TECHNOLOGY ASSESSMENT REPORT

prepared for
AERO-TECH ENGINEERS PVT. LTD.
AND
THE INDUSTRIAL CREDIT AND INVESTMENT CORPORATION OF INDIA

Sanders International, Inc.
1616 P Street, N.W., Suite 410
Washington, D.C. 20036

July 1996

Technology Search Report on:
Scrubber Technologies & Other Air Pollution Control Equipment
For: Aero-Tech Engineers Pvt. Ltd.
July 12, 1996

I. Executive Summary:

Background. Aero-Tech Engineers is an established air pollution control technology firm located in Mumbai, India. This company has over fifteen years of experience in the manufacture and installation of air pollution control systems in: scrubbers, ventilation systems, fans, blowers, bag filters and cyclone separators. In the area of scrubbers, Aero-Tech installed packed tower-, venturi-, and wet scrubbers.

This company contacted the TEST program for assistance in locating U.S. companies who are interested primarily in partnerships for design improvements in Aero-Tech's current wet scrubber systems. Secondly, Aero-Tech is interested in U.S. technologies in other air pollution control systems, such as air blowers, dust collection systems, wet and dry ESPs and volatile organic compound (VOC) controls. Thirdly, Aero-Tech is interested in U.S. firms who would like a longer-term partnership commitment in India, as opposed to a straight sale of equipment or a distribution agreement.

Search Methodology and Summary of Findings. Sanders International (SI) consulted its environmental technology databases to locate over 30 scrubber and other air pollution control manufacturers. From that list, we eliminated eight firms because they were either foreign owned firms (Canada or Germany), or we determined that the company only made air pollution control components, such as pipe fittings for scrubbers or other ancillary equipment. For Aero-Tech's information, we provide a list of the companies we eliminated in Attachment A of this report.

Of the remaining 25 firms, SI conducted extensive phone interviews over a three to four week period with the appropriate international company representatives. The results of this process are as follows:

- *Eight companies expressed great interest in further information and communication with Aero-Tech Engineers for a possible partnership in upgrading of scrubber systems, or in other air pollution control equipment.* Those companies are: Bayliss Technologies; Compliance Systems; Turner Envirologic; Kimre; Enviros Technologies; Misonix; Advanced Environmental Systems; and Warren Engineering. Discussion of each of these companies, along with their contact information is listed in part A of Section II: Priority Producers.

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- *Six other companies expressed interest in either working with Aero-Tech on a case-by-case basis*, or with air pollution control system partnerships in areas other than wet scrubber technology upgrades. They are listed in part B of Section II.

- *Eleven other companies were contacted by telephone and telefax and discussions were held regarding possible partnerships with Aero-Tech Engineers.* At this point, these firms are not interested in a formal arrangement. The reasons for their lack of interest are that they are already in partnership with an Indian firm, do not have the correct technology, or that they are not interested in expanding their markets to India at this time, due to their concerns over investing in a market at such great distance. These firms are described in Section III: List of Other Producers.

SI has obtained brochure information on the majority of the Priority Producers listed in Section II. The brochures will be mailed to ICICI, who will forward all brochure materials to Aero-Tech Engineers. Attachment B lists the companies who have provided brochures to date, and those companies who will be sending brochures in the near future.

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Manali Petrochemical Limited
Part I: Technology Search Report for Flash Evaporators

I. Background of Technology Search

Manali Petrochemical Ltd. (MPL) is a part of Southern Petrochemical Industries Corporation Limited (SPIC). MPL is involved in the following industrial sectors: chemical; manufacturing; pharmaceuticals; electronics; transportation; and construction. In 1990, MPL began production of polyols and propylene oxide. These are materials used in products such as automobile seats and refrigerators.

MPL is interested in recovering valuable process water used in industrial production of polyol at the MPL plant in Madras. MPL has identified the flash evaporator as the appropriate technology for petrochemical process water recovery and has estimated that this process can recover up to 30 to 40 percent of the wastewater generated. Currently, MPL considers all the water used in the production of polyol to be wastewater and discharges it directly into the Bay of Bengal after treating it for high BOD and COD levels.

Through the Industrial Credit and Investment Corporation of India (ICICI), MPL requested that Sanders International (SI) perform a technology assessment to identify manufacturers of flash evaporators. To assist MPL, SI made some preliminary inquiries into wastewater recovery systems currently in use in the U.S. SI found that, in general, petrochemical plants do not re-use their wastewater as it is too expensive to do so.

SI used its databases to locate approximately 16 U.S. companies that manufacture evaporation technology. After a paper review of these firms, we selected the top firms we felt were the most appropriate for MPL. In this process, we assumed MPL is interested in either a direct purchase of the equipment or in licensing the technology to manufacture evaporators in India. We conducted detailed interviews with these firms to determine if their equipment was the correct choice for MPL and, in this process, selected the top seven firms. We have provided profiles of these firms in Section III and enclosed their product brochures with this report.

1.4b

II. Summary of Technology Search Results

In order to conduct this technology search, SI used its standard in-house databases to locate approximately 16 companies that were listed as evaporator manufacturers. Among these companies, we identified seven companies that manufacture evaporators for the treatment of wastewater. These companies are: Rosenblad Design Group; Aqua Chem, Inc.; Niro, Inc.; Stord, Inc.; Graver Water; Paget Equipment; and FMC Corporation.

All of these companies expressed a strong interest in following up with MPL. As mentioned previously, most evaporator manufacturers in the U.S. have not treated petrochemical wastewater with evaporator technology. The evaporator manufacturers did not see treatment of petrochemical wastewater as a problem, provided they had a detailed chemical analysis of the wastewater. They did, however, question the choice of flash evaporation as the appropriate technology. The general consensus was that the flash evaporators were more energy intensive and did not recover the same quantity of water as other popular types of evaporators like falling film evaporators. The company representatives we contacted unanimously told us that the evaporator manufacturer is in the best position to recommend the appropriate technology.

Three companies, Wheelabrator, Artisan Industries, and Cannon Boiler Works, said they have manufactured evaporators in the past, but at this point did not feel they could make an appropriate evaporator to meet MPL's needs.

The remaining six companies were not interested in further discussions with us or could not be reached despite repeated attempts.

Manali Petrochemical Limited
Part II: Technology Search Report on CFCs Testing Equipment

Executive Summary. MPL has requested two technical searches with regard to the manufacture of polyols in India. The first request was for flash evaporation systems for wastewater treatment in the production process. The second was for specific instrumentation for the monitoring of CFCs (chloro-fluorocarbons) in the manufacturing stage. This report addresses the second request which covers MPL's requirements for U.S. company technology quotes for the following items:

1. a rate of rise meter;
2. a hydroxyl meter; and
3. a thermal conductivity meter

Summary of Results. Sanders International surveyed a listing of over 100 U.S. firms that manufacture environmental monitoring equipment. However, we found that the equipment which is required is very specific to the foam/plastics industry and is only made by a few U.S. companies. The company contacts made came mainly from industry resources, such as the U.S. Environmental Protection Agency and the Society for Plastics Industries. Therefore, the results of the technical search do not provide many vendors from which MPL will be able to choose.

Part I of this report gives a brief background on some of the history of the expulsion of CFCs in much of U.S. industrial applications and a discussion of what some companies like Allied Signal and others are doing to delete CFCs from the production process. It also covers some of the conversations Sanders International had with U.S. manufacturers on the present production of foams without CFCs and some of the technologies used to reduce or eliminate CFCs in the U.S. manufacturing market.

Part II of this report describes the vendors who produce the three pieces of equipment mentioned above and gives a summary of price quotes given for those specific pieces of equipment. All of these vendors were suggested by companies who work with CFCs. We understand from the vendors that MPL has already been in contact with one or two of the companies, and those companies are eager to hear back from MPL.

Part III suggests some further contacts for MPL, either for technical assistance in the phase-out of CFCs or for collaboration with U.S. companies who make polyols. We list the companies contacted and additional resources for MPL if they require further information, such as technical papers on the phase-out of CFCs in the U.S.

Part IV shows the attachments of price quotes and company materials faxed to Sanders International.

I. Background and CFC Production Information

Manali Petrochemical Limited (MPL) is involved in the manufacture of polyols for use in insulation and for use in automobile seats. MPL is the largest supplier of polyol systems for major Indian companies who manufacture these products. We understand that MPL is interested in monitoring the level of CFCs used in their manufacturing processes and are experimenting with other methods of foam production, such as using cyclopentane or carbon dioxide as a blowing agent for foams, which would eliminate the need for using CFCs.

Traditionally, CFCs have been used as the blowing agent for producing polyols. In the U.S., the Montreal Protocol committed the U.S. to phase out use of CFCs in insulation and other areas by January 1, 1996, to reduce ozone depletion. Developing nations have approximately ten more years before phase-out of CFCs should be complete; however, India is on the right track in starting to reduce CFCs at this early stage

We found that most U.S. producers have switched from using CFCs to HCFCs as blowing agents. As of 1993, companies are also using carbon dioxide for the production of insulation foams. Hydrogen carbons have a much lower ozone depleting potential than CFCs. There are, however, some areas where CFCs are still used in various manufacturing processes. This report will not describe those manufacturing areas, but if the reader is interested, we have provided the contact person at the U.S. Environmental Protection Agency (U.S. EPA), who was very helpful with industry information on CFCs (see Part III).

Allied Signal is one of a few manufacturers of CFCs in the U.S. Allied Signal believes it is difficult to monitor CFCs in the polyol foam, once they have been used as a blowing agent. There is a way of measuring CFCs in foam cells, by crushing the foam. But some of the CFC is absorbed in the plastic (not in the foam cell), and the reading is therefore not very precise.

Allied agreed that the rate of rise (or raise rate) meter will give a fairly accurate reading of CFCs and is critical in measuring the success of the foam. It is a good quality control device for foam production. The agent we talked with was curious why MPL would want a hydroxyl meter. This meter measures the hydrogen which is present in the CFC molecule, or the OH concentration. Allied does not require this type of equipment since all chemicals they buy have the hydroxyl number as part of the packaging on the label. Unless MPL would like to experiment with the chemicals, or check the hydroxyl ratings listed by the vendors, Allied Signal thought this piece of equipment would not be required.

Allied does use the thermal conductivity meter for measuring the K factor and suggested one vendor for MPL's use. One piece of equipment which MPL did not list as a required instrument is one which measures CFCs in the air. For health and safety reasons for factory workers at the polyol plant, the U.S. requires air quality readings in the production area. Gas Tech is the instrument they use to measure air emissions and this unit is made by a company with the same name: Gas Tech. The American Society for Plastics Industries has also produced a handbook for plant emissions which would be useful for MPL in the upgrade of its current facilities.

Allied Signal has recently sent one of its representatives to India and Sanders International sent information to this company on MPL as a possible contact for this Allied Signal representative while in India. This firm would certainly be interested in working with MPL, if technical assistance is required, as changes are made in the current use of CFCs.

We also spoke extensively with BASF, a large manufacturer of polyols, and admittedly, a competitor of MPL. BASF has done a lot of research with regard to CFCs in their production process. They have done this by using other catalysts or surfactants to stabilize the structure of the foam. Thus they have eliminated the need for using CFCs as the blowing agent in the foam. Since this firm is in competition with MPL, they were certainly not very keen on giving details of their research; however, they were very helpful in suggesting manufacturers and prices for the equipment which is sought by MPL. They have had very good results with the vendors listed in the next section. Their suggestions agree with those vendors listed by Allied Signal for the equipment needed in India.

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

ANAEROBIC WASTEWATER TREATMENT FOR A PETROCHEMICAL PLANT

TECHNOLOGY ASSESSMENT REPORT

prepared for
SOUTHERN PETROCHEMICAL INDUSTRIES CORPORATION, LTD. (SPIC-SMO)
AND
THE INDUSTRIAL CREDIT AND INVESTMENT CORPORATION OF INDIA

Sanders International, Inc.
1616 P Street, N.W., Suite 410
Washington, D.C. 20036

September 1996

Technology Search on
Anaerobic Wastewater Treatment for a Petrochemical Plant
for Southern Petrochemical Industries Corporation, Ltd. (SPIC-SMO)

I. Background and General Description of Technical Search.

SMO is a subsidiary of SPIC: Southern Petrochemical Industries Corporation Ltd., a company involved in several industrial sectors: chemical manufacturing, pharmaceuticals, electronics, transportation and construction. SMO works in the design and construction of petroleum refineries and is currently interested in a partnership with a U.S. firm for wastewater treatment processes for a new SMO petrochemical plant that will open in mid-1997 in Madras. This company is interested in a combined anaerobic-aerobic treatment process to treat the water to Tamil Nadu's Pollution Control Board standards. They would like to find a U.S. firm who can provide the engineering for the anaerobic treatment stage.

II. Assessment of Technology Firms and Results.

Sanders International used its corporate database and other sources to locate and screen many large U.S. wastewater treatment engineering firms which should be able to solve the petrochemical treatment problem. The original list of contacts we developed contained approximately fifty firms. In the first few weeks, we selected *half of those fifty companies*, based on our knowledge from previous contacts that the majority of these firms are interested in working in India. Most of these U.S. companies were listed in the "Environmental Business Journal" as the top water and wastewater equipment manufacturers. Of the original list, *we sent information to fourteen firms* which were interested in receiving information on SPIC-SMO. After sending the materials, Sanders International called these firms in lengthy interviews to determine whether their engineering and manufacturing capabilities matched the technology request. Over half of those firms are interested in working in India, but not all have the correct technology for SMO's requirements.

Of these firms, *two expressed great interest in working with SPIC: Biothane, and Smith & Loveless*; a third firm, JWI would be interested in working with SPIC possibly *in the future after one or two years*. At this point they simply do not have the capacity to take on projects in India. *Seven other firms expressed various degrees of interest* in working with SPIC; however, they either would not have the capability of designing the full wastewater treatment plant or they were difficult to reach for more detailed discussions.

Following are the results of the Technical Search Report (TSR) for SPIC-SMO as well as recommendations for SPIC to follow for future contacts. Section III of the report describes the top firms interested in, and capable of, working with SPIC. This is followed by an overview in Section IV of the results of the other calls made to the initially interested dozen firms. Section V lists the names of the other companies contacted in the list of thirty, to avoid any overlap with future attempts made by SPIC-SMO to contact U.S. firms. Finally, Section VI offers a summary and recommendations for SPIC-SMO for further action.

Comprehensive list of Indian firms

Quick List: Contact List
Printed on 07/26/96 11:19:27 by TST
Index: Company/Contact
Filter: TEST Contacts in India

Company	Contact Name	City	Primary Phone	Primary Fax
	Jimut Chatterjee	Golf Garden, Calcutta	011-91-472-0634	
	Pradip Bandyopadhyay	Calcutta 700 031		
	S. Vaideeswaran	New Delhi 110 024		
A.V. Valves Ltd.	Satish Jain	Agra 282 006	91-562-363546	91-562-345217
Accurate Analysers Pvt. Ltd.	Noname	Nasik		
Aditya Environmental Services	Noname	Bombay	91-22-456473	
Aditya Lime Industries Ltd.	P.K. Maheshwari	Bombay	91-22-8723046	
Advanced Biochemicals Ltd.	Mr. C. L. Rathe	Maharashtra	91-22-533-1325	91-22-534-3445
Aero Biological Centre	Noname	Thane		
Aeroclean Associates	Noname	Kalyan		
Agra Iron Founder's Association	Raman	Agra 282 004	011 91 562 352 227	011 91 562 352 599
Agro Pulping (Div. of Chellam)	S. Raghavan	Madras	91-44-444-491	91-44-445-578
Air Pollution Monitoring Lab.	Noname	Thane		
Akar Impex Pvt. Ltd.	R.G. Vaidya	Noida 201 301	91-1189-892-3291/892	91-1189-892-6025
Amchem Products Pvt. Ltd.	Raj Mann	Noida 201 303	91-1189-29158	91-1189-21823
Amritlal Chemaux Ltd.	S. S. Nandurdikar	Bombay 400 016	91-22-453-251	91-22-464-234
Anand Consultants	Rakesh C. Shah	Ahmedabad	22092	
Andhra Pradesh Pollution	Noname	Hyderabad		
Andrew Yule & Company Ltd.	Mr. Ganguli/Mr. Bandyopadhya	Calcutta 700 020	91-33-247-4668	91-33-247-1850
Anti-Pollution Engineers	Noname	Bombay		
Apex Computers	Mohd Zameer Pasha	Hyderabad 500 002	0405606692	
Apollo Paper Mills Ltd.	D. K. Mukherjee	Bombay	91-22-28772970	91-22-2840737
Apurva Water Treatment Systems	N. R. Doshi	Bombay	8720795	
Aqua Bio-Treat	Noname	Pune		
Aqua Bird Water Treatment Co.	Parkar Ahmed	Bombay 400 102	91-22-628-2517	91-22-628-6845
Aqua Chem Industries	Anil Banare	Bombay		
Archaic Decor Pvt. Ltd.	K.V. Devavrata	Visakhapatam	011-91-546741	
Arthur Andersen & Co. SC	Mr. Manish Khanna	Bombay 400 005	91-22-218-2929	91-22-218-0290
Aryan Pesticides Ltd.	K. S. Natrajan	Bombay	91-22-5554484	91-22-5561786
Ashok Leyland Ltd.	Mr. A. F. Couto	Madras	91-44-534-2141	91-44-534-2493
Ashwamedh Engineers & Consult.	Noname	Bombay		
Asian Alloys Ltd.	Pawan Sachdeva	New Delhi	6418843	
Assam Pollution Control	Mr. Parag Phukan	Guwahati		
ASSOCHAM	S. Narayanaswamy	New Delhi 110 001	91-11-310704	91-11-312193
Associated Industrial	Noname	Bombay		
Avenue	Shadab Khan	Hyderabad 50028	040310832	
B.C. Jindal Group	Noname	New Delhi	91-11-373-4816	91-11-334-3060
Balaji Group	Mr. C.S. Vijayaraghavan	Madras	91-44-828-0321	91-44-823-3108
Ballarpur Industries Limited	Mohan M. Phadke	New Delhi 110 001	91-11-332-8332	91-11-332-7729
Bass Pollution Control Systems	Sumeet Sharma	Bangalore 560 001	91-812-215-402	91-812-215-506
Bengal Waterproof Ltd.	Mr. D. Bose	Calcutta	247-1601	247-6152
Bhagawati Assoc. Pvt. Ltd.	Noname	Bombay		
Bharat Aluminum Co., Ltd.	Noname	New Delhi	91-11-436-0101	
Bharat Dall and Flour Mills	Gajendra Singh Narang	Mandsaur	011-91-52455	

2.1.1.(a)

Company	Contact Name	City	Primary Phone	Primary Fax
Bharat Heavy Electricals Ltd.	Noname	Hardwar		
Bharat Petroleum Corporation	M. K. Rohtagi	Bombay	91-22-2618289	91-22-2188389
Bharat Petroleum Corporation	Mr. M. Kumar	Bombay 400 005	91-22-218-9172	91-22-218-2304
Bhaskar Tea & Inds., Ltd.	Mr. K. M. Bhandari	Calcutta	225-4215	225-4559
Bhilai Engineering Corp. Ltd.	B.R. Jain	Bhilai 490 023	91-788-355708	91-788-357368
Bhilai Engineering Corp. Ltd.	K.K. Malviya	New Delhi 110 048	91-11-317-1390	91-11-644-5815
Bio-Systems India	Preeti Mehta	Ahmedabad 380 006	91-79-79329	91-79-401-825
Bio-Tech Envirocare Systems	R. D. Kenkre	LBS Marg -- Thane 400 601	91-22-534-0737	91-22-534-4657
Biotech Consortium India Ltd.	Dr. S. Chandrasekhar	New Delhi 110 019	91-11-643-8926	91-11-642-9686
Birla Cellulosic, Ltd.	Mr. J. K. Maru	Baroda	323-882	339626
Blue Star Limited	G.L. Nayar	Bombay 400 025	91-22-430-9113	91-22-422-6369
Blue Star Ltd.	P.V. Viswanathan	Madras 600 034	91-44-827-2056	91-44-825-4906
Bombay Chamber of Commerce	Vivek S. Date	Shoorji Vallabhas Road, Bomba	91-22-261-1211	91-22-262-1213
Bombay Dyeing & Manufacturing	Noname	Bombay	91-22-86501	91-22-261-4520
BP India Limited	Noname	Bombay	91-22-527583	
BPL Refrigeration Ltd.	C. C. Chouhan	Bangalore	2263634	2251936
BSL Limited	Noname	New Delhi	91-11-6832350	91-11-6838720
CDGI: Center for the Devel't	Shri S.A.T. Rizvi	Jalesar Road, Firozabad	91-561-821672	91-561-823886
Center for Biochemicals, CSIR	Noname	New Delhi		
Centre for Energy Studies	S.P. Sabberwal	New Delhi 110 016	91-11-685-7645	91-11-686-2037
Century Group	Mr. Durgh Chandra	Shahad 421 103	91-251-546568	91-251-540064
CESC Limited	Mr. Kallol Basu	Calcutta 700 001	91-33-3550	91-33-303704
Cetex Petrochemicals	Mr. Vinesh Sadekar	Madras 600 004	91-44-4991323	
Chanderpur Works	Mr. Sumesh Chandra	Haryana 135 001	91-1732-25574	91-1732-23758
Chemical Bank	R. Murlidhar Rao	Bombay 400 021	91-22-243537	91-22-204-3613
Chemicon Engineering	A. Bannerjee	Bombay	91-22-2040261	
Chemistry Laboratory	Noname	Amritsar		
Chemotech Consultants Labs	Noname	Thane		
Chempharm Engineers	Anil Sapra	Delhi	7223129	
Cimmco Birla Limited	Ashok K. Grover	New Delhi 110 020	91-11-681-0582/0146	91-11-681-9418
Coast Guard Hdqrtrs	Noname	New Delhi	91-11-338-3050	
Cochin Refineries	M.L. Mohammad Ali	Kerala	91-6484-777281	91-6484-75855
Concepts India	Noname	Bombay	91-22-5517093	
Confed'n of Indian Industry	Mr. Ravi Varadachari	Worli, Bombay 400 018	91-22-493-1790	91-22-493-9463
Confederation of Indian Indust	S.K. Bhargava	New Delhi 110 003	91-11-462-9994	91-11-462-6149
Consolidated Fibres & Chemical	Mr. Bhaskar Banerjee	Calcutta	2472412	2471909
Consolidated Hydel Projects	J.R. Gaind	Gurgaon 122 015	91-124-340950	91-124-340-0321
Coopers & Lybrand	Julie P. Rezler	Bombay 400 021	91-22-234052	91-22-204-0398
Coromandel Engineering Co. LTD	M. A. Murugappan	Madras	512060	
CSME	Dr. S. Banerjee	Calcutta 700 091	91-33-359-0781	91-33-37-6290
Cyno Clean Company	R. Narasimhan	Madras 600 006	91-44-452867	91-44-456853
Dalal Consultants & Engineers Pvt. Ltd.	Mr. B.S.S. Bali	Bombay 400 018	011-91-22-493-4821	011-91-22-4950539
Datamation	Chetan Sharma	New Delhi 110 092	91-11-222-2320	91-11-224-3087 2
Datamation Consultants, Pvt. Ltd.	Chetan Sharma	New Delhi	91-11-2222-320	91-11-2454230

Company	Contact Name	City	Primary Phone	Primary Fax
DCM Ltd.	Noname	New Delhi	91-11-3717283	91-11-3711357
DCW Ltd.	Mr. H. K. Dedhia	Mumbai	91-22-287-1914	91-22-202-8838
Dept. of Biosciences Lab.	Noname	Surat, Gujarat		
Dept. of Science and Tech.	A.K. Chakrabarty	New Delhi 110 016	91-11-686-4642	91-11-686-2418
Development Consultants Pvt.	Noname	Calcutta	297601	
Dewan Kraft Systems Pvt. Ltd.	Deepak Dewan	New Delhi 110 048	91-11-641-6305	91-11-647-4646
Dharamsi Morarji Chemical Co.	Noname	Ambarnath		
Dhody Brothers Pvt. Ltd.	Rakesh Dhody	New Delhi 110 016	91-11-696-0448	91-11-686-8214
Din & Grey Consultants Pvt Ltd	Girish P. Dingre	Bombay 400 056	91-22-831-797	91-22-204-0395
Doshi Ion Exchange & Chemical	D. S. Doshi	Gujarat	877156	
Dr. Beck and Co. (India) Ltd.	Noname	Pune		
Dr. Reddy's Laboratories	Mr. Satish Reddy	Hyderabad	91-842-223716	91-842-291955
Driplex Water Engineering	Noname	New Delhi		
DuPont Far East Inc. - India	V. Singh	New Delhi 110 066	91-11-688-5443	91-11-688-5046
Dyna-K	C.F. Dias	Bhosari, Pune 411 026	91-212-369-822	91-212-792-636
E. Merck (India) Ltd.	Noname	Bombay	91-22-4922855	91-22-4922454
ECE Labs	Noname	Bombay		
ECIL Electronics Corporation	J. S. Bhatia	Hyderabad 500 762	91-40-7122734	91-40-7121611
Econ Pollution Control Consult	Noname	Bombay		
EID Parry India Ltd.	Mr. P. R. Jawaharlal	Madras	91-44-534-0251	91-44-534-0858
Eimco-KCP Ltd.	Noname	Madras	479445	
Electronics Corp. of India Ltd	J.S. Bhatia	Hyderabad, 500 762	91-40-622-734	91-40-621-611
Electrosteel Castings Ltd.	Mr. S. Y. Rajagopalan	Calcutta	91-33-248-4071	91-33-248-1803
Engineering Projects (India)	Noname	New Delhi	3316821	
Engineers India Ltd.	Mr. A.K. Banerjee	New Delhi 110 066	011-91-11-602-121	011-91-11-687-2693
Engineers India Ltd.	Mr. K. Sathyanaryana	New Delhi 110 066	011-91-11-602-121	011-91-11-687-2693
Enkem Engineers	Mr. Subramani	Madras 600 010	91-44-641-1362	91-44-641-1788
Ensure Exim PVT. Ltd	Raj Bagga	Mumbai 400 005	011 91 22 2186749	011 91 22 2184090
Entech Engineering Associates	S. S. Naik	Bombay	4121451	
Entech Labs	Noname	Thane		
Enviro Chem Analyzers	P. R. Sheth	Bombay	91-22-655529	
Enviro Designs & Equipment	Noname	Cochin		
Enviro-Clean Systems Ltd.	N. Venkata Naryanan	Hyderabad 500 039	91-842-854001/02	91-842-853554
Envirochem Laboratories Pvt.	Noname	Trichur		
Environ'l Engineering Consult.	Dr. D. C. Kantawala	Bombay	91-22-2025329	
Environmental Engineering	Noname	Nasik		
Environmental Engineering	Noname	Allahbad		
Environmental Engineering	Noname	Sangli, Maharashtra		
Environmental Engineering	Noname	Tirupati		
Environmental Engineering	Noname	Kharagpur		
Environmental Engineering	Noname	Thane		
Environmental Engineering, Inc	Noname	Nagpur		
Environmental Enterprises	Mr. Korde	Bombay		
Environmental Laboratory	Noname	New Delhi		

Company	Contact Name	City	Primary Phone	Primary Fax
Environmental Sciences Lab.	Noname	Pantnagar		
Environtech	Noname	Bombay		
Essen and Company	Noname	Bangalore		
Excel Industries Ltd	A.C. Shroff	Bombay 400 102	91-22-628-8258	91-22-620-3657
Excel Tubes (India) Pvt. Ltd.	Manoj Harbhajanka	Calcutta 700 001	91-33-220-5038	91-33-220-8648
Exnora Int'l Foundation	T.K. Ramkumar	Madras 600 004	91-44-494-0022	91-44-434-7376
F. Harley & Company	A.S.N. Sastry	Calcutta 700 014	91-33-244-5344	91-33-244-7918
Federation of Indian Chambers	N.S. Jain	New Delhi 110001	91-11-331-9251/61	91-11-332-0714
FGP Limited	Noname	Hyderabad	91-842-235536	91-842-241498
FICCI	M A J Jeyaseelan	New Delhi 110 001	91-11-331-9251/61	91-11-332-0714
FICCI	Uma Garud	New Delhi 110 001	91-11-331-9251/61	91-11-332-0714
Fichtner Consulting Engineers	N. Ramaswami	Madras 600 018	91-44-412-3210	91-44-434-4579
Fidelity Industries Ltd.	Mr. Ashok Muthana	Madras	91-44-852-6225	91-44-852-6230
Find Technology Pvt. Ltd.	M.P.S. Puri	New Delhi 110 013	91-11-469-7550	91-11-462-1112
Forbes Marshall Ltd.	Mr. Farhad Forbes	Pune	91-212-773495	91-212-777413
Fortune Bio-Tech Ltd	Annam Dilip Kumar	Secunderabad 500 015	91-40-841519	91-40-843945
Fosroc Chemicals (India) Ltd	Mr. D. Sitaramaiah	Bangalore	2225495	2233474
Gaco Systems India Pvt. Ltd.	A. Parameswara	Poona	52350	
Gadark Laboratories	Noname	Bombay		
Gammon India Ltd.	Mr. Abhijit Rajan	Bombay	91-22-4306761	91-22-4300221
Gandhi Laboratories	Noname	Raipur		
Garapa Foods Ltd.	Pankaj Bhutani	New Delhi 110 020	91-11-684-8173	91-11-684-6476
GDR Ventures	M.R. Sampath	Madras 600 097	91-44-234-5610	91-44-234-2992
Geo. Miller & Co. Ltd.	S. D. Mundhra	New Delhi 100 019	91-11-643-2521	91-011-646-4817
Geochem Labs. Pvt. Ltd.	Noname	Bombay		
Gharda Chemicals Ltd.	Dr. P.D. Trivedi	Dist. Thane, Mahrashtra	91-251-471216	91-251-472777
Global Environmental Engin'g	Arun Jalagaonkar	Pune	91-212-327876	91-212-328441
Gloster Telecom Ltd.	Mr. S. M. Singhvi	Calcutta	2498241	
Godavari Fertilisers & Chem.	Mr. V. S. Sampat	Secunderabad		
Grand Prix FAB	Chander Bhalla	New Delhi 110 044	91-11-694-8131	91-11-694-8076
Greysoft Communications	Prabha Chandrasekhar (Mrs.)	Madras 600 085	044 413155	
Grindwell Norton Ltd.	M.R. Ramarathnam	Bangalore 560 049	91-812-510-7317	91-812-510736
Guha Systems & Industries	S. Chidambaram	Madras	011-91-656496	
Gujarat Pollution	Noname	Baroda		
Gujarat Refinery Lab	Noname	Dist. Baroda		
H.P. State Board Lab for	Noname	Himchal Pradesh		
Haryana State Ind'l Dev. Corp.	Mr. Ashok Lavasa	Chandigarh	543671	543166
Hema Laboratories	Noname	Dist. Thane		
Hindalco Group	Mr. A.K. Gupta	P.O. Renusagar 231 218	91-5446-72501 / 7259	1-5446-72382
Hinditron	Hemant Sonawala	Bombay 400 006	91-22-363-5021	91-22-363-0197
Hindustan Anti-Biotics	Noname	Pune		
Hindustan Dorr-Oliver Ltd	B.M. Rahul	Bombay 400 099	91-22-832-5541	91-22-836-5659
Hindustan Newsprint Ltd.	Noname	Kerala	4829-2711	4829-2702
Hindustan Oil Explor'n Co.	Mr. P. N. Varma	Bombay	91-22-604-5407	91-22-604-5377

Company	Contact Name	City	Primary Phone	Primary Fax
Hindustan Organics Chemicals	Dr. Reena Ramchandran	Mumbai	91-22-2014271/ 2014	91-22-2059533
Hindustan Petroleum Corp.	S. Nanda	Bombay	91-22-2612149	91-22-2613576
Hindustan Zinc Ltd.	Noname	Rajasthan	91-294-529-102	91-294-526-443
Hindustan-Oman Petroleum Corp.	Mr. M. N. Advani	Bombay	91-22-283-0189	91-22-283-0189
HOCL	B.B. Galkwad	Maharashtra 410207	91-2143-50041	91-2143-50050
Hydranautics India	R. P. Desai	Gujarat		
Hydraulic & General Engineers	A.V. Rao	Bombay	4948075	
Hydraulic & General Engineers	Dr. A.V. Rao	Bombay 400 043	91-22-555-5647	91-22-555-0045
IBM Computer	Mr. Salman	Hyderabad 500028	010229612	
IBP Caltex Ltd.	Mr. K. C. Mathew	New Delhi	91-11-464-2314	91-11-464-2320
ICC Indian Chamber of Commerce	Y.C. Deveshwar	Calcutta 700 001	91-33-203988	91-33-204495
ICICI	K. Harinathan	Bombay 400 038-50	91-22-261-8251	91-22-262-5444
ICICI	Rajiv Jain	Bombay 400 020	91-22-202-2535	91-22-204-6582
IDRC - Intl Dev. Rsrch. Center	Ravi K. Maithel	New Delhi 110 003	91-11-461-9411	91-11-462-2707
IDRI	Samar Chatterjee	New Delhi 110 091	91-11-436-1341/4791	91-11-436-0678
Ignifluid Boilers	V.N.G. Rao	Madras 600 020	91-44-491-5528	91-44-491-1283
IL&FS Venture Corporation	Ms. Meena D'Sa	Pune 411 004	91-212-351-833	91-212-351-846
Indabrator Ltd.	Noname	Bombay	91-22-8734301	91-22-8727926
Indian Aluminum Co., Ltd.	Noname	Dist. Raigad		
Indian Boilers Manufacturers'	Mrs. D.B. Baldawala	Bombay 400 018	91-22-492-6629	91-22-493-7505
Indian Coast Guard	Mr. Postwala	Bombay	91-22-437-9868	91-22-493-3727
Indian Navy	Mr. Vishnu Bhagwat	Bombay	91-22-268-1202	91-22-266-0932
Indian Oil Corporation	Mr. Krishnamurthy	Bombay	91-22-4950057	91-22-6438078
Indian Oil Corporation Ltd	Mr. A.K. Mathur	Bandra (East), Bombay 400 05	91-22-546568	91-22-642-3272
Indian Petrochemicals Corp.	R. J. Sarvaiya	Raigad, Maharashtra	021442	
Indian Seamless Metal Tubes	T. Datta	Pune	91-212-622417	91-212-624450
Indo Rama Synthetics Ltd.	Mr. S. P. Gupta	New Delhi	91-11-335-1101	91-11-332-6827
Indo-American Chamber of Commerce	Kamal Vora	Bombay 400 020	011-91-22-221413	011-91-22-204-6141
Indo-American Chamber of Commerce	V. Rangaraj	Bombay 400 020	011-91-22-221413	011-91-22-204-6141
Indo-German Invest. Prom. Svc.	C.S. Sathyamurthy	New Delhi 110 021	91-11-301-4352	91-11-301-6921
Indocan Engineer'g Systems Ltd	Mr. A. Parmeshwaran	Pune 411 003	91-212-775226	91-212-775243
Industrial Boilers, Ltd.	Mrs. D.B. Baldawala	Bombay 400 018	91-22-492-6629	91-22-493-7505
Industrial Hygiene Laboratory	Noname	Panaji, Goa		
Industrial Hygiene Laboratory	Noname	Panaji, Goa		
Industrial Management Advisory	S.L. Prabhu	Anna Nagar, Madras 600 040	91-44-621-2887	91-44-642-6888
Instrumentation Ltd.	S.R. Bhatnagar	New Delhi 110 003	91-11-4360101	91-11-4360905
Interroll (India) Pvt. Ltd.	Ashish Mohan	New Delhi 110 064	91-11-531-311	91-11-541-3351
Invinex Laboratories Ltd.	Mr. R. Chandra Agarwal	Hyderabad		
Inzofil	Mr. Gautam	New Delhi 110019	91-11-642-3371	91-11-642-5564
Ion Exchange	Satish Chilekar	Bombay 400 011	91-22-493-9520	91-22-493-8737
IREDA - Indian Renewable	V. Bakthavatsalam	New Delhi 110 003	91-11-460-2774	91-11-460-2855
J. B. Chem & Pharmaceuticals	Mr. J. B. Mody	Bombay	91-22-495-4844	91-22-493-0534
J.B. Boda Surveyors P. Ltd.	Noname	Bombay		
Jayshree Chemicals Ltd.	Mr. M. K. Dutta	Calcutta	91-33-220-5998	91-33-221-1788

Company	Contact Name	City	Primary Phone	Primary Fax
JCT Ltd.	Noname	New Delhi	91-11-3322860	
Jindal Strips Ltd.	Mr. O. P. Jindal	New Delhi	91-11-545-9925	91-11-545-4318
JK Corp Ltd.	Narenda Ahuja	New Delhi 110 002	91-11-331-1112	91-11-371-2680
Jord Engineers (India) Ltd.	Rakesh Chaturvedi	New Delhi	6446369	
Jost's Engineering Co. Ltd.	K.R. Prasad	Bombay, 400 001	91-22-266-1150	91-22-266-1951
JPS Associates	Vidya Kane/K. Venkat	New Delhi 110016	91-11-686-2487	91-11-686-4547
JR Fibreglass Industries Ltd	Jitendra Thakkar	Bombay 400 063	91-22-873-5693	91-22-873-5864
JVP Group	Noname	New Delhi	91-11-602227	91-11-605142
Kalyani Consultants	K. V. Mardikar	Raigad, Maharashtra	P.P.2193	
Kanoria Industries Ltd	Ajay Kanoria	Bombay 400 021	91-22-202-3841	91-22-202-2884
Keltron Controls	Mr. J. Krishnakumar	Aroor, KERALA	91-047887-2323	
Kerala State Industrial Dev.	Amitabh Kant	Thiruvananthapuram	0471-69922	66293
Kerala State Pollution	Noname	Cochin		
Kinetics Technology India Ltd.	Rajeev Chopra	New Delhi 110 019	91-11-621-1815	91-11-647-1984
Kirloskar AAF International	S.S. Bhandiwad	Bangalore 560 052	91-80-220-0226	91-80-228-1212
Kirloskar AAF International	S.S. Bhandiwad	Bangalore 560 052	91-80-220-0226	91-80-228-1212
Klean Laboratories	Noname	Pune		
Kochhar & Company	Maria Goodwin	New Delhi 110 048	91-11-647-5477	91-11-646-9656
Kolmak Chemicals Ltd.	Mr. H. K. Mohata	Calcutta	91-33-247-7512	91-33-247-8604
Kribhco Krishar Bharati Coop	K. Das	Surat 394 515	91-261-620-034/6200	91-261-620-038
Krishak Bharati Coop., Ltd.	Noname	Surat, Gujarat	91-261-6414198	91-261-6432063
Krishak Bharti Coop. Ltd.	Noname	New Delhi	91-11-641-4198	
Krishna Agro Chem Ltd.	Mr. S. M. Arulsamy	Madras	91-44-826-0328	
Krypton Industries, Ltd.	M. L. Kankaria	Calcutta		
KTI - Kinetics Tech. India Ltd	I. Ram Kishore	New Delhi 110 019	91-11-647-4759/62	91-11-644-6871
Kumar's Metallurgical Corp.	Mr. Satish Kumar Agarwal	Secunderabad	813346	813482
Laboratory of Env'l Engineer'g	Noname	Roorkee		
Larsen & Toubro Ltd	Sanjeev S. Rege	Bombay 400 072	91-22-578-1401	91-22-578-3437
Larsen & Toubro, Ltd.	T.P.R. Sarma	Bombay 400 072	91-22-578-1401	91-22-578-3437
LG Balakrishnan & Bros Ltd	Mr. J.A. Fernandes	Coimbatore 641 006	91-422-532-325	91-422-532-333
Lobo Business Svcs Pvt. Ltd.	Mr. Mario Lobo	Bombay 400 001	91-22-645-4074	91-22-645-4073
M.N. Dastur & Company Ltd.	Noname	Calcutta	265420	
M.P. Pradushan Niwaran	Noname	Mandal		
Madhukar Engineering Pvt. Ltd	Ashok Madhukar	New Delhi	91-11-6414268	
Magna Electro Castings, Ltd	N. Krishna Samaraj	Coimbatore 641 018	91-422-210-109	91-422-216-209
Mahabal Enviro. Engineers Pvt.	Noname	Bombay		
Mahanagar Gas Ltd.	Mr. A. M. Nimbalkar	Bombay	91-22-811-0220	91-22-811-0301
Manali Petrochemical Ltd.	Mr. N C Pillai	Madras	91-44-235-0284	91-44-235-3028
Mangalore Refineries & Petroch	C. O. Keswani	Bombay	91-22-2854215	91-22-2029772
Mardia Chemicals Ltd.	Mr. Rasiklal Mardia	Ahmedabad	468-058	656-0116
Maruti Udyog Ltd.	Mr. R. C. Bhargava	New Delhi	91-11-331-6831	91-11-371-3575
Matrix, Information Services PVT. LTD	Makarand Waikar	Mumbai 400 021	011 91 22 282 6655	011 91 22 282 6630
MECON	A.P. Roy	Bihar 834 002	91-651-300-016	91-651-300-708
Melco Management Consultants	Mr. V. Nilkantan	Bombay 400 005	91-22-218-4904	91-22-218-0165

Company	Contact Name	City	Primary Phone	Primary Fax
Met-Pro Industries, Ltd.	Mr. John Samuel	Madras	91-44-518673	
Metallurgical & Eng'g Consult.	Noname	Ranchi		
Micro Envir'l Consultants	Noname	Bombay		
MIL Industries Limited	Rajiv Sreedhar	Madras 600 098	011-91-44-625 8382	011-91-44-625-7583
MIL Industries Limited	V. Chandramouli	Madras 600 098	011-91-44-625 8382	011-91-44-625-7583
Mil Industries Ltd	Rajiv Sreedhar	Madras 600 008	91-44-825-0092	91-44-825-0820
Ministry of Non-Con. Energy S.	B.R. Prabhakara	New Delhi 110 003	91-11-436-1481	91-11-436-1298
Modern Suitings Ltd.	Noname	Alwar, Rajasthan	91-144-70578	91-144-70107
Modern Threads Ltd.	Mr. Rajesh Ranka	Jaipur	91-141-623430	91-141-41382
Mysore Cements Ltd.	Mr. N.L. Hamirwasia	Bangalore	2264097	2262165
Mysore Sugar Col, Ltd.	Mr. B. L. Shankar	Karnataka	91-8232-74036	91-8232-74938
MyTron Systems Inc.	M.K. Joshi	Jaipur	91-141-362-881	91-141-383-952
NaikEnviro	Mr. Shirish S. Naik	Bombay 400 019	91-22-401-2067	91-22-401-5155
Naina Semiconductor Ltd.	K.M. Mehta	New Delhi 110 020	91-11-681-5545	91-11-622-1451
Nat'l Leather Development Prg.	A. Saharsranaman	Madras 600 020	91-44-491-1152	91-44-491-1769
National Chemical Laboratory		Pune		
National Environmental Eng'g	Noname	Nagpur		
National Leather Develop. Prog	A. Sahasranaman	Madras 600 020	91-44-491-1152	91-44-491-1769
National Productivity Council	Noname	New Delhi 110 003		
National Thermal Power Corp.	Mr. A.L.N. Murty	Madhya Pradesh		91-54463-4353
National Thermal Power Corp.	Mr. G. S. Sohal	Allahbad, U.P.		91-54463-2423
National Thermal Power Corp.	Mr. Rajendra Singh	New Delhi	91-11-436-0100	91-11-436-1018
Natl Thermal Power Corp Ltd	Mr. S. Sen	New Delhi 110 003	91-11-436-0100	91-11-436-1018
NEERI National Environmental	Noname	Nagpur		
Neptune Equipment Ltd	S.P. Shah	Bombay 400 023	91-22-266-5778	91-22-266-4536
New House Marketing	K.S. Prabhakar Rao	Secunderabad	011-91-844740	
Neyveli Lignite Corp. Dist.	Mr. S. P. Varma	Tamil Nadu	91-4148-22280	91-4148-22646
Nippon Denro Ispat Ltd.	Mr. M. L. Mittal	Bombay	91-22-285-5517	91-22-285-5519
Nirma Ltd.	Mr. Karsanbhai Patel	Ahmedabad	401722	656-9136
Nuchem Limited	Dr. N. Sriram	Faridabad 121 006	91-129-285-401	91-129-283-902
Oil & Natural Gas Commission	Mr. B. C. Bora	New Delhi	91-11-332-0973	91-11-331-3028
Optem Engineering Consultants	Ranjan Goel	New Delhi 110030	6893191	
Orient Paper & Industries Ltd.	Mr. K. P. Singhi	Calcutta	91-33-220-1680	91-33-243-0490
Orion Electrostatics & Systems	C. M. Bagga	Bombay	91-22-8222864	91-22-8225896
Oswal Chemicals & Fertilisers	Noname	New Delhi	91-11-371-5242	
Panacea Biotec Ltd.	Noname	New Delhi	91-11-6842195	91-11-6840199
Paragon	Gulshan Kumar Jawa	Chandigarh UT		
Paramount Pollution Control Lt	R.V. Kadam	Baroda 390 007	91-265-336-111	91-265-336-251
Parekh-Micro Electronics	Mr. R. J. Parekh	Bombay	91-22-516-4798	91-22-515-2219
Pasupati Acrylon Ltd.	Mr. Mukesh Jain	New Delhi	91-11-371-4944	
Phillips Carbon Black, Ltd.	Noname	Calcutta	2208515	2480140
Phosphate Company Ltd. (The)	Suresh Bangur	Calcutta 700 001	91-33-220-0771	91-33-220-0636
Pittie Renewable Energy System	Ravi Pittie	Pune 411 014	91-212-680-792	91-212-680-150
PPDC: Process & Product	Dr. Rao or S.A.T. Rizvi/ Delhi	Agra	91-562-44673	

Company	Contact Name	City	Primary Phone	Primary Fax
Praj Industries	Mr. N.S. Kunkolikar	Shivajinagar, Pune 411 004	91-212-34-9400	91-212-32-1689
Praneet Enviroquips Pvt. Ltd.	P. K. Gupta	Chandigarh 160 002	91-172-603-753	91-172-547-187
Premier Ziba	Govind Srivastava	New Delhi 110 020	91-11-681-0353	91-11-644-2361
Protech Consultants Pvt. Ltd.	Ravi Narasimhan	Madras 600 018	91-44-499-0416	91-44-499-2167
Prudential Mouli Sugars Ltd.	Mr. P. M. Nair	Hyderabad	598938	598812
Punjab Agro Industries Corp.	Noname	Chandigarh	91-172-651622	91-172-40398
Pure Tech Engineering PVT	B. Ravi	Madras 600 006	91-44-543-015	91-44-434-2247
Pure Water Systems Pvt. Ltd.	Noname	Madras	866638	
R.J. Shah & Co. Ltd.	R.J. Shah	Bombay 400 037	91-22-415-0180	91-22-414-9242
Rajasthan Electronic &	Mr. M.P. Jindal	Sirsi Rd, Jaipur 302 012	91-141-367841	91-141-312701
Recon Ltd.	S. Jayaprakashmady	Bangalore	602142	
Refnol Resins & Chemicals	Noname	Bombay	91-22-2615824	91-22-2615811
Reliance Industries Ltd.	Mr. Anil Ambani	Bombay	91-22-282-6070	91-22-204-5577
Renewable Energy Systems Ltd.	T. Anjaneyulu	Hyderabad 500 855	91-40-896362	91-40-895807
Reva Enviro Systems	B.B. Bhalerao	Nagpur 440 010	91-712-533120	91-712-527009
Ritu Overseas	Rajiv Singhal	New Delhi 110 001	91-11-378-2294	91-11-38-9293
Saaz Con (P) Ltd.	Syed Ali Zaheer	Hyderabad	225047	
Samarth Enterprises	Mukund Holkar	Nasik	011-91-0253-70089	
Saroj Trade Link	Amit N. Sinha	New Delhi 110 070	91-11-689-2205	91-11-689-6454
Seamak Hitech Products	Mr. Arvind Rajan	Bangalore 560 038	91-80-526-6644	91-80-227-4405
Seven Hills Consultancy	Prakash Hingway	Nagpur 440 010	91-712-531504	91-712-536529
Shayoka Consultants (P) Ltd.	Jay Swaminarayan	New Delhi 110 034	91-11-727-4285	91-11-727-7364
Shree Industries & Services	S. Gupta	Bangalore, Karnataka 560 027	91-80-223-6755	91-80-221-4748
Shriram Industrial Enterprises	Surendra Kumar	New Delhi	500190	
Shriram Inst. for Indust. Res.	R.K. Banerji	New Delhi 110 007	91-11-725-7267	91-11-725-7676
Shriram Institute for	R.K. Banerji	New Delhi 110 007		
SK Systems Private Ltd	S.K. Chaudhary	New Delhi 110 008	91-11-571-2329	91-44-575-1612
Sneha Laboratories (P) Ltd	B.R. Lakshimi	Madras 600 001	91-44-511-033	91-44-522-3928
Solapur Chemicals Pvt. Ltd.	Mr. H.E. Godbole	Solapur 413 001	91-217-651-854/652-8	91-217-601-489/612-9
Southern Alloy Foundries	Kandaswamy	Aminjikarai, Madras	421855	
Southern Pesticides Corp.	Noname	Hyderabad	30237	
SPIC Electric Power Corp.	Mr. P.R. Sundaravadivelu	Madras	91-44-826-1287	91-44-825-5798
SRF Ltd.	Noname	New Delhi	91-11-331-8155	
SSIF Standard Steel & Iron Fou	Mahendra Nath Kaushal	Jeoni Mandi, Agra	562 265421	562 363055
Subhash Projects&Marketing Ltd	Sushil Sethi	New Delhi 110 020	91-11-684-4980	91-11-684-6003
Sudarshan Chemical Industries	Prakash S. Kulkarni	Pune, Maharashtra 411001		
Sudarshan Chemical Industries	Ramesh Ukidve	Pune 411 001	91-212-667-334	91-212-643-400
Sunrise Process Equipments Ltd	Joy Kutty	Baroda 390 010	91-265-444958	91-265-445142
Suraj Foundry	Rakesh C. Jain	Agra 282 006	91-562-344802	91-562-344802
Suraj Foundry	Rakesh Jain	Agra 282 006	91-562-363-647	91-562-344-802
Swarg Farm	Bhupender Singh Johl	Rampur		
Tamil Nadu Newsprint & Papers	Noname	Madras	91-44-235-0758	91-44-235-0834
Tamil Nadu Pollution Cntrl Bd	R. K. Jayaseelan	Madras 600 044	91-44-402417	
Tata Consultancy Services	Mr. K. Sudarshan	Bangalore 560 052	91-80-225-8376	91-80-220-3337

Company	Contact Name	City	Primary Phone	Primary Fax
Tata Consulting Engineers	N.J. Patel	Bombay 400 025	91-22-430-2419	91-22-437-4402
Tata Energy Research Institute	Raj Kumar Prasad	New Delhi 110 003	91-11-462-2246	91-11-462-1770
Techmann/Aero-Tech Engineers	D. K. Chakrabarti	New Bombay 400 701	91-22-769-2387	91-22-534-0263
Terai Tea Co., Ltd.	Mr. Rajendra Kanodia	Calcutta		289182
The B+ Company	Rajat Sood	New Delhi 110 029	91-11-601-462	91-11-687-7265
The National Indust. Dev. Corp	S.R. Sapra	New Delhi 110 021	91-11-670-153/55	91-11-687-6166
The Pioneer	K. Giriprakash	New Delhi 110 002	91-11-375-5271	91-11-375-5275
The Tata Iron and Steel Co Ltd	Sourav Daspatnaik	Calcutta 700 071	91-33-247-7051	91-33-40-3556
Thermax Babcock & Wilcox Ltd.	A. Chaudhuri	Pune 411 034	91-212-771745	91-212-770533
Toshniwal Instruments PVT Ltd	Mr. H.M. Shah	Bombay 400 018	91-22-492-3979	91-22-493-6166
Total Technology & Solutions	Dr. T.G. Sundar Raman	Madras 600 008	91-44-826-3048	91-44-828-0963
Tracko International	Sanjay Garg	Agra 282 006	91-562-344-108	91-562-344-577
Transoft International	Ram Tripathi	City, Hosur Rd. Bangalore	91-80-422824	91-80-422824
Trivsons Systems	M.K. Dutta	Secunderabad	91-40-771-5334	91-40-771-2336
Tubes Products Ltd.	Mr. A. R. Nagaraja	Pune	91-212-422135	91-212-422135
U.P. Laaghu Jal Vidyut Nigam	A.K. Hangal	Lucknow 226 019	91-522-226904	91-522-248075
Unidyne	Ashok Singh	Bombay 400 054	91-22-614-6826	91-22-649-6553
Unidyne	Mohan S. Iyer	Bombay 400 054	91-22-614-6826	91-22-649-6553
Uniexcel Agencies & Services	S. Nagaswami	Ahmedabad 380 054	91-79-461-621	91-79-121-7100
US AID	Rajat Jain	New Delhi 110 016	91-11-686-5301	91-11-686-8594
US Consulate General	Robert K. Boggs	Calcutta 700 071	91-33-242-3611	91-33-242-0544
USAID-Office Tech. Dev. & Ent.	Amitabha Ray	New Delhi 110 016	91-11-686-5301	91-11-686-8594
USAID-Office Tech. Dev. & Ent.	Dick Goldman	New Delhi 110 016	91-11-686-5301	91-11-686-8594
Utility Equipment & Management	P.C. Khannah			
V.K. Verma & Co.	Virendra Kumar Verma	New Delhi 110 001	91-11-332-5811	91-11-332-0925
V.R.S. Ferro Alloys Pvt. Ltd.	Mr. G. N. Rajasekaran	Madras		
Vam Organic Chemicals Ltd.	Mr. Shyam Bang	New Delhi 110 001	91-11-332-9442	91-11-332-9441
Varun Enterprises	Mr. Chatterjee	Gandhi Marg, New Delhi	3314214	3712108
Ventair Pvt. Ltd	Mr. Kumar & Mr. R.A. Lokaiyan	Madras 600 020	91-44-491-3741	91-44-491-0733
Vijay Dairy & Farms Products	Noname	Tiruchirapalli		
Vikram Ispat	B. R. Nahar	Bombay	91-22-2043454	91-22-2851120
Vikram Ispat	Mr. Nishant Tanksale	Bombay	91-22-204-3454	91-22-285-1120
Vikram Projects Ltd	Mr. Sumit Shah	Lower Parel, Bombay 400 013	91-22-492-3511	91-22-493-8700
Vimta Labs Limited	Dr. S. P. Vasireddi	Hyderabad 500 051	91-40-624-141	91-40-623-657
Voltas Limited	D.K. Kelapure	Bombay 400 023	91-22-272-118	91-22-261-8504
Voltas Limited	Mr. A.H. Tobaccowala	Bombay 400 038	91-22-261-8131	91-22-261-8504
VST Tillers Tractors Ltd.	Mr. V. P. Mahendra	Bangalore	851-0805	
Waste Minimization Group	Chitranjan Desai	Surat 395 002	91-261-631964	91-261-635858
Watreat Engineers (I) Pvt.	Ajit Mehta	Bombay	91-22-688593	
Western Paques India Ltd.	Chandan P. Gadgil	Pune		
Western Waterford Pvt. Ltd.	N. B. Thadani	Bombay	91-22-5600024	
World Link Corporation	Vikram Ohri	New Delhi 110 029	91-11-542-9616	91-11-688-7692
WS Industries, Ltd.	Mr. Narayan Sethuramon	Madras	91-44-482711	91-44-482-8495
Xavier Labour Relations Inst.	Suman K. Mukerjee	Jamshedpur	011-91-0657-310173	011-91-0657-427814

Company	Contact Name	City	Primary Phone	Primary Fax
Yokogawa Blue Star Ltd.	C.L. Madan	Bangalore 560 001	91-80-211513	91-80-214270

TOTALS

397 records printed.

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Annex I

September 6, 1994

TO: Mr. Paul Keller
DynCorp Meridian

Ms. Jeanne Maltby
KBN Engineering

Ms. Azita Yazdani
Pollution Prevention International

Mr. Dan Bradbury
Sheladia

FROM: Jeff Hallett
TEST Project Manager

Subject: Assessment of TEST Technology Searches and Plans for 1995

Background

Since assuming management responsibilities for the TEST program in August 1993, Sanders International (SI) has, on behalf of ICICI's TEST Group and its Indian clients, commissioned thirteen technology search reports. Twelve of these reports were drafted by Sanders International sub-contractors. Table 1 shows the subjects of the reports and the firm responsible for their preparation.

Given the high demand perceived by TEST project designers for timely and accurate information on U.S. environmental firms, their products, technologies and services, the technology search portion of TEST's technical assistance component has been recognized as one of the most important service areas the TEST program offers. From the outset of the program, this area has also been recognized by both the Indian and U.S. sides of the TEST program to contain some of the most difficult tasks. This is due to: the variety and complexity of environmental technologies, widely differing operating conditions and regulatory environments, different technical and business approaches to resolution of pollution problems, and the need to provide highly specific "street smart" information at low cost.

In August 1993 kick-off meetings with ICICI's TEST Group, Sanders project management spent the bulk of the time discussing the TEST Group's understanding of the nature of

demand among their clients for technology search data, as well as the problems and short comings of the technology search information provided to ICICI by TEST's interim contractor. As a result of these meetings, SI's analysis of the problem and synthesis of the TEST Group's input, SI drafted and circulated the Annex A document "TEST Technology Searches Proposed Approach" as an annex to the 1993-1994 TEST Workplan. SI circulated the "Approach" document to TEST sub-contractor firms for use as a general guide in preparing the technology search reports.

ICICI Comments on Technology Search Reports and Approach

Based on discussions with ICICI TEST Group members and a meeting with one of the Indian firms that had commissioned a technology search for automotive catalytic converter technologies, the general reaction to the TEST technology searches by ICICI's Indian clients has been that they have not been useful. While the information has been of general interest, the reports have not played a significant role in moving the Indian clients toward business linkages with U.S. firms. Both SI and the Test Group agreed it would be a top priority to review and improve the technology search procedures and output.

After considering all comments from and discussions with Indian clients, SI and the TEST Group agreed that the reports have been insufficiently focussed on the technical problems or issues of greatest concern to the Indian firms. One Indian manager stated that he believed that he could have gathered most of same information provided in the report by sending one of his employees to do research in the U.S. consulate's commercial library. While perhaps an overstatement, the observation is indicative of an inadequate accounting on TEST's part of the existing knowledge base and technological sophistication of the Indian firms.

One fundamental problem seems to be that the Indian firms' underlying questions or problems have not been sufficiently isolated and defined. For example, the firm that commissioned a report on automotive catalytic converter technology was really only interested in finding a U.S. firm that could transfer technologies for the manufacture of metal monoliths. An Indian firm that requested a report on recovery and re-use technologies for rice husk ash was really only interested in new processes for the recovery of industrial-grade silicon from the ash. Neither of these points emerged clearly until some months after the initial technical assistance request had been made. Before technology searches are commissioned, efforts must be made to draw out the Indian firms' true priorities in order to avoid wasted effort and cost and the reporting of unneeded information. This will be the responsibility of SI and the TEST Group.

A second fundamental problem is that most of the information in the technology search reports seems to have been drawn largely from generally available sources like magazines, company brochures, textbooks and association contacts, rather than the professional know-how and experience of the report drafter or contacts with expert individuals involved in the specific industry technology area. The kind and quality of "street smart" information we need in the technology search reports can, realistically and economically, can only come be provided by true industry/technology experts and not from basic research efforts or literature searches.

Therefore, the individuals that conduct these searches must either possess the required knowledge and experience or be able to draw upon personal networks of individuals that have this expertise.

Finally, ICICI's policy of collecting a fee from their Indian client firms amounting to 25% of the U.S. costs of the searches has highlighted another problem with respect to TEST's technology search efforts. While the first dozen reports were done on a no-fee basis, since the beginning of the year, ICICI has not commissioned any reports without first having the Indian firm's commitment to pay the technical assistance fee. To date, only two Indian firms have agreed to pay the technical assistance fee out of ten pending technical assistance requests. In order to execute the technical assistance component of the TEST program, SI and the TEST Group agreed that we must not only improve the quality and utility of the technology searches, but also bring down the costs to a level that the Indian firms will be more willing to pay. This requirement underscores the need to put the technology search questions to individuals that can quickly provide information required without extensive and prolonged research efforts.

1995 Goals

By intensively focussing the questions and problems before submitting tasks to the subcontractor firms, SI and the TEST Group hope to **increase the number of technology search reports that can be done, reduce turnaround time for the reports and reduce the costs of the reports.** To put it in another way, we will not be able to do technology searches unless the Indian firms agree to pay for a portion of them. The Indian firms will not agree to pay unless the reports are cheaper and clearly of value to them. The reports will not be cheaper unless they are much more narrowly defined and able to be completed very quickly by very knowledgeable U.S. experts.

1995 Actions

1. In light of the past year's experience and the reaction of the Indian clients to our efforts, the **technology search approach in Annex A will be modified** to provide a narrower band of guidance.

2. SI and the TEST Group have agreed to **re-double efforts to better focus and clarify future technical assistance requests**. This means the TEST Group and SI will conduct a more intensive iterative effort to help the Indian client define what it is they are really seeking. In so doing, we hope to be able to offer an information product to the Indian client firm that will be of sufficient quality and value that he or she will be willing to pay the technical assistance fee, and more importantly, that the results will have a better prospect of leading to a TEST-financed commercial transaction.

3. **Future reports will be designed on a case-by-case basis consistent with the modified technology search approach**. An outline and cost estimate for each report will be prepared by SI and submitted to the TEST Group for client approval. Conference calls involving the

Indian clients, sub-contractor personnel, the TEST Group and SI will be arranged to insure full understanding by all parties about what information is required. Additional calls may be arranged, as needed. Sub-contractor costs in this project development stage will be billed separately from the technology search itself.

4. Prior to beginning work on technology search reports, SI would like a manager/supervisor from the subcontracting firm (in collaboration with SI) **to assess the clarity of the task assigned and confirm, either verbally or in writing to SI, understanding of the exact nature of the final report desired.** If additional information of any kind is required, the manager/supervisor should work with SI to secure what is needed.

5. **Technology search reports should not contain verbiage explaining deficiencies in the presentation of the task, lack of background information, or other rationale.** We will resolve such deficiencies prior to drafting of the report.

6. Subcontractor personnel who execute the technology searches must have a high level of expertise and industry knowledge in the technology areas assigned. Prior to commissioning sub-contractor reports, **SI would like subcontractors to designate the personnel nominated to do thereports and, in not on file with SI, submit their curriculum vitaes.** For specialized requests that may exceed the in-house capabilities of subcontractor firms, SI may suggest technical experts to be engaged for these tasks or the subcontractor may propose experts from their own sources.

Additional guiding principles for future technology searches

1. Future technology search reports should assume an expert-level of knowledge by the Indian client of the technology area under study. Most of the Indian clients dealt with to date are already in business in the technology area or a related technology area under study or evaluation. We can assume they know what all the current treatment processes are and generally how they work.

2. However, the Indian clients are very **interested in details of the treatment processes that might either recommend them for or against use in India.** Ideally, individuals conducting technology searches will possess and be able to communicate detailed knowledge on the intricacies of various treatment processes.

3. The Indian clients are especially **interested in metrics that will help them compare different technological approaches**. Our efforts should be aimed at **defining differences among technological or treatment alternatives and ways of quantitatively demonstrating these differences**. Metrics include but are not limited to: acquisition, operating and maintenance costs, energy costs, treatment costs per unit, and efficiency measurements of various sorts.

4. **Cost is an issue. If it's cheaper it's better**.

Table 1
TEST Technology Searches
August 1993-August 1994

Air Pollution Control Equipment	KBN Engineering	September 1993
Reverse Osmosis Technologies	KBN Engineering	September 1993
Removal & Re-use of Chromium in Tanneries	Pollution Prevention International	September 1993
Anaerobic Sludge Digestor Technologies	KBN Engineering	September 1993
Treatment of Coke Oven Wastes	Sanders International	September 1993
CNG Conversion Kits	Dyn-Corp/Meridian	September 1993
Reactor Clarifiers	KBN Engineering	September 1993
High BOD Removal Systems	KBN Engineering	September 1993
Catalytic Converter Technology	Dyn-Corp Meridian	September 1993
BOD Reduction in Distillery Wastes	Pollution Prevention International	January 1994
Metals Removal from Wastewater Streams	Sheladia	February 1994
Solid Waste from Caustic Chlorine Plants	Dyn-Corp/Meridian	July 1994
Treatment of Cyanide-Bearing Wastes with Hydrogen Peroxide	Dyn-Corp/Meridian	July 1994

SANDERS INTERNATIONAL
BUDGET PROPOSAL FOR COMPANY/TECHNOLOGY SEARCH

Date: April 12, 1996
Project: TEST
Client: Solapur Chemicals Pvt. Ltd.
Subject: Sand Reclamation Equipment

Assistance Requested:

Solapur Chemicals Pvt. Ltd. manufactures resin coated sand and ferrous castings.The coated sand is used as a raw material by foundries producing iron, steel and aluminum castings. The company uses silica and phenolic resin as a raw material for its castings.

This company is interested in installing a sand reclamation plant which will be the first of its kind in India. The plant will allow Solapur Chemicals to reduce the consumption of new silica by recycling once-used sand. Initially, Solapur Chemicals would like to buy sand reclamation equipment from the U.S.. Subsequently, however, they would like to acquire the technology license to design and manufacture sand reclamation equipment for end users in other parts of India.

To assist Solapur Chemicals in this task, Sanders International (SI) will contact the 20 companies specializing in sand reclamation systems that are in the list provided to us in Solapur's proposal. We will use our environmental technology databases and determine through telephone conversations whether these companies have products appropriate for the Indian market and whether they have any interest in doing business in India. Based on past work with sand reclamation firms, we will contact another 10-15 companies to assess if they have the appropriate sand reclamation technologies.

After reviewing approximately 35 of these companies, we will report on those we believe are most interested and qualified (between 5-10 firms) to enter into a commercial dialogue with Solapur Chemicals. We will clarify the nature of the business relationship Solapur Chemicals is interested in and conduct detailed interviews with each company to determine whether their technologies match Solapur Chemical's objectives and capabilities.

Proposed Technical Assistance

1. **Verify company list:** SI will contact the companies specified in the proposal sent to us to verify if they produce the appropriate sand reclamation technologies.

11. **Send proposal to each company**: Based on the results of the above discussions, SI will prepare a shortlist of companies that are interested in doing business in India and that manufacture the appropriate sand reclamation technology. SI will send copies of Solapur Chemicals' proposal to each of these companies.

lll. **Contact additional companies:** SI will use its environmental databases and contact an additional 10-15 companies by phone to determine if they have sand reclamation technologies of relevance to Solapur Chemicals. Based on the results of these phone interviews, SI will also send Solapur Chemicals'proposal to these companies.

IV. **Follow up**: At this stage, SI will follow up with all the companies that have received Solapur Chemicals' proposal. We will determine if these companies are interested in doing business in India with Solapur Chemicals. Based on the results of these phone interviews, we will prepare a shortlist of U.S. companies.

V. **Prepare report and provide company materials:** SI will provide a report on the technologies supplied by the firms that have been contacted as well as brochures and literature on all qualified U.S. firms.

References

We estimate that the above task will take one week of technical assistance time. The task should be completed within four weeks of start-up, allowing for key U.S. companies to receive information on Solapur Chemicals and send their technical qualifications and corporate capabilities to Sanders International.

Cost Breakdown and Timing

		Rate	Units	Amount
I.	Salaries Mid-Level	$20.19/hour	40	$807.6
II.	Overhead (Fringe plus Indirect Costs)	$31.54/hour	40	$1216.6
III.	Other Direct Costs (Phone, Fax, Xerox)			$200.00
IV.	Total Estimated Costs (Items I through III)			**$2269.2**

Task to be completed within four weeks of authorization

2.2.1

TEST PROJECTS

TEST Business Missions and Delegations

The following exchanges took place through the United States Asia Environmental Partnership (US-AEP)/World Environment Center (WEC) Environmental Business Exchange program from October, 1993, to June, 1995. These exchanges were implemented on a cost share basis with the TEST program.

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Name: Evaluation of Incinerator Technology
Destination: U.S.
Date: October, 1993 and December, 1993
Exchange: B. Ravi of Pure Tech Engineering toured U.S. facilities to evaluate incinerator technology for chemical and other hazardous waste industries in the Madras area. He identified International Technology Corp's (IT Corp) rotary kiln incinerator as the appropriate technology for his proposed project. In December, 1993, Pure Tech representatives, A. Goldwin Joseph and R. Narasimhan visited the Sikes Incinerator facility operated by IT Corp to evaluate the feasibility of transferring IT Corp's

technology to India.
Venture: Pure Tech Engineering has completed discussions with IT Corp to establish a technology licensing agreement for IT corp's rotary kiln incinerator. Securing project financing is in the final stages.
Project Cost: The estimated value of this project is $25 million.
Status: A full engineering cost study has been completed, and efforts are underway to secure the necessary commitments from waste generators in Madras.

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Name: Diesel Emissions Control Technology
Destination: India
Date: October, 1993
Exchange: Jim Silvers, Ram Rathi, Louis Harms, and Glenn Dunmire of Fluid Power Incorporated (FPI) went to India to demonstrate a real pressure control valve for use in diesel engine emissions systems to reduce particulate emissions.
Venture: N/A
Project Cost: N/A
Status: Closed

Table of Contents

Name: Air Filter Technology Evaluation
Destination: U.S.
Date: October, 1993
Exchange: D. Chatterji, INALSA, visited the U.S. to identify cost effective air filter technologies and options that might be introduced in India. U.S. manufacturers included in the tour were Pneumafil Corporation, Donaldson, Northland Supercell, Dorr-Oliver, Air Cleaning Specialists of California, and Room Cleaning Engineering.
Venture: Inalsa/Varun Enterprises has entered into a technology licensing agreement with Pneumalfil Corporation to manufacture air intake filter technology for gas turbines.
Project Cost: The value of this project is $.7 million out of which $ .4 million was financed by ICICI.
Status: The loan for this project was sanctioned by the ICICI in June, 1995.

Table of Contents

Name: Linductor Recovery System
Destination: India
Date: November, 1995
Exchange: Christian Lint of Yankee Environmental Services and Catherine Clerf of CAC International met with a number of Indian firms to introduce their technology for vacuuming spilled oil to the Indian market. Meetings were conducted with Mahindra and Mahindra, Madda Controls and Ion Exchange.
Venture: Sale of the Linductor to appropriate clients and possible licensing or distribution of this oil spill clean-up technology.
Project Cost: 200,000 per Linductor Unit
Status: In early 1996, Yankee Environmental Services shipped the first sale of two units to India. Testing and evaluation of the Linductors under Indian conditions is scheduled for April 1996. Upon successful testing, the Indian Coast Guard plans to use the Linductors, for emergency oil spill response and other harbor clean-up work.
See Case Profile

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Name: Real Time Toxic Emissions Monitoring Systems
Destination: India
Date: November, 1993
Exchange: K3 Corporation manufactures software systems to integrate environmental sensors, computers, and telecommunications to provide effective industry analytical and management tools. In this activity, Kris Kudrnac of K3 Corporation went to India to meet with C.G. Hartmen and Braun, Blue

Star Ltd., and Assorted Instruments Manufacturing.
Venture: N/A
Project Cost: N/A
Status: Closed

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Name: Fluidized Bed Chemical Recovery Systems for Paper Mills
Destination: India
Date: November, 1993
Exchange: Enders Process Equipment uses a fluidized bed reactor system to recover pulping chemicals and destroy organic pulping residue by thermal oxidation. Under this exchange, Joseph Enders met with several Indian companies interested in this technology including: UP Straw and Agro Products, Ltd.; Grasim Industries; Harihar Polyfibers Ltd.; Shreyans Paper Mills, Ltd.; West Coast Paper Mills, Ltd.; Shiva Paper Mills, Ltd., ABC Paper Mills, Ltd.; and Zenith Papers.
Venture: Enders has entered into a technology licensing agreement with Agro Pulping Machinery, Ltd. of Madras to manufacture and supply the fluidized bed incinerator system for the pulp and paper industry. Enders and Agro Pulping have signed an agreement to install the first system in Shreyans Paper Mills.
Project Cost: The total project cost is $4.1 million, and $1 million has been approved by the ICICI as a conditional grant.
Status: The engineering design for the plant in Sheryans has been finished, and it is expected the plant will be completed by mid-1996
See Case Profile

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Name: Oil Absorbent Demonstration
Destination: India
Date: November, 1993
Exchange: Ab-Sorb manufactures a low-material for use in cleaning and absorbing spilled oil and other substances. Potential applications for this technology range from shop floor use to major oil spill response activities. The company believes that there is enormous potential for recovery and re-use of spilled petroleum products using Ab-sorb products. Under this exchange, Jack Wallace of Absorb explored the potential for forming joint ventures with Indian partners. Eventually they identified one company, Ferro Alloys Corporation, to work with them in conducting feasibility and market studies.
Venture: Memorandum of Understanding
Project Cost: N/A
Status: Ongoing

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Name: Industrial Wastewater Treatment Technology Assessment
Destination: U.S.
Date: December, 1993
Exchange: Representatives of Ion Exchange traveled to the U.S. to evaluate wastewater treatment technologies relevant to the pulp and paper, tannery, and iron and steel industries. U.S. industries included in the tour were: Kinetic Recovery Corporation; Kinetico Engineered Systems, Inc., Memtek Corporation, Osmonics Incorporated, Koch Membrane Systems, Green Bay Packaging, Black and Veatch, Zimpro Environmental, Krupp Wilpute Corporation, and Thetford Systems, Inc. Ion Exchange was represented by Dr. Satish Chilekar, Ravi Vaidya, and T. Chandran.
Venture: Koch Membrane Systems signed a distributorship agreement with Ion Exchange to market thin membrane technology for pulp and paper treatment.
Project Cost: N/A
Status: Closed

Table of Contents

Name: Auto Exhaust Emissions Control Demonstration
Destination: India
Date: January, 1995
Exchange: Officials from Lean power demonstrated technology for retro-fitting non-catalytic convertor equipped vehicles with exhaust emissions control systems that promise to significantly reduce air emissions. Lean Power representatives met with Lucas-TVS, Lucas Indian Service, Mahindra and Mahindra, Maruti Udyog Ltd., Premier Automobiles, Hindustan Motors, TATA Engineering and Locomotive, Telco, and the Automotive Research Association of India.
Venture: Lean Power signed a Memorandum of Understanding (MOU) with Automotive Research Association of India to test and adapt its product for the Indian market.
Project Cost: N/A
Status: Lean Power and the Automotive Research Association of India are under negotiation to establish a joint venture with a major Indian auto components manufacturer.

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Name: Shriram Industrial Enterprises Limited (SIEL) Environmental Management and Safety Systems Study
Destination: U.S.
Date: January, 1994
Exchange: Surendra Kumar of SIEL visited the U.S. to evaluate technology related to environmental management and safety techniques in the chemical and aquaculture industries and in industrial parks, and fly ash utilization in thermal power plants. SIEL evaluated the cost effectiveness of these various technologies and options for them to be utilized in India. U.S. facilities included in the tour were: Research Triangle Foundation; Southern Star Shrimp Farm; Harlingen Shrimp Farm; Texas A&M University; Aquaculture Research Center; Aquaculture Management Association; Dow Chemical Company; Radian Corporation; Tellico West Industrial Properties; Big River Conversion Systems, Inc.; Ferro Tech; and E.I. Du Pont de Nemours and Company.
Project Cost: N/A
Venture: N/A
Status: Closed

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Name: Nuchem Wastewater Treatment Evaluation
Destination: U.S.
Date: February, 1994
Exchange: Nuchem, Ltd. has been working in the field of wastewater and effluent treatment based on electrodialysis and membrane technologies using reverse osmosis. In order to expand their understanding of biologically based wastewater treatment technologies, they came to the U.S. to have discussions with various U.S. organizations. Nuchem was represented by Dr. N. Sriram.
Project Cost: N/A
Venture: N/A
Status: The trip resulted in an ongoing business collaboration between Nuchem and the Radian Corporation of Denver, Colorado for environmental lab services and wastewater treatment projects.

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Name: Corporate Environmental Program
Destination: U.S.
Date: April, 1994
Exchange: Indian industry executives visited state development agencies in Washington, California, and Colorado. The US-AEP/WEC-sponsored representatives were: Subir Gupta, Assistant Manager, Tata Risk Management Services; R.K. Banerji, Shriram Institute for Industrial Research; Ashok Panjwani, Vice President, United Phosphorous Ltd., A.V. Kane, Manager, Gujarat Alkali and Chemicals, Ltd., K. Harinathan, Manager, Industrial Credit and Investment Corporation of India. The TEST-sponsored representatives were: Dr. S.K. Saxena, Dy. Director, National Productivity Council, Mr. P.P. Lahiri, Sr.

Consultant, Associated Chambers of Commerce; Mr. B.F. Salunia, Member Secretary, Gujarat State Pollution Control Board; and Mr. R. Kannan, Asst. General Manager, ICICI.
Project Cost: N/A
Venture: N/A
Status: N/A

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Name: Clean Technology for Paper Mills
Destination: U.S.
Date: July, 1994
Exchange: ThermoChem, Inc./Manufacturing and Technology Conversion International (MTCI) have developed a technology for eliminating water pollution from mini-paper mills and distilleries while simultaneously recovering chemical and energy. Mr. V.S. Venkataraman, Managing Director and Dr. M. Mahalingam, General Manager of Esvin Tech traveled to the U.S. to evaluate the application of this technology at Mead pulp mill and Weyerhauser pulp mill.
Venture: Thermochem/MTCI has licensed its technology to Esvin Tech. Esvin Tech plans to manufacture and market this technology in India. They expect to install this technology in Delta Paper mills.
Project Cost: N/A
Status: Delta Paper Mills has applied to the ICICI for project financing to support the installation of Thermochem/MTCI's technology.
See Case Profile

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Name: Indian Boiler Manufacturers Association (IBMA) Assessment of Environmentally Friendly Boiler Technology
Destination: U.S.
Date: June, 1994
Exchange: Delegates from the Indian Boilers Manufacturers Association (IBMA) visited the U.S. to evaluate the latest in fuel-efficient boilers and environmentally friendly boiler related technology. The delegates were represented by D.B. Baldawala, Director, Industrial Boilers Ltd., V.N.G. Rao, Managing Director, Ignifluid Boilers India, Ltd., Mr. C.R. Engineer, Vice President, Marketing, Mr. G. Trivedi, Director, Thermax Ltd., Mr. M.S. Walia, Director, Walia Engineering Associates Pvt. Ltd. The delegates visited the following U.S. companies: Beltran Associates; Research Cottrell; American Schack; Johnson Matthey; Houston Lighting and Power Co. & Castone International; Sellers Engineering Co.; Henry Vogt Machine Co.; and John Zink Co.
Venture:

1. Castone International, which has developed a unique machine that makes bricks from fly ash, signed a Memorandum of Understanding (MOU) with Industrial Boilers to develop sales for their machine in India.
2. Ignifluid has entered into a technology licensing agreement with Tampella to manufacture Tampella's fluidized bed boiler technology in India.

Project Cost: The total project cost for the Tampella/Ignifluid deal was $1.5 million out of which $.9 million was financed by ICICI.
Status: Closed

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Name: Premier Ziba: Evaluation of Biotreatment Alternatives for Industrial Wastewater Treatment
Destination: U.S.
Date: June, 1994
Exchange: Under this exchange, representatives of Premier Ziba visited U.S. Biotech Inc., to explore the possibility of using U.S. Biotech's bacterial formulations to treat industrial wastestreams in India. The two companies had detailed discussions on test marketing U.S. Biotech's products to sugar processing, tannery and sewage treatment industries in India.

Venture: While in the U.S., the two companies signed a formal distribution agreement.
Project Cost: N/A
Status: Since U.S. Biotech's bacterial formulations have not been tested in India, they need to have the approval of the Department of Biotechnology of the Government of India as well as the Customs Authorities of the Ministry of Environment. Premier Ziba submitted these approval vehicles in August, 1994 and, in early 1996 received authorization to import.

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Name: Nuchem Weir, Ltd.: Evaluation of Various Environmental Technologies
Date: October, 1994
Exchange: Two representatives of Nuchem Weir, Ltd. came to the U.S. to evaluate:

1. water pollution control equipment;
2. agricultural waste construction design materials; and
3. analytical laboratory facilities. With regard to these, they visited Biotrol Corporation, Toma International, and Radian Corporation. Nuchem representatives included Dr. N. Sriram and Mr. P. Barar.

Venture: N/A
Project Cost: N/A
Status: On going

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Name: Uniexel Agencies and Services Pvt. Ltd
Destination: U.S.
Date: April, 1995
Exchange: Uniexel Agencies & Services Pvt. Ltd., based in Ahmedabad, visited the U.S. to identify potential U.S. partners for manufacturing stainless steel filters and filter components for treating effluent wastes from the chemical and petrochemical industries. Uniexel visited companies specializing in laser welding, microplasma welding, porous stainless steel filters and their components. U.S. companies included in this tour were: Alabama Laser Technologies, Applied Energy, Inc., Martin Kurz, Inc., Texcel, Inc., Jetline Engineering, Inc., Perforated Tubes, Inc., Utilase, Inc., and Weldlogic, Inc. Uniexel was represented by Mr. S. Nagaswami.
Venture: N/A
Project Cost: N/A
Status: Uniexel is currently conducting a feasibility study to determine volume and size of equipment and will follow up with the U.S. companies by the end of 1995.

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Name: Vimta Environmental Laboratories: Laboratory Services Technology Assessment
Destination: U.S.
Date: May 1, 1995
Exchange: Vimta Labs, Ltd., based in Hyderabad, came to the U.S. to augment the analytical capabilities of their environmental services division. Specifically they are interested in linking up with a large U.S. environmental laboratory to strengthen their capabilities in detecting dioxins and furan as well as other environmental toxins. They would also like to expand their capabilities in performing environmental impact assessments, risk assessments, and audits. Vimta visited the following companies: Environ, Tighe and Bond, Inchcape, Harding Lawson Associates, Waste Management International, EPA Environmental Research Labs (Cincinnati), EPA Environmental Research Labs (Athens), Radian Corporation, Woodward Clyde, and Roy Weston. Vimta was represented by Dr. S.P. Vasireddi, Managing Director and Dr. K.S.M. Rao, Director of Labs and Technical Manager.
Venture: N/A
Project Cost: N/A
Status: Vimta has identified four companies, including: Roy F. Weston, Radian Corporation, Inchcape, and Harding Lawson for further discussion regarding forming a strategic alliance to implement projects in India. Among these companies, Roy F. Weston expressed interest in working with Vimta. They would

like to sign an MOU with Vimta to collaborate on future projects.

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Name: Dyna-K Automotive Stampings: Catalytic Converter Technology Assessment.
Destination: U.S.
Date: May 7-May 21, 1995
Exchange: Dyna-K Automotive Stampings of Pune is interested in manufacturing metallic substrates for catalytic converters for the automobile industry. They would like to supply these substrates to coaters/loaders of precious metals, and, perhaps, subsequently do the canning operation. Dyna-K is seeking a partnership with a U.S. firm via a licensing agreement, or a joint-venture partnership in this area of manufacturing. The U.S. partner should be in a position to evaluate Indian products, participate in product development in India, assist in development of manufacturing capability in India, and finally, assist in the process of product upgrading. The U.S. companies on this tour included: Car Sound Exhaust System, Neutronics, Johnson Matthey, United Emission Catalyst, Metreon, and Combustion Associates. Dyna-K will be represented by Mr. Dias, Executive Director.
Venture: N/A
Project Cost: N/A
Status: On going. Dyna-K returned to the U.S. in June of 1996. Dyna-K is currently negotiating with one U.S. substrate manufacturer for technology tie-up to produce substrates for catalytic converters for two and three wheel vehicles.

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Name: Ventair Private, Limited: Air Pollution Control Technology Assessment
Destination: U.S.
Date: March 16-March 30, 1996
Exchange: Ventair Private, Ltd. is interested in expanding its current line of air pollution control equipment through partnerships with U.S. air pollution companies. This company currently produces fans, scrubbers, bag houses and air filtration devices. The U.S. partner should be interested in an eventual licensing agreement, however, Ventair is also interested in distribution or agent agreements with U.S. partners. The U.S. companies on this tour included: Eclipse Services, Advanced Industrial Technology Corporation, Beltran, Emtrol, Air Purification Inc., Vanaire, and Nikro Industries.
Venture: Purchase of wet ESP from Beltran for a specific industrial site in Madras; technology licensing with other firms.
Project Cost: N/A
Status: Ongoing

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Name: Western Pacques: Public and Private Hazardous and Municipal Waste Management.
Destination: U.S.
Date: April 3-April 12, 1996
Exchange: Western Pacques is the leading firm involved in solid waste management in India for Indian municipalities involving waste collection, sorting, composting, and anaerobic digestion for waste to energy project. The purpose of this visit is to meet with U.S. firms involved in providing integrated solid waste management technologies, equipment and services who would be interested in exploring the potential for collaboration with Western Pacques. The U.S. companies and organizations on this tour include: Applied Compost Consulting; California Waste Recovery; Medina Bioremediation Systems; WMX Technologies, Inc.; McGill Environmental Systems; Tighe & Bond; and the Renssaler Polytechnic Institute. Western Paques was represented by Mr. Rakesh Khana, Associate Vice President.
Venture: N/A
Status: Mr. Khana met with the chairman of WMX Technologies, Inc. The meeting was positive, and there is a potential for collaboration between the two companies.

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Name: Electronics Corporation of India Limited (ECIL): Air and Wastewater Monitoring

Destination: U.S.
Date: July 21-August 4, 1996
Exchange: ECIL is a large electronics firm currently involved in airport detector systems; medical sensors and underwater electronic monitoring devices. ECIL is trying to diversify its capabilities to provide monitors in air and wastewater monitoring. The purpose of this visit is to meet with U.S. firms who are intersted in exploring collaboration with ECIL for licensing or distribution of the U.S. monitoring devices.
Venture: N/A
Status: N/A

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Market & Business | Regulations, Laws & Policy | Technologies | U.S. Technology Providers
Indian Buyers & Contacts | Financing | Related Government Programs | Upcoming Events
Information Resources | What's New | Home

The Trade in Environmental Services & Technologies program organized a two week visit to India, February 10-24, 1995 by four U.S. environmental firms that have developed processes that employ innovative biological and chemical processes for the treatment of industrial wastes. All the U.S. participants received an almost overwhelming amount of interest from Indian environmental firms and waste generators, interested in exploring the applicability of these low cost and energy efficient technologies to Indian environmental problems. As a result of the visit, all of the U.S. firms are in the process of evaluating numerous opportunities and proposals for pilot and demonstration projects in various industrial sectors. Sanders International is working with the U.S. firms and the most promising Indian contacts to develop best prospects for commercial linkages. We expect 2-3 pilot project proposals will be submitted to ICICI's TEST group for financing over the course of the next three months.

The 1995 U.S. Bio-Treatment Delegation was organized in response to a mandate from TEST Advisory Council to direct project resources toward solutions to the environmental problems of India's small and medium scale sector. Under India's new and dynamic economic environment, smaller sized textile, tannery, chemical, metal working and food processing plants are accounting for a growing share of both output, employment and pollution. The size and nature of these smaller-sized firms has generally meant a corresponding lack of attention and resources directed at preventing or mitigating the effects of their effluents. Moreover, many of the conventional air and wastewater treatment technologies remain beyond the means of these firms. Pressures for economic growth and employment being as great as they are in a country like India, Indian environmental regulators find it difficult, if not impossible, to force these industries to deal effectively with their effluent streams or to close them down.

In this context, the market potential in India of U.S. biological treatment technologies which can be less expensive to acquire and operate, less complex to operate and much less energy intensive, becomes very interesting. The event was organized in cooperation with the Biotech Consortium of India, Ltd., India's leading organizationat mental regulators, this has presented a dilemma The firms presented and discussed their technologies at seminars with Indian business communities and environmental officials in Delhi, Madras and Bombay, organized in cooperation with Indian chambers of commerce in the three cities. Des

INDIAN FOUNDRY DELEGATION TO THE U.S.A
LIST OF PARTICIPANTS
June 10 - 24, 1995

1. Mr. M. Agarwal, Managing Partner
   Motilal Agarwal & Company

2. Mr. N. Bhargava, Director
   Kalyan Steel Products Ltd.

3. Mr. K. Dhawan
   Aakar Sheet Metals

4. Mr. D.K. Dixit, President
   Mysore Kirloskar Ltd.

5. Mr. S. Garg, Partner
   Tranco International

6. Mr. R.K. Gupta, Director
   R.K. Chain (Private) Ltd.

7. Mr. V.K. Gupta, Partner
   Arbanya Alloy Castings

8. S.P. Gupta
   ML Auto & Spare Parts, Ltd.

9. Mr. K. Harinathan, Managing Director
   Industrial Credit & Investment Corporation of India, Ltd.

10. Mr. S.K. Jain, Managing Director
    A.V. Valves Limited

11. Mr. Kandaswamy, Director
    Southern Alloy Foundries Ltd

12. Mr. A.N. Kaushal, Partner
    Kaushal Industries

13. Mr. M.N. Kaushal, Managing Partner
    Standard Steel & Iron Foundry

14. Mr. K.V. Mahidhar, Counsellor/Energy
    Confederation of Indian Industry (Southern Region)

TEST MISSION STATEMENT:

To improve environmental protection in India while increasing the productivity of Indian industry on a sustainable basis, and to encourage and facilitate profitable business linkages between U.S. and Indian firms in the environmental sector.

The Trade in Environmental Services and Technology (TEST) program is pleased to sponsor the first Indian Foundry Delegation visit to the United States. TEST, a United States Agency for International Development (USAID)-funded program, is aimed at assisting India to address its increasingly serious industrial pollution problems by encouraging and facilitating sustainable and profitable commercial linkages between Indian firms and U.S. environmental equipment and service providers. The Indian Foundry Delegation is one of the several delegations sponsored by TEST to address specific industry related pollution problems. Previously, TEST has sponsored an Indian boilers manufacturer's visit to the U.S. and a U.S. bio-treatment delegation to India. These delegation visits have led to concrete and successful business ventures between U.S. and Indian firms.

The purpose of the Indian Foundry Delegation is to:

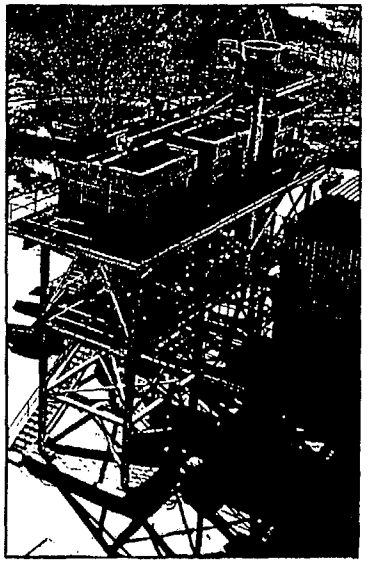
- assess appropriate and cost-effective U.S. processes, technologies and equipment that will be applied in India to prevent or control harmful emissions from the Indian foundry industry;
- create awareness within the U.S. environmental industry of Indian environmental problems, environmental business opportunities in India, and the support available through the TEST and other U.S. government programs to assist U.S. and Indian companies in forming commercial linkages; and
- provide opportunities for U.S. environmental companies to offer solutions to pollution problems in the Indian foundry industry as well as in other industry sectors.

The primary emphasis of the delegation will be on low-cost and appropriate technologies to treat air emissions [illegible] foundries. The delegation will, however, examine other critical problems relevant to their industry such as technologies for sand re-use and reclamation, water conservation and re-use in foundry applications, and energy efficient and less polluting foundry component designs.

Suraj Foundry, Agra, India, 1995

While in the United States, the group will:

- participate in the annual American Foundrymen's Society (AFS) seminar on "Environmental Concerns of the Foundry Industry" in Chicago, IL, June 11-13;
- attend the Air & Waste Management Association's (AWMA) annual convention and trade exhibition in San Antonio, TX, June 18-21; and
- meet with various U.S. private companies that specialize in environmental technologies relevant to the foundry industry, and tour facilities where these technologies have been installed.

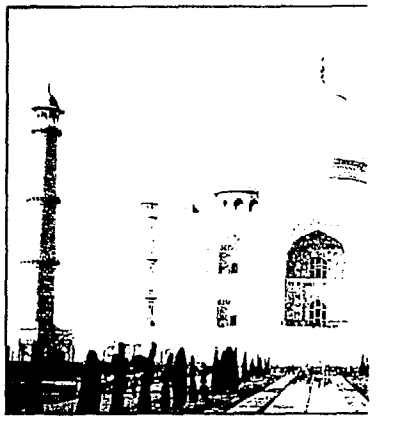


Floatex Density Separator, by Carpco, [illegible] United States

THE INDIAN FOUNDRY

The Indian foundry industry dat[illegible] thousand years. In Northern In[illegible] areas surrounding Agra, foundrie[illegible] Mughal Period more than four h[illegible] independence in 1947, the Indi[illegible] witnessed impressive growth. I[illegible] primarily ferrous metal castings [illegible] automobile, machine tool, railwa[illegible] consumer products industries.

Foundries are located in major c[illegible] surrounding Agra, Calcutta and C[illegible] example, more than 500 foundri[illegible] around the ancient city of Agra. I[illegible] renowned Taj Mahal. Agra found[illegible] historical legacy as descendants [illegible] Taj and artisans to the Mughal c[illegible] past decade, the Agra foundries h[illegible] scrutiny and pressure from the I[illegible] environmental groups and archa[illegible] pointed to the foundries as one [illegible] pollution damage to the Taj's pri[illegible]



The Taj Mahal, India, 1995

Prompted by a 1993 lawsuit brou[illegible] environmental activist, the Indian [illegible] the unprecedented step of order[illegible] to install adequate air pollution c[illegible] face closure. While most foundri[illegible] the order, the problem of affordal[illegible] emissions c[illegible] remains and th[illegible] of this hist[illegible] rich and co[illegible]

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Suraj Foundry, Agra, India, 1995

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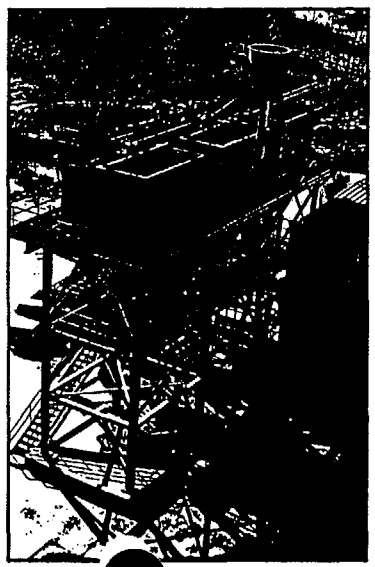
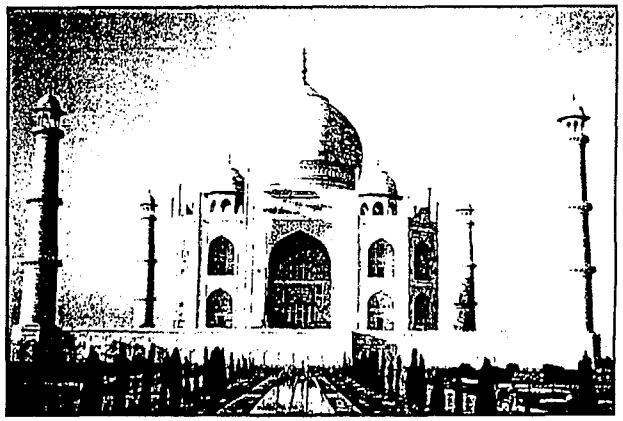


Floatex Density Separator, by Carpco, United States

THE INDIAN FOUNDRY INDUSTRY

The Indian foundry industry dates back several thousand years. In Northern India, particularly in the areas surrounding Agra, foundries flourished during the Mughal Period more than four hundred years ago. Since independence in 1947, the Indian foundry industry has witnessed impressive growth. Indian foundry products, primarily ferrous metal castings, are used widely in the automobile, machine tool, railway, defense, and consumer products industries.

Foundries are located in major clusters in the areas surrounding Agra, Calcutta and Coimbatore. For example, more than 500 foundries are located in and around the ancient city of Agra, home to the world-renowned Taj Mahal. Agra foundry workers claim a rich historical legacy as descendants of the builders of the Taj and artisans to the Mughal court. However, over the past decade, the Agra foundries have come under scrutiny and pressure from the Indian government, environmental groups and archaeologists who have pointed to the foundries as one of the sources of air pollution damage to the Taj's pristine white facade.



The Taj Mahal, India, 1995

Prompted by a 1993 lawsuit brought by an Indian environmental activist, the Indian Supreme Court took the unprecedented step of ordering the Agra foundries to install adequate air pollution control equipment or face closure. While most foundries have complied with the order, the problem of affordable and effective air emissions control remains and threatens the existence of this historically rich and economi... ...al industry

Indian Hazardous Waste Management Delegation to the U.S.

Sanders International, an environment business development and consulting firm, is organizing a high level delegation to the U.S. under the Trade in Environment Services and Technology (TEST) program. The visit is being sponsored by the U.S. Agency for International Development (USAID) mission in India along with the United States Asia Environmental Partnership (US-AEP), and it will take place from October 14-25, 1996. The delegation will consist of high level officials from government organizations, including the Central Pollution Control Board -- India's equivalent of the EPA -- as well as members of private industry.

The delegation will consist of representatives from the following government and quasi-government organizations: Central Pollution Control Board; National Productivity Council;; United Phosphorous Ltd.; Gujarat Industrial Waste Management Company; Agro Pulping Machinery Pvt. Ltd.; and Industrial Credit and Investment Corporation of India.

The goal of the delegation will be to evaluate U.S. hazardous waste management regulations and technologies. Hazardous waste is one of India's most critical environmental problems, and this problem will magnify as India's industrial production increases over the next decade. India enacted its first hazardous waste regulations in 1989, but these regulations are not strictly enforced as technology and infrastructure available for waste treatment and disposal are limited. The Indian government is, therefore, looking for ways to formulate appropriate policy measures governing hazardous waste management, treatment, and disposal.

Specifically, we expect this mission to:

-expose key decision makers to hazardous waste regulations and technologies. This will lead to more aggressive enforcement of regulations in India, and, thereby, set the stage for future technology procurement; and

-allow key Indian industrialists to evaluate potential technology suppliers and teaming partners for upcoming projects in India, including the World Bank Hazardous Waste Management program and credit line.

India Hazardous Waste Management Delegation
Final Delegation List

1. Dr. Dilip Biswas*
Chairman
Central Pollution Control Board
Parivesh Bhavan
East Arjun Nagar
Delhi 110 032
Tel: 91-11-222-7233/221-71213
Fax: 91-11-221-7078/220-4948

2. Mr. N.K. Verma
Senior Environmental Engineer
Central Pollution Control Board
East Arjun Nagar
Delhi 110 032
Tel: 91-11-222-7233/221
Fax: 91-11-221-7078/220-4948

3. Dr. A.K. Saxena
Director Incharge-Pollution Control
National Productivity Council
Lodi Road, New Delhi 110 003
Tel: 91-11-461-1243/469-0331
Fax: 91-11-461-5002

4. Mr. K. Harinathan
Senior Vice President, TEST
Industrial Credit and Investment Corporation of India (ICICI)
Scindia House, Vth Floor
N.M. Marg, Ballard Estate
Mumbai- 400 038
Tel: 91-22-266-1371
Fax: 91-22-262-5453

5. Mr. P.N. Pameswaran Moothathu
Chief Manager (Environment)
United Phosphorous Ltd.
117, GIDC Estate
Ankleshwar 393 002
Tel: 91-2646/22023 22116
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6. Mr. Dinesh S. Shah
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Gujarat Industrial Waste Management Company
S.P. House
14, Vidya Vihar Colony
Usmanpura
Ahmedabad-380 013
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Fax: 91-79-642-0618

7. Mr. Narayanan Swaminathan
Director
Agro Pulping Machinery Pvt. Ltd.
Madras
Tamil Nadu
Tel: 91-44-483-9620
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*Cancelled:

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2.2.2

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FACSIMILE MESSAGE

To: Amitabha Ray

From: Jeff Hallett

Date: November 29, 1993

Total Pages (including cover):

MESSAGE:

Trip Report

I led a delegation of U.S. environmental firms to India November 11-23 to participate in the Indo-U.S. Joint Business Council Meeting in New Delhi and to meet with Indian firms that had expressed an interest in meeting with the delegates in order to establish business linkages under the TEST program. All delegates visited New Delhi and Bombay and met with the TEST Group at ICICI.

Delegates included: Mr. Christian Lint and Ms. Catherine Clerf of Yankee Environmental Services of Seattle, Washington, Mr. Kris Kudrnac of K3 Corporation of McLean, Virginia and Mr. Jack Wallace of Absorb, Inc. of Minneapolis, MN. Their travel was funded by the WEC/USAEP

Yankee Environmental Services is a small firm out of Seattle Washington. The firm is interested in marketing and eventually producing in India, its "Linductor" oil recovery system. The Linductor appears to be far more efficient and effective in vacuuming spilled oil from water than any device currently on the market. It can also be used to vacuum debris from water, sludge from oil tankers and even contaminated earth and sand. Yankee attended the "India: Bridging the Gap" meeting in Seattle and attracted a great deal of interest from the Indian participants. During the trip Yankee was able to meet with numerous Indian firms interested in purchasing their systems and in representing the firm. Ultimately, Yankee agreed to sign a representation agreement with Mantec, Inc. of New Delhi and is making an agressive push to sell Linductors to the Indian Coast Guard.

K3 Corporation markets real time toxic emission monitoring systems. These systems integrate environmental sensors, computers, specially designed software and telecommunications to provide a monitoring, analytical and management tool for plant sites at the local, regional, and national level. K3 has systems installed in Czechoslovakia. These systems are ideal for factories that may emit toxic substances

and are located in densely populated areas. During the visit, Mr. Kudrnac demonstrated his simulation software at the Joint Business Council meeting. He also met with numerous firms that were interested in learning more about his technology. However, it appears that India's environmental monitoring industry is still in an early stage and probably is not ready to accept a technology as sophisticated as K3 Corporation's.

Jack Wallace's firms manufactures and sells an innovative product that absorbs various spilled liquid materials (both hazardous and non-hazardous) which can then be recovered with specially designed equipment. The material uses waste paper as its main component. The process fashions the waste paper into hard absorbent pellets. Mr. Wallace signed a memorandum of understanding with the FACOR Corporation in order to begin a feasibility study on introducing the product into India. The major constraint, however, seems to be that their is very little unused waste paper available in India, unlike in the U.S. There is an active market for waste paper and it is not clear that the technology will prove economically feasible. However, Wallace is interested in exploring utilization of other fibrous materials for the product such as sugar cane waste and or jute. We will monitor his progress in developing this opportunity.

Finally, I met Kevin Lindquist of the Donaldson Corporation and learne that they are trying to negotiate a joint venture with an Indian company called Munradtech to manufacture gas turbine filters. Lindquist thought him firm would be very interested in taking advantage of TEST's low interest lows in order to move the opportunity ahead. I put him in contact with Mr. Harinathan, and will follow-up.

Despite the fact that we were very pressed to put the delegation together as rapidly as possible and were not able to screen the U.S. technologies as thoroughly as possible, the delegation proved successful in creating greater awareness about the the TEST program and its potential benefits. I am confident at least two deals will come out of this investment and therefore conclude it was a worthwhile endeavor.

I look forward to your comments and reactions to the trip.

TRADE MISSION TO U. S. A.

18TH JUNE '94 - 1ST JULY '94

SPONSORED BY

U.S. - ASIAN ENVIRONMENTAL PARTNERSHIP

&

WORLD ENVIRONMENT CENTRE

Prepared by:

INDIAN BOILERS MANUFACTURERS' ASSOCIATION

I. IBMA AN OVERVIEW:

Indian Boilers Manufacturers' Association is the only apex body in India representing boiler manufacturers and industries ancillary to boiler manufacture in the organised sector of our country.

IBMA members design, develop, manufacture and market world class boilers in terms of both quality and efficiency.

The boiler manufacturing activity took birth in the early 60's and ever since has evolved to meet the burgeoning needs of the Indian Industry with unique solutions.

Today India manufactures on Energy Efficient spectrum of boilers, firing coal, oil, gas, lignite and agrowastes to stringent standards made possible through R & D efforts, technology tie-ups with world leaders in the field and the most importantly through a deep involvement with, and a study of clients needs.

On the technical and managerial man-power front, the Indian boiler industry is privy to some of the best talents the country's business and engineering schools produce. The boiler industry has made rapid strides here in recent years by positioning itself in an arena as challenging and rewarding as other.

The Indian Boilers Act, 1923 has been upgraded and amended from time to time in-corporating strict inspection rules both during manufacture and use of boilers, and ensures that every manufacturer complies with these rules. Quality standards are further strengthened through the presence of international inspection agencies operating in India namely Lloyds, Bureau Veritas, ASME, ISO, etc.

The Indian Boiler Industry in the recent years has been exporting boilers to Middle East and African and other Asian markets and this would not have been possible, with the Industry first establishing its position on home grounds in areas like technology manufacturing infrastructure, sales and services network and the requisite human resources.

Rapid industrialisation and urbanisation are bound to add to environmental and ecological degradation as happened every where. All of us at IBMA are making heavy investments to design and manufacture equipments which are eco-friendly. We also continuously search for the latest technology development both at home and abroad and our Trade Mission to U.S.A. which was sponsored by U.S. Asian Environmental Partnership (US-AEP) with the coordination of World Environment Centre was a timely step in that direction.

IBMA would like to put on record its sincere thanks to US-AEP/WEC for their outstanding support in making the trade mission a success.

II. MISSION OBJECTIVES :

India's economic reforms have moved decisively forward. Several policy amendments in the areas of financial services corporate law, credit policy, taxation, exim policy, exchange control were initiated. These will strengthen the market system and encourage competitive enterprise.

IBMA business Mission aimed to :

create a better awareness in the global community about the range and depth of the reforms.

to explore the potential for export of boilers and boiler component.

to seek strategic alliances, preferably joint ventures, with arrangements for buyback or reexports.

Study the latest developments in the arena of boilers and boiler related products and examine their suitability for Indian conditions, and

to learn from experiences of industries in the technologically advanced countries to ensure that rapid industrialization and urbanisation do not lead to environmental and ecological degradation.

III. MISSION DELEGATES:

The Trade Mission of 7 Members was led by Ms. D. B. Baldawala, President of IBMA and Director of Industrial Boilers Ltd.

The following delegates were the part of the Mission.

Ms. D. B. Baldawala
President, IBMA

Director,
Industrial Boilers Ltd.

Mr. N. K. Desai,
Chief Executive,
Laxmi Boilers

Mr. V. N. G. Rao,
Mg. Director,
Ignifluid Boilers India Ltd.

Mr. C. R. Engineer,
Vice President Marketing,
Industrial Boilers Ltd.

Mr. G. Trivedi,
Director,
Thermax Ltd.

Mr. B. P. Trivedi,
Partner,
Jayant Welding & Engineering Works

Mr. M. S. Walia,
Director,
Walia Engineering Associates Pvt. Ltd.

IV. VISITS OF THE DELEGATION:

18th-21st June '94	Sat - Tue	: Attended A.G.M. of American Boilers Manufacturers' Association (ABMA)
23rd June '94	Thu	: Beltron Associates, New Jersey
24th June '94	Fri	: Research Cottrell, Somerville, NJ
27th June '94	Mon	: American Schack, Pittsburgh. PA
28th June '94	Tue	: Johnson Matthey, Wayne, PA
29th June '94	Wed	: Caston Houston, TX and Houston Electric Power
30th June '94	Thu	: Sellers Engineers, Danville, KY
		&
		Henry Vogt Machine Co. KY
1st July '94	Fri	: John Zink Co., Tulsa, OK

COMMERCIALLY SENSITIVE

March 16, 1995

TO: Mr. Amitabha Ray - TEST Project Officer
Mr. K. Harinathan - Senior Vice President - ICICI (TEST Group)

FROM: Jeff Hallett - TEST Project Manager (USA)

SUBJECT: Bio-Treatment Delegation Trip Report

Attached please find a copy of the final report and annexes for the 1995 U.S. Bio-Treatment Delegation. BCIL's report is a satisfactory summary of the entire program. Overall, the response by the Indian business communities in Delhi, Madras and Bombay to the delegation and the technologies represented exceeded our expectation by a considerable margin. The goals of the program were achieved to: 1) raise the level of awareness and understanding in India about bio-treatment technologies; 2) strengthen and support the Biotech Consortium of India's work in promoting and developing biotechnologies in India and; 3) develop promising opportunities for TEST-financeable business linkages between the participating U.S. firms and interested and qualified Indian firms. We judge the event to have been a well-timed and worthwhile initiative and are confident that measurable commercial results from this trip will be forthcoming. Moreover, we perceive a very interesting possibility that the Indian environmental industry could take and further develop these technologies for wider application in India and other developing country markets.

Background

The Trade in Environmental Services & Technologies program organized a two week visit to India, February 10-24, 1995 by four U.S. environmental firms that have developed processes that employ innovative biological and chemical processes for the treatment of industrial wastes. All the U.S. participants received an almost overwhelming amount of interest from Indian environmental firms and waste generators, interested in exploring the applicability of these low cost and energy efficient technologies to Indian environmental problems.

As a result of the visit, all of the U.S. firms are in the process of evaluating numerous opportunities and proposals for pilot and demonstration projects in various industrial sectors. Sanders International is working with the U.S. firms and the most promising Indian contacts to develop best prospects for commercial linkages. We have a realistic expectation that 2-3 pilot project proposals will be submitted to ICICI's TEST group for financing over the course of the next three months.

The 1995 U.S. Bio-Treatment Delegation was organized in response to a mandate from TEST Advisory Council to direct project resources toward solutions to the environmental problems of India's small and medium scale sector. Under India's new and dynamic economic environment, smaller sized textile, tannery, chemical, metal working and food processing plants are accounting for a growing share of both output, employment and pollution.

The size and nature of these smaller-sized firms has generally meant a corresponding lack of attention and resources directed at preventing or mitigating the effects of their effluents. Moreover, many of the conventional air and wastewater treatment technologies remain beyond the means of these firms. Pressures for economic growth and employment being as great as they are in a country like India, Indian environmental regulators find it difficult, if not impossible, to force these industries to deal effectively with their effluent streams or to close them down. In this context, the market potential in India for U.S. biological treatment technologies which can be less expensive to acquire and operate, less complex to operate and much less energy intensive, shows promise worth investigating and developing.

Sanders International Comment

In organizing this event, we perceived that there was a general level of awareness in the Indian environmental industry about various bio-treatment options but not a great deal of detailed understanding. We were uncertain how the Indian business community would react to the delegation firms, their presentations and technologies. Thus, we were unprepared for the enthusiasm and immediate understanding demonstrated by the seminar attendees, as well as the interest shown in immediately beginning discussions on the mechanics of establishing business linkages.

The decision to work with the Biotech Consortium of India (as opposed to directly with one of the Indian business organizations) was, on balance, a sound one. The program helped to raise the profile of the Biotech Consortium which is currently the only organization of its kind promoting the development and implementation of biotechnologies in India. Strengthening and supporting organizations that can play the role of strategic intermediary/broker in the environmental industry in India is a secondary TEST program goal.

A minor irritant involved BCIL's status as a profit-making consulting firm. While our view was that BCIL's only involvement with the delegation was to handle logistical and

administrative arrangements, some members of the BCIL staff hoped to represent the U.S. participant firms on a private basis and pursued this during the delegation's visit. This could have, but did not, result in conflicts with other Indian firms interested in pursuing business linkages with the U.S. firms. In a future arrangement of this type, we would explicitly rule out this sort of activity beforehand.

Despite a very compressed amount of time available for preparation and promotion activities, attendance at the seminars in the three cities exceeded BCIL's estimates but essentially met our expectations given past experience with meetings of this type. As indicated earlier, everyone wanted an individual meeting with the U.S. participants which proved somewhat clumsy and impractical.

For future endeavors of this type involving a seminar or workshop with a similarly-sized delegation and number of attendees, we may implement the following three level program comprising: 1) a large group meeting; 2) small group meetings to permit additional interaction with delegates, followed by submission of forms outlining business interests and credentials; 3) 30 minute to 1 hour individual meetings on the second day with pre-screened and selected firms.

Press coverage of the delegation's visits and activities was adequate. Some press attended the three seminars and conducted interviews. More formal press conferences as stipulated in the purchase order agreement would probably have provided more extensive coverage. In future programs of this type, we would suggest involving USIS to draw upon their networks and expertise and to maximize press and other media coverage.

TEST's participation in the ENCON trade show provided an excellent showcase for the TEST program, its services, successes and available resources. It also provided another venu for the U.S. delegates to interact with potential partners and collaborators. Some of the visitors to the TEST booth learned of and later went on to attend the New Delhi Bio-Treatment seminar. A lesson learned: some visitors came to the booth to talk to the companies and also learned about TEST; others came to the booth to read the material about TEST or see a demonstration of the information system and then learned about the delegation and its technologies.

Follow-up Activities

3i Systems: Sanders is working with 3i on the development of up to five pilot projects incorporating their bio-reactor, possibly in combination with bacteria to be supplied by Bidegradation Systems, Inc. Discussions are underway with Daurala Sugars, Mangal Dyeing, Puretech Engineering, Pai & Pai Chemicals and Protech Consultants for projects involving distilleries, dyeing units, cyanide production and an unspecified air phase use of the reactor. These projects will be bundled and presented to ICICI's TEST Group for financing. We understand that Rajiv Datar's father is, through his local firm, serving as 3i's agent in organizing these projects. He has apparently already been in contact with the

TEST Group.

DDH Enterprises: DDH is inclining toward some kind of business relationship with a firm called Fireside of Madras that has developed proprietary enzymes for various commercial end-uses. If concluded, Fireside will concentrate on developing pilot projects for the DDH chemical fixation technology with the Central Leather Research Institute in Madras for a project at their Pallavaram wastewater treatment facility and with the Madras Municipal Water Treatment Works. Dale Harris is, in addition, reviewing contacts, correspondence and proposals from approximately a dozen firms and individuals. He also had a meeting with Earl Kessler of USAID New Delhi's Housing Office and will follow-up on that contact.

Biodegradation Systems, Inc.: BSI is working with a firm called RJ Associates for the design of a reactor for the degradation of arsenic. He is also developing a number of possible projects involving bio-conversion of waste to ethanol/methanol and methane. BSI also made a promising contact with the Gujarat National Fertilizer Company for a job to help them better manage the bio-processes in a reactor they are using to produce methane from cattle dung. BSI concluded an MOU with Western Pacques to jointly develop business in the areas of cleaning of chemical process streams, bio-treatment of cyanide and benzene from waste streams and bio-treatment of pharmaceutical wastes.

Industrial Ecosystems: IES is currently drafting a proposal for the Oil and Natural Gas Corporation for a pilot project to bio-remediate approximately 500 yards of petroleum contaminated soil (150-300,000 ppm contamination). The agreement with ONGC will be structured to include a number of other commercial projects to be contingent upon the success of the pilot. IES is working with Puretech Engineering of Madras to develop this pilot project. IES is, in addition, exploring a project with the Madras Refinery to convert petroleum sludge pits into fuel pellets using IES drying and pelletization technologies.

TRIP REPORT

Indian Foundry Delegation
to the United States

June 10 - 23, 1995

Trade in Environmental Services and Technologies (TEST) Program
U.S. Agency for International Development

- co-sponsored by -
U.S.A.E.P./The Asia Foundation

Prepared By
Sanders International, Inc.

Submitted To
The Asia Foundation

July 11, 1995

Executive Summary

In April, 1995, the United States Agency for International Development (USAID) in India concluded a general Memorandum of Understanding (MOU) with the Agra Iron Founders' Association (AIFA) to address environmental problems of the foundry industry in Agra. The Indian Foundry Delegation visit to the United States in June, 1995, was the first activity to be launched after the signing of the USAID/AIFA MOU. The delegation visit was sponsored by the Trade in Environmental Services and Technology (TEST) program, with partial financial assistance provided by the United States Asia Environmental Partnership (US-AEP)/Asia Foundation. The purpose of the delegation visit was to:

- assess appropriate and cost-effective U.S. processes, technologies and equipment that will be applied alleviate environmental problems in Indian foundries;
- create general awareness within the U.S. environmental industry of environmental problems in India and business opportunities related to environmental protection and remediation; and
- provide opportunities for U.S.-Indian business linkages to address these problems.

Over a two week-period, the delegates attended the annual American Foundrymen Society (AFS) seminar on "*Environmental Concerns of the Foundry Industry*" in Chicago; met with various U.S. private companies specializing in environmental technologies for foundries; toured foundry facilities; and participated in the Air and Waste Management Association annual trade show in San Antonio.

In addition to meeting their primary objective to assess cost effective environmental technologies, the Indian foundry delegates learned some important lessons on their U.S. visit. For example, they observed that Indian foundry production is generally one tenth to one thirtieth of U.S. production levels. This means that air pollution control equipment installed in U.S. foundries need to be redesigned for smaller facilities and remain cost effective for India.

The foundrymen also noted that U.S. pollution standards are more stringent than those in India. This fact alerted them to upcoming changes in India within the next few years. The delegates recognized that Indian regulations would likely follow suit in the years to come and that it was appropriate to act in anticipation of these changes.

Finally, the foundry delegates observed the U.S. foundry industry is extremely sensitive to foreign competition. One fourth of U.S. foundries have had to shut down over the past several years due to cheaper foreign competition and enforcement of strict EPA regulations. Therefore, there was great reluctance to allow the Indian foundry delegation access to U.S. foundry operations.

Despite these differences, as mentioned above, a number of initial ties were developed between

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several members of the delegation and U.S. companies. It will be the responsibility of the TEST management team to ensure that these environmental business linkages continue to develop and grow over time. These are:

- further cooperation between the AFS and the Confederation of Indian Industries (CII);
- interest from the delegation in USAID sponsoring a reverse exchange mission to India for the design of a complete waste management system (air, liquid and solid waste) for a cupola foundry system in Agra and other areas in India;
- eventual exchanges and tie-ups with one or more U.S. firms visited in the areas of sand reclamation, slag reutilization technologies, and bag house manufacturing and other dust collection systems.

I. Introduction and Background

In April, 1995, the United States Agency for International Development (USAID) in India reached a general Memorandum of Understanding (MOU) with the Agra Iron Founders Association (AIFA) to control, abate and prevent the problems of foundry industries in Agra. This cooperation offers assistance to more than 150 foundries to improve their production processes, reduce energy needs, and diminish pollution emissions through the introduction of efficient technologies. In order to accomplish its objective of establishing a commercially competitive process to reduce foundry pollution in Agra, USAID decided to support Indo-U.S. technology collaboration, training, and information and business exchanges.

India is home to approximately 5000 foundries located in major clusters in the areas surrounding Agra, Calcutta and Coimbatore. The 150 foundries located in Agra have received particular attention, as this ancient city is home to the world-renowned Taj Mahal. Agra foundry workers claim a rich historical legacy as descendants of the builders of the Taj and artisans to the Mughal court. However, over the past decade, the Agra foundries have come under scrutiny and pressure from the Indian government, environmental groups and archaeologists who have pointed to the foundries as the source of air pollution damage to the Taj's pristine white facade.

Prompted by a 1993 lawsuit brought by an Indian environmental activist, the Indian Supreme Court took the unprecedented step of ordering the Agra foundries to install adequate air pollution control equipment or face closure. While most foundries have complied with the order, the problem of affordable and effective air emissions control remains and threatens the existence of this historically rich and economically vital industry. Some of the damage to the Taj has been traced to the sulphur dioxide emissions from Agra-area furnaces *(cupolas)* which are used to metal iron for making castings. Although sulphur dioxide is the major element causing damage, other polluting emissions from cupolas include particulates, metallic oxides, unburnt hydrocarbons, and carbon monoxide, all of which have contributed to air pollution problems in the Agra area. In addition, other aspects of foundry operations, including molding, sand preparation, metal core making, and finishing, generate pollutants in the form of metals-laden

foundry sand, dust and carbon monoxide.

The Indian Foundry Delegation visit to the United States in June, 1995, was the first activity to be launched after the signing of the USAID/AIFA MOU. The delegation visit was sponsored by the Trade in Environmental Services and Technology (TEST) program, with partial financial assistance provided by the United States Asia Environmental Partnership (US-AEP)/Asia Foundation. TEST, a United States Agency for International Development (USAID)-funded program, is aimed at assisting India to address its increasingly serious industrial pollution problems by encouraging and facilitating sustainable and profitable commercial linkages between Indian firms and U.S. environmental equipment and service providers.

The 13-member delegation consisted of AIFA members who are small foundry owners from Agra, two foundry owners from Maharashtra and Tamil Nadu, one representative of the Confederation of Indian Industries (CII), and one official from the Industrial Credit and Investment Corporation of Indian (ICICI).

The purpose of the delegation visit was to:

- assess appropriate and cost-effective U.S. processes, technologies and equipment that will be applied in India to prevent or control harmful emissions from the Indian foundry industry;

- create awareness within the U.S. environmental industry of Indian environmental problems, environmental business opportunities in India, and the support available through the TEST and other U.S. government programs to assist U.S. and Indian companies in forming commercial linkages; and

- provide opportunities for U.S. environmental companies to offer solutions to pollution problems in the Indian foundry industry as well as in other industry sectors.

The primary emphasis of the delegation was on low-cost and appropriate technologies to treat air emissions from foundries. The delegation, however, examined other critical problems relevant to their industry such as technologies for sand re-use and reclamation, water conservation and re-use in foundry applications, and energy efficient and less polluting foundry component designs.

While in the United States, the group:

- participated in the annual American Foundrymen's Society (AFS) seminar on "Environmental Concerns of the Foundry Industry" in Chicago, IL, June 11-13;

- attended the Air & Waste Management Association's (AWMA) annual convention and trade exhibition in San Antonio, TX, June 18-21; and

- met with 13 U.S. private companies that specialize in environmental technologies relevant to the foundry industry and toured facilities where these technologies have been installed.

The purpose of this report is to give a factual account of the meetings and seminars attended by the delegates, assess whether the objectives of the Indian foundrymen were met by the visit to the U.S, and provide appropriate follow-up action items.

II. Summary Account of Meetings and Seminars

Sunday, June 11
Welcome to the United States and Registration for American Foundrymen's Society Meeting
Chicago, Illinois

Meetings were held throughout the day to welcome the delegates to the United States; and to make introductions of Sanders International, the TEST program, US-AEP and the Asia Foundation exchange program. Discussions were held on the foundry pollution issues relevant to both the Agra region in the North as well as the more Southern regions of India (Maharashtra and Tamil Nadu). As information on the individual delegates was difficult to obtain prior to their trip, this session was helpful for members of the TEST program to understand the opportunities and constraints in the Indian foundry sector.

In the evening, the Indian delegates attended a welcome reception and registration session for the annual American Foundrymen's Society (AFS) meeting.

Monday, June 12
BHA & American Foundrymen's Society
Chicago, Illinois

BHA Company Profile: BHA specializes in air pollution control equipment and replacement parts for bag houses and bag house systems of the traditional and jet pulse type. They produce acoustic horns, cartridge filters, filter bags and cages, and controls and instrumentation for those systems. They also provide services to maintain air pollution components. The company is active in many areas throughout the world, and BHA has a fully-owned subsidiary in India where they are already doing business with several larger Indian firms who are interested in bag house systems. They are very active in supplying pollution control equipment to the cement industry.

Comments: BHA is interested in expanding its market to the foundry industry; however, most of the bag houses they install are relevant for foundries with a much larger production capacity than those in the Agra region. The presentation was very educational and well received by all delegates, especially since it contained information on the different types of newer bag house systems such as the jet pulse. Two of the delegates expressed interest in filter bag as well as housing production (or valve and other foundry produced components) in India and have asked

Trade in Environmental Services and Technologies (TEST)
Status Report - October 1996

Ventures and Partnerships Formed: *The following were facilitated through technical assistance from Sanders International, often with TEST financing from the Industrial Credit and Investment Corporation of India (ICICI) and/or business exchange support from U.S.-AEP:*

1) Amcane International and **Praj Industries** have formed a joint venture called **Praj/Amcane** to market a sugarcane separation technology. This technology separates the outer surface of the sugarcane from the pulp. This results in reducing harmful effluents during the sugar manufacturing process. ICICI has disbursed a loan of $1 million to **Kothari Sugars** to install this technology in their manufacturing plant.

2) American Air Filter International (formerly Snyder General), Louisville, Kentucky and **Kirloskar Industries** of Pune formed a joint-venture manufacturing plant for the production of air pollution control equipment and some wastewater treatment equipment. The total plant cost was $3,000,000 of which $1,800,000 was financed by the ICICI. AAF International owns 50% of the manufacturing plant which currently has reached about $20,000,000 in annual sales.

3) Beltran, New York, New York and **Ventair Private Ltd.** of Madras have entered into a licensing agreement to design and build an air pollution control system for a Madras-based titanium dioxide plant. Beltran has provided the designs for a wet electro-static precipitator (ESP) system which will be built in conjunction with Ventair. Beltran is traveling to India in October, 1996 to meet with the Indian client for final approval of the ESP systems.

4) Davy International (formerly Davy McKee), San Ramon, California & **TTG Industries**, Madras: Technology transfer for the design of water-jacketed gas collection hoods from Davy International. The technology was used in two of Hindustani Copper's smelter plants. ICICI financed $300,000 of a total project cost of $500,000 to finance the engineering and design work.

5) Donaldson, Minneapolis, Minnesota and **Mundradtech** of New Delhi: Joint-venture for the production of gas turbine filters. ICICI financed $500,000 of a total $1,000,000 project cost. The plant opened in December, 1995 in Gurgaon, just outside of Delhi. The new JV currently has annual sales of over $4,000,000.

6) Enders Process Equipment, Glen Ellyn, Illinois and **Shreyans Industries** of New Delhi: Through TEST technical assistance and financing, Enders and its local representative have erected a $4,100,000 black liquor incineration and caustic soda recovery plant at Shreyans Pulp & Paper mill in Ludhiana, Punjab. The plant has successfully completed its test run and is now operating commercially. TEST provided technical assistance, U.S.-AEP supported a business exchange, and ICICI provided a conditional grant of $1,000,000 to finance the demonstration of this technology.

7) **EPR**, West Springfield, Massachusetts and the **Agra Iron Founders Association** (AIFA), Agra: TEST introduced EPR to the AIFA through a U.S.-AEP funded delegation visit to the U.S. The delegation traveled to the U.S. in search of technological solutions for pollution problems associated with small foundries located near the Taj Mahal. EPR has signed an agreement with the AIFA to demonstrate a low-cost air pollution technology for fine particulate collection from foundry emissions and is negotiating with a prospective Indian distributor/representative on a business linkage. TEST intends to finance the demonstration project at an Agra foundry and the start-up costs of the distribution arrangement.

8) IIT Research Institute of Chicago Illinois and **Thermax** of Mumbai: Through TEST technical assistance, these two firms are collaborating to introduce IIT's low-cost medical waste treatment technology in India. Thermax will license the IIT technology and manufacture the units in India for use by small community hospitals.

9) Industrial EcoSystems (IES), Pacifica, California and **Biotech Consortium of India, Ltd.** (BCIL): TEST introduced IES and BCIL during the 1995 TEST Biotreatment Delegation to India. IES and BCIL have submitted a proposal for TEST/ World Bank financing of a demonstration project for the bioremediation of hydrocarbon-contaminated soil for a TEST initiative aimed at promoting broader understanding and awareness of U.S. biological treatment technologies.

10) Koch Membrane Systems, Wilmington, Massachusetts and **Ion Exchange** of Bombay, India: Under a U.S.-AEP funded exchange, Ion Exchange visited the U.S. Ion Exchange signed an agreement with Koch Membrane for the distribution of thin membrane technology for wastewater treatment in pulp & paper mills in India.

11) Lean Power, College Park, Maryland and **Bajaj Motors** are negotiating an agreement to install and test the firm's electronic emissions control device on Bajaj motor cycles. Lean Power made its initial trip to India in 1994 with the help of a U.S.-AEP business exchange and TEST technical assistance.

12) Ogawa, Inc., Pompano Beach, Florida and the **Electronic Corporation of India, Ltd.** have entered into a distribution arrangement for Ogawa's Passive Air Sampler, a low-cost and highly effective ambient air monitoring device that detects sulfur dioxide and oxides of nitrogen. The relationship developed through TEST technical assistance and a U.S.-AEP funded business exchange for ECIL representatives.

13) Pfaudler Inc., Rochester, New York and **Gabriel India, Ltd.** of Pawanoo in Himachal Pradesh: Gabriel purchased a vacuum evaporation system for the recovery and recycling of heavy metals from electroplating wastewater. ICICI financed the deal with a loan of $200,000 for the total project cost of $300,000.

14) Pneumafil Corporation, Charlotte, North Carolina and **Inalsa/Varun Enterprises** of Jaipur: Through a combination of technical assistance and financing, the two companies signed a

technology licensing agreement for the manufacture of air intake filters for gas turbines. ICICI financed $400,000 of a $700,000 project for the license.

15) Radian, Denver, Colorado and **Nuchem Ltd.**, of Faridabad: As a result of TEST technical assistance and U.S.-AEP business exchange support, the two firms are establishing an environmental laboratory analysis unit to service the Indian market. Radian and Nuchem are also jointly pursuing wastewater treatment projects in India.

16) Research Cottrell, Somerville, New Jersey and **Associated Cement Companies** of New Delhi: ICICI financed a licensing agreement for a flow modeling technology for gas collection equipment. The total project cost was $600,000 of which TEST financed $400,000.

17) Royce Instrument Corporation, New Orleans, Lousiana and **Electronics Corporation of India Limited,** Hyderabad, India, have entered into an agreeement for a marketing tie-up for marketing water quality monitoring instruments in India.

18) RTP Environmental Associates, Green Brook, New Jersey with **Stearns & Wheeler**, New York and **Raj Iron Foundry**, Agra: RTP and Stearns & Wheeler are working with Raj Iron Foundry to re-engineer the foundry's coke-burning cupola to coke and gas-combustion system. Raj Iron Foundry has commissioned both firms to do the engineering work and both U.S. firms will travel to India in the fall of 1996. The project was initiated as a result of the U.S.-AEP-funded Agra Foundry Delegation Visit to the U.S. and a follow-up trip to India for RTP Environmental.

19) Swemco Inc., New York, New York & **Joy Environmental Technologies, Inc.**, Houston, Texas concluded deals with **TTG Industries** of Madras: Through a technology transfer from Swemco and a purchase of equipment from Joy, TTG was able to develop an air pollution system for an acid plant being built in India. The deal required financing for the gas cleaning system technology for the plant's gases, which was designed by Swemco. The deal also required the purchase of an electrostatic precipitator from Joy Environmental. The total project cost was $5,400,000 of which TEST financed $530,000.

20) Synosys, New Brunswick, New Jersey and **Exogen** of Pune: As a result of TEST technical assistance and its participation in the 1995 TEST Biotreatment Delegation, Synosys has established a joint venture company with Exogen, Inc. to further develop and market its innovative bioreactor wastewater treatment systems. Synosys has provided pilot-scale units to several Indian enterprises for testing which have returned excellent results in treating distillery and textile wastes. Exogen is currently working with an Indian venture capital group to raise funds for full commercialization of the technology in India.

21) United Emission Catalysts (UEC), Canton, North Carolina and **Pradushan Controls**, of India: UEC has entered into a licensing agreement with Pradushan Controls for the manufacture of certain components of catalytic converters for diesel engines. The initial order placed by Pradushan Controls was for the sale and distribution of two hundred catalytic converters for trucks and buses. With TEST technical assistance, UEC has approached the U.S. Export-Import Bank (EXIM) to

finance export of the catalytic components under one of EXIM's business environmental export insurance programs. Currently, Hindustan Motors is completing testing of a UEC converter on one of their manufactured buses.

22) **U.S. Biotech**, Teterboro, New Jersey and **Premier Ziba** of Delhi: With TEST technical and U.S.-AEP business exchange assistance, U.S. Biotech and Premier Ziba have concluded an agreement to distribute U.S. Biotech's bio-additives for various wastewater treatment applications in India. Premier Ziba has secured Indian government approval to import bio-treatment products into India and test and demonstrate the effectiveness of the microbes in India. A multi-phased program has been designed to use the biotechnology in India to ameliorate serious pollution problems caused by small scale industries such as: fish farming, distilleries and pulp & paper mills.

23) **Vanaire**, Louisville, Kentucky and **Ventair**, Madras jointly bid in the summer of 1996 to construct an air ventilation system for an industrial client in Madras. The two firms have agreed to form a joint venture to bid jointly on other air pollution ventilation projects. This cooperation is a result of a TEST Technology Search Report and a subsequent U.S.-AEP business exchange.

24) **Roy F. Weston**, Westchester, Pennsylvania and **Ankleshwar Industrial Estate Consortium** of Ankleshwar, Gujarat: Through TEST introductions and technical assistance, the Ankleshwar Industrial Estate Consortium and the Roy Weston Corporation are collaborating in the development of an integrated waste treatment complex for the heavily polluted industrial estate. The work will include a sanitary landfill, a hazardous waste incinerator and a common effluent treatment plant. A joint proposal for a masterplan/feasibility study was recently cleared by the State of Gujarat's Pollution Control Board and the Gujarat Industrial Development Corporation.

25) **Yankee Environmental**, Seattle, Washington and **the Indian Coast Guard**: As a result of technical assistance from the TEST program and travel sponsorship from the U.S. Asia Environmental Partnership, the Indian Coast Guard purchased two Yankee Environmental "Linductors" valued at $400,000. This technology is used for clean-up of oil spills through a vacuum & oil separation process. Yankee is currently pursuing an effort to establish a joint venture spill response company using the Linductor clean-up systems.

TES

Test Start Date	Indian Company	Product/ Tech. Sought	U.S. Partner	TA Level	Exch-Fnde	# Partic.	Status of TEST Case	Action Required	Contacts For Further Info.
January 1995	Aero-Tech Engineers	Air pollution control technology	Misonix, Warren Engineering Bayliss Technologies	5	NA	NA	Exchange to take place in November - December 1996	AEP will receive final approval & arrange exchange	Mr. Chakrabarti, Aero-tech E. Harwit, SI
June 1995	Agra Iron Founders Assoc.-X (and other Indian foundries)	air pollution equip. for foundrie also sand reclamation	EPR, Ogawa, RTP, MSI	5	AEP/TEST	14	See MIL entry, pushing for agreem	Continue follow-up w/EPR,MIL	F. Renkowicz; JHallett, SI
Dec 94	Alpro Associates	Distillery waste emphas. water reuse	None	1			SI sent TSR & cost estimate 3/95	ICICI Action-No response. Presume closed	E. Harwit, SI
Dec. 94	Ankleshwar Industrial Estate Consortium/represented by United Phosphorus-x	Integrated waste treatment complex	Weston International	5	AEP/TEST	2	These two companies are collaborating in the development of an integrated waste treatment complex, pending WB support.	Mission to follow-up with Ministry of Environment re approval of funding for Masterplan	J. Hallett, SI Bart Bhatla, Weston International Mr. Panjwani , United Phosphorus
Dec 94	Artech Labs	Environmental Instrumentation	None	1	NA	NA	SI sent TSR & cost estimate 3/95	ICICI Action. No response, Presume closed	S. Ganguli, SI
Dec 94	Aruna Sugars/ Triveni Engineer	BOD Treatment Distillery Waste	Various-Zimpro, Pollution Control Engineering,	3	NA	NA	Recv'd performance guarantees from US companies and sent to ICICI 2/95.	ICICI Action. No Response. Presumed not interested to proceed	E. Harwit, SI
Summer 93	The Associated Cement Companies Ltd.	Flow modeling and testing lab	Research Cottrell	1	NA	NA	Loan sanctioned 9/94. SI worked with firm on other technology search for air pollution control.	No action	J. Hallett, SI
Spring 94	The Associated Chambers of Commerce & Industry of India-X	Grant application for establishment of environ. info center in New Delhi	No U.S. partner	2	AEP/TEST	1	ICICI evaluating grant request Presume will not be granted.	ICICI action	J. Hallett, SI
Aug. 93	Agro Pulping Machinery Ltd.-X	Water pollution control equipment	Enders Process-X Equipment Also Ab.sorb & EPR	5	AEP/TEST	4	Loan sanctioned 8/94 w/ Enders Project commissioned June 1996 Operating commercially.	Workshop at Ludhiana to promote success of project, Nov. 96 Working on EPR and Ab.sorb	Joe Enders E. Harwit, J. Hallett, SI Jack Wallace, Ab.sorb
Aug. 93	Akar, Impex, Noida, UP	Water pollution control equipment	None	1	NA	NA	SI sent letter asking Akar to select U.S. companies	No response from correspondence to Akar. ICICI Action	R.J. Vaidya C. Eiff, SI
Spring 94	Andrew Yule & Co.	Water pollution control equipment	Kinetic Recovery EEG Environmental	4	NA	NA	Met with Andrew Yule in Calcutta 2/95, discussed other interest in air pollution control diversification. Later company reor derailed effort.	SI contacted several companies. So far, no interest in working with distressed state firm.	Mr. G. Ganguli, Gen'l Manager, Dr. Reinhardt, Kinetic Recovery J. Hallett, C. Eiff, SI
Spring 95	Aqua Bird Water Treatment Co.	Membrane/ ultrafiltration, electrodialysis systems	None	2	NA	NA	Sent revised TSR outline and cost estimate 3/95 No reponse. Presumed no interest.	ICICI Action	Parkar Ahmed E. Harwit, SI
Spring 94	Bajaj Motors	Electronic emissions control device	Lean Power-X	3	AEP/TEST	3	Lean Power is negotiating an agreement to install and test the firms electronic emissions control device on Bajaj motor cycles.	No action	J. Hallett, SI
Fall 93	Balmer Lawrie & Co., Ltd.	Wastewater Treatment technol	None	1	NA	NA	No responses to inquiries. Presume no interest.	ICICI action	K. Harinathan, ICICI
Fall 93 & Summer '96	Batliboi Int'l Ltd./HGE	Various water pollution control technologies	Various U.S. companies from TSR reports	3	NA	NA	Currently evaluating SI report on U.S. wastewater treatment firms	ICICI Action	A.V. Rao S. Ganguli, E. Harwit, SI
July 94	Biosystems India	Distribution of bio-augmentation product, eventual investment planned	Biosystems U.S.A.	2	NA	NA	Demo at South India Viscose failed due to need for additional ox in wwater treatment ponds Probably closed.	ICICI Action	Dr. P. Mehta J. Hallett, SI
Fall 93	Biotech Envirocare Systems Pvt., Ltd.	Floating aerators WWT equipment	None	1	NA	NA	Company lost interest in pursuing oppor., presume closed.	None	K. Harinathan, ICICI

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TES S

Test Start Date	Indian Company	Product/ Tech. Sought	U.S. Partner	TA Level	Exch-Fnde	# Partic.	Status of TEST Case	Action Required	Contacts For Further Info.
May. 96	Biotech Consortium of India, Ltd.	Bioremediation of hydrocarbon contaminated soil	Industrial EcoSystems (IES)-X	5	TEST	1	BCIL has developed opportunity with Oil and Natural Gas Corp. to do demo. Seeking Indian comml firm to execute demo with, possibly Nuchem	SI to follow up with IES	J. Wilson, IES J. Hallett, SI S. Ganguli, SI
Fall '93	Cadilla Laboratories, Ltd.	General Interest in the TEST program	None	1	NA	NA	Indian firm did not respond to TA offers	None	K. Harinathan, ICICI
Fall '96	Centrol Pollution Conrol Board - X	Technical Assistance in writing Envir. legislation	U.S. EPA	4	AEP/TEST	1	TEST will follow-up with both side as part of haz.waste deleg followup	SI, EPA and NPCB action	S. Ganguli, SI Mr. Verma, Biswas, NPCB
Fall '93	Cethar Vessels Ltd.	General TEST interest on various technologies	None	1	NA	NA	Indian firm did not respond to TA offers	None	K. Harinathan, ICICI
Aug. 93	Cyno Clean - X	Hazardous waste treatment plant	International Technology Corp. & Fuller KCP	5	AEP/TEST	4	Pending completion of EIA for current site. Missed deadline for WB financing, Delayed indefinitely.	ICICI Action	Alan Baker, IT Corp Brian Field, Fuller KCP B. Ravi, Pure Tech J. Hallett, E. Harwit & S. Ganguli, SI
Spring '94	Delta Paper Mills Ltd. -	Effluent gasification	MTCI/Thermochem-X	3	AEP/TEST	2	TA provided; awaiting proposal to ICICI. Problems with gasification technology.	ICICI Action	J. Hallett, SI
January '95	Din & Gray Consultants Pvt. Ltd.	Training for EIA & EA	None	1	NA	NA	Indian firm did not respond to req for clarification and focus of TA request.	ICICI Action/follow-up	Girish P. Dingre J. Hallett, SI
Nov. 93	Dyna-K Automotive Catalytic Stampings - X	Metal monoliths for catalytic converters	Metreon Car Sound Exhaust Systems Metal Methods	5	AEP/TEST	2	Dias visited May 95. Trip report received June 95. Focus shifted to CATS for two wheelers. Summer 96 -Dias shelves project	Metreon is evaluating their substrates for the 2-wheel market; Metal Methods is on hold for the substrate technology.	Dyna-K: C.F. Dias E. Harwit, SI
Fall '93	Econ Pollution Control Pvt. Ltd.	EIA HW Consult	None	1	NA	NA	After initial contact, no TA request submitted Probably closed	ICICI action	A. K. Sahu, Econ J. Hallett, SI
Fall '93	E.I.D. Parry	Environmental consulting	None	1	NA	NA	Closed July 94	None	K. Harinathan, ICICI
Dec 94 & Fall96	Electronic Corp. of India, Ltd.-X	Env. Monitoring for air and water pollution controls	Ogawa Royce Instruments Monitor Labs	5	AEP/TEST	2	Sent TSR & CE 1/95 Business exchange resulted in agre ments with 3-4 firms	Awaiting completion of demo of Ogawa passive air monitors at Agr Follow-up with other U.S. firms	SAIC- Ajay Chada Mr. Gopalakrishnan, ECIL E. Harwit, SI
Jan. 94	Enkem Engineers Pvt. Ltd.	Seeking partner- ship with U.S. firm to help h[illegible] w- co[illegible] ties	Talking to Barrett Consulting; Barrett had expressed interest & has sent bid materials to bid on an Indian plant.	3	NA	NA	Barrett and Enkem are jointly bidding on ADB projects	No action Barrett will keep us informed	Barrett Consulting: Marcos Lopez or Frank Barrett; Enkem Engineering: Mr. Subramani E. Harwit, SI
Spring '94	Enviro Clean Systems Ltd.	[illegible]. on	None	1	NA	NA	No TA request form Indian firm after initial contact. Closed.	None	Venkata Naryanan, Enviroclean.
Spring '95	Esvin Technolo[illegible]		MTCI	3	NA	NA	See Delta Paper Mills entry	None	K. Harinathan, ICICI
January '95	Exogen -		Synosys-X (formerly named 3i Systems)	5	TEST	2	Exogen is currently working with an Indian venture capital group to raise funds for the full scale commercialization of the technology in India.	SI to follow up with Synosys	R. Dattar, Synosys M. Vasudevan, Sysnsys J. Hallett, SI S. Ganguli, SI
Spring'94	F. Harley & Co., Pvt. Ltd. - X		E.E.R. Energy & Environmental	4	AEP/TEST	1	EER and Born no longer interested as of fall '95.	No action	F. Harley: Dr. Sastry; E.E.R.: Blair Folsom

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TES S

Test Start Date	Indian Company	Product/ Tech. Sought	U.S. Partner	TA Level	Exch-Fnde	# Partic.	Status of TEST Case	Action Required	Contacts For Further Info.
			Research Born Environmental				Sastry retired. No further interest in pursuing project from F Harley		in CA office Born: Sidney Born
Spring '95	The Fertilisers & Chemicals Travancore Ltd.	Waste water treatment technologies	Siegmund Environmental and other U.S. firms	2	NA	NA	Initial interest in package wastewa plants. U.S. firms not interested, feel Indian firm lacks adequate exper. to develop technology	None	E. Harwit, SI
Fall '93	FACOR	Liquid waste absorbent technology for oil and tannery indust.	Ab.sorb-X	4	AEP/TEST	1	Signed MOU but unwilling to put money into demo and commercial ization. Closed.	Follow-up re other Indian firms wit interest: Agro-Pulping and Southern Alloy Foundries	Jack Wallace: Absorb E. Harwit, SI
Spring '94	Fine Hydrochem	TEST inquiry only	None	1	NA	NA	No request for TA made after initial contact	None	K. Harinathan, ICICI
Fall '94	Fortune Bio-tech Ltd. (Andra Pradesh)	U.S. laboratory Services and Eco-friendly pesticides.	Technology Sciences Group (Washington)	2	NA	NA	Financing proposal submitted stages of approval 1/95 submitted rpt on TSG credentials	Project considered unqualified for TEST support because not related to industrial polluton	J. Hallett, SI
Fall '93	Gabriel India, Ltd.	Vacuum evaporation system for recovery and recycling of heavy metals from electro-plating wastewater	Pfaudler, Inc.	1	NA	NA	ICICI financed this deal with a loan of $200,000 for the total project cost of $300,000	No action	Howard Hartley, Pfaudler K. Harinathan, ICICI
Spring '94	Grindwell Norton Ltd.	Requested TEST info. only	None	1	NA	NA	No request for TA made after initial contact	No Action	K. Harinathan, ICICI
Spring '94	H.B. Consultants & Engineers Pvt. Ltd.	Requested TEST info. Only	None	1	NA	NA	No request for TA made after initial contact	None	Mr. Ramarathnam, HB Consultants
November '93	Hindustan Electronics	Air Monitoring Devices	K3 - X	4	AEP/TEST	1	Met with a number of interested Indian firms, but technology is too advanced for Indian at present.	Closed - No action	Chris Kudranac - K3 J. Hallett, SI
July 94	Hindustan Organic Chemicals Ltd.	Water pollution equipment	Aquachem Enviro Systems TF Purifier	3	NA	NA	3/95: received subcontractors response to HOCL questions, sent to ICICI	ICICI Action	C. Eiff, SI
Dec 94	Jost's Engineering	Paint VOC/Sludge	None	2	NA	NA	2/95 sent TSR estimate	ICICI action	E. Harwit, SI
Spring '94	Horizon Batteries	Electic Battery for Vehicles	Technologies, Inc. (Texas)	1	NA	NA	Proposal submitted for financing	ICICI action	K. Harinathan, ICICI
Fall '93	Humphreys & Glasgow Consult-ants Pvt. Ltd.	Gen. engineering consultants	Jacobs Engineering Group (California)	2	NA	NA	US JV partner contacted. Not interested to receive TA or other assistance from TEST	ICICI to follow up with Indian Indian joint-venture of Jacobs Engineering.	S. Ganguli, SI
Spring 94	Ignifluid Boilers India Ltd. - X	Air pollution control equipment	Tampella Power Corp.; Detroit Stoker; also looking at Castone for fly ash uses.	5	AEP/TEST	2	Loan sanctioned 9/94 Loan never drawn, financing withd by ICICI in early 1996	Closed	Ignifluid Boilers: Mr. Rao; Tampella Power Corp: Mr. Patel
Fall 95	Indocan Engg	Wastewater treatment thru production of ferric chloride	PVS Chemicals	3	NA	NA	Fall 96 meeting in Bombay	Followed-up with PVS in Oct. 96 Waiting for response from PVS	C. Eiff, SI D. Rutkowski, PVS Chemicals
Summer '94	Industrial Boilers - X	Air pollution control tech; fly ash utilization technologies	Castone and other US firms	4	AEP/TEST	2	There was lengthy discussion of a MOU w/ Castone, then dropped	No action	J. Hallett, SI Mrs. Baldawala, Ind. Boilers
Sept. 93	INALSA, New Delhi - X	Industrial air filters	Pneumafil, Charlotte, NC	5	AEP/TEST	2	Loan sanctioned in summer 1995.	Closed	Mr. Chatterjee: INALSA Pneumafil: Ugo Bert
Nov. 93	Ion Exchange - X	Wastewater treatment tech.	Allied Signal Modular Environ-mental Technology Koch Membrane Systems	4	AEP/TEST	3	Licensed membrance technology from Koch Membrance as result of TEST/USAEP business exchange No further assistance required.	No action	Ion Exchange: Satish Chilekar; New Jersey contact for Allied Signal: Brent Defeo; E. Harwit, SI

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TEST [redacted]S

Test Start Date	Indian Company	Product/ Tech. Sought	U.S. Partner	TA Level	Exch-Fnde	# Partic.	Status of TEST Case	Action Required	Contacts For Further Info.
Fall '93	Jet Engineering Co.	Requested TEST info only	None	1	NA	NA	Business agreement w/ MET	Closed	K. Harinathan, ICICI
Spring '94	J.S. Group of Companies	Water pollution equipment	None	1	NA	NA	No TA assistance requested.	Closed	K. Harinathan, ICICI
Summer '93	Kirloskar	Air pollution equipment	American Air Filter	1	NA	NA	Loan sanctioned for a JV between the two companies	No Action	J. Hallett, SI Bert Grohmann, AAF
Oct. 93	Larsen & Toubro Bombay -	Gas station clean-up equipment	EBW International Fluid Power-X	3	AEP/TEST	2	Met with Fluid Power in India 1993 EBW in 1995	L&T not interested to proceed with either firm	S. Gangul, SI
Nov. 93	Lucas-TVS Ltd.	Automotive air pollution control for India	Lean Power-X	4	AEP/TEST	2	10/96: Lean Power currently doin demos with Bajaj for 3wheelers	SI Follow-up with Lean Power	J.Hallett Stephen Bryen, Lean Power
Nov. 93	Mantec Consultants, Pvt. -	Oil recovery unit	Yankee Environ. Services-X	5	AEP/TEST	2	Sale completed to Indian Cst Guar Field demos took place 10/96	SI Follow-up	Christian Lint, Yankee J. Hallett, SI
Spring '94	Marathe Engineering Industries	Requested info. on TEST program only	None	1	NA	NA	No TA requested after initial conta	None	K. Harinathan, ICICI
Spring '94	McClelland Engineering Industries	Requested info. on TEST program only	None	1	NA	NA	No TA requested after initial conta	None	K. Harinathan, ICICI
January ' 95	MIL Industries Ltd.	Air pollution control equip. also solvent recovery	EPR - X	5	AEP/TEST	2	Closed for solvent recovery; Negotiating with EPR on distr. agree.	Follow-up both sides	Rajiv Sreedhar, MIL J. Hallett, SI
Aug. 93	Munradtech	Joint venture for production of industrial air filters	Donaldson, Inc.	5	NA	NA	Loan sanctioned 9/94 Operating successfully	No action.	K. Lindquist, Donaldson S. Ganguli, SI J. Hallett, SI
October '96	National Productivity Council - X	Hazardous Waste remediation	IT Corporation	5	AEP/TEST	2	NPC is continuing discussions w/ IT on hazardous waste	SI will follow-up with both parties in November '96	Dr. Saxena, NPC A. Baker, IT Corp.
Oct. 93	Neptune Equipment Pvt. Ltd.	Service station recovery and recycling	None	2	NA	NA	SI sent information on EBW. EBW met Neptune, not interested pursue alliance.	Probably closed	S.P. Shah S. Ganguli, SI
Spring '94	Nilkamal Plastic and Allied Industries	Requested info. on TEST only	None	1	NA	NA	No TA request after initial contact	No action	K. Harinathan, ICICI
Spring 94	Nuchem Weir, Ltd New Delhi - X	Environmental Audits and Bioremdiation Environ. Labs.	Radian Corporation and Industrial Ecosystem	4	AEP/TEST	2	Radian and Nuchem are establishin an environmental analysis unit. Also pursuing bioremed. demo wit Oil and Natural Gas Corp.	SI to follow-up with IES Nuchem having financial difficulties Unable to take TEST loan at presen time. ICICI will monitor/	Dr. N. Sriram, Jack Wilson IES, J. Hallett, SI Mr. Barar -Mng Dir S. Ganguli, SI Avi Patkar, Radian
Summer 95	Paramount	Hazardous waste treatment	Clean Harbors IT Corporation	3	NA	NA	Paramount has not responded. Possible collaboration with IT Corp.	Follow-up earlier contact with Paramount re collaboration with IT Corp.	C. Eiff, SI A. Baker, IT Corp.
Summer 96	Pradushan Controls	Catalytic converters for diesel engines	United Emissions Catalysts (UEC)	4	NA	NA	Through TEST technical assistance UEC has approached the U.S. EXI Bank for assistance	UEC considering ICICI loan request, if they decide on a real JV partnership with Pradushan	E. Harwit, SI M. Hobbs, UEC
Spring 94	Praj Industries Ltd	Solvent recovery Cane Crushing	Amcane	2	NA	NA	TEST loan sanctioned 1996 for Praj Amcane JV	No action	Mr. N.S. Kunkolikar
Spring 94	Premier Ziba	Biotechnology for industrial waste-water treatment	U.S. Biotech-X	5	AEP/TEST	3	Clearances finally granted 8/96 Beginning pilot demos of product TEST likely to finance if PZ submits proposal	ICICI followup PZ SI followup US Biotech	Mr. Govind Srivastava, Premier Ziba E. Harwit, SI J. Hallett, SI
Summer '96	Raj Iron Foundry	Re-engineer the foundry's coke-burning cupola to coke	RTP Environmental Associates Stearns & Wheeler	5	NA	NA	Raj has comissioned these firms to do the engineering work. Both	SI follow up with RTP	E. Harwit, SI Sunil Hangal, RTP

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TEST CASES

Test Start Date	Indian Company	Product/ Tech. Sought	U.S. Partner	TA Level	Exch-Fnde	# Partic.	Status of TEST Case	Action Required	Contacts For Further Info.
		and gas combustion system					firms to travel to India in Fall, 1996		
Spring '95	R.J. Shah and Co. Ltd.	Air pollution control technologies	Nucon, CSM. Vara	4	NA	NA	Shah exchanging info with US firm Moving slowly	SI follow up ICICI followup with Shah	C. Eiff, SI
Spring 94	Raman Boards Ltd.	Rice husk ash recovery technologies	None	2	NA	NA	Submitted tech. search outline & cost	No response, seems no interest to proceed with search	Mr. V. Raman
Fall '93	Shriram Industries - X	Air and Waste Water Treatment technologies	None	2	AEP/TEST	1	Did not follow-up with TEST after exchange. No TA assistance requested.	ICICI follow-up	J. Hallett, SI
Spring '94	S.K. Systems Pvt. Ltd.	Requested info. on TEST only	None	1	NA	NA	No TA requested after initial conta	Closed	S. Ganguli, SI K. Harinathan, ICICI
Spring '94	SIV Industries Ltd.	Requested TEST info.	None	1	NA	NA	No TA requested after initial conta	Closed	J. Hallett, SI
Spring '96	Solapur Chemicals	Sand reclamation technologies	Dependable Foundries, GMD, National Engineering, Kloster	5	NA	NA	AEP is receiving final approval for exchange to U.S. and travel	SI awaiting decision from USAEP	S. Ganguli, SI
Fall '94	Sudarshan Chemical Industries Ltd.	VOC recovery for rayon plant	Radian	3	NA	NA	Sudarshan refused to invest in de project, wanted 100% funding	Closed	Ramesh Vkidve Avi Patkar Dr. R.J. Rathi
Spring '94	Tata Consultancy Services	TEST info. requested only	None	1	NA	NA	No TA requested after initial conta	None	K. Harinathan, ICICI
Spring '94	Tata Consulting Engineers	TEST info. requested only	None	1	NA	NA	No TA requested after initial conta	None	N.J. Patel
Spring '94	Tata Risk Management	Hazardous waste environ. impact - risk assessment	None	2	NA	NA	No TA requested after initial conta	None	Subir Gupta
Summer '94	Technology Transfer Ass'n	Computer database	No U.S. partner	2	NA	NA	Submit proposal under info. component, no action, probably closed	ICICI Action	K. Harinathan, ICICI
Summer '93	TTG Industries	Water-jacketed gas collection hoods	Davy International	1	NA	NA	ICICI financed $300,000 of a total project cost of $500,000 to finance engineering design work.	Closed	John Sedlak, Davy Intl.
Summer '93	TTG Industries	Air pollution system for an acid plant	Swemco Inc. and Joy Environmental Technologies, Inc.	1	NA	NA	ICICI financed $530,000 from a total project cost of $5,400,000	Closed	Jim O'Farrell, Swemco
Spring '94	The Phosphate Co. Ltd.	Air and Water pollution control technologies	None	2	NA	NA	1/95-ICICI ask for TA estim. SI seeks clarication on request Firm did not respond.	ICICI action	Suresh Bangur
Summer 95	Thermax Ltd.	Hospital waste disposal	IIT (Illinois Institute of Technology)-X	5	AEP/TEST	1	MOU signed for cooperation & pending action by Thermax on sending a market assess. report	SI followup with IIT	E. Harwit, SI Sid Firstman, IIT Dr. Joshi, Thermax
Spring '95	TIL Ltd. Uniexcel Agencie & Services Pvt. LTd. - X	laser welding tech. for environmental filter production	Energy Systems, Utilase, Texc MKI	5	AEP/TEST	2	After extensive TA and exchange Uniexcel has been unable or unwilling to commit	ICICI will follow-up on TSR report and Uniexcel	J. Hallett, SI C. Eiff, SI S. Nagaswami
Summer '94	Vam Organic, (also Enpro) Kinetics Technol. India, Ltd. Delhi	Water pollution processes/ air pollution, VOC technology	Info. forwarded to Research Cottrell in Sept. for VOC	3	NA	NA	Research Cottrell not interested, already have Indian partner. No additional TA requested	No Action	Prakash Dhargalkar, Research Cottrell J. Hallett, SI
Summer '95	Ventair-X	Air ventillation systems other air pollution technologies	Beltran	5	AEP/TEST	1	Entered into licensing agreement with Beltran to build air pollution control system. Beltran to travel to India in Fall, 1996.	SI to follow up with Beltran	E. Harwit,SI Mr. Lokaiyan, Ventair
May. 95	Vikram	Gen'l engineering	None	1	NA	NA	Approached Joy Environmental at their request, not interested to collab.	ICICI action	Sumit Shah

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TEST

Test Start Date	Indian Company	Product/ Tech. Sought	U.S. Partner	TA Level	Exch-Fnde	# Partic.	Status of TEST Case	Action Required	Contacts For Further Info.
		resources					No additional TA requested		
Jan. 94	Vimta Labs Ltd. - X	Partnership with a pollution testing lab	Weston, Radian, Law	5	AEP/TEST	2	USAID/ICICI to push Vimta to identify projects for collaboration with potential partners. Vimta has yet to commit.	Vimta Exchange completed May 95. Vimta to follow up with U.S. companies. 10/96: No action from Vimta.	S.P. Vasireddi S. Ganguli, SI
Fall '93	Voltas Ltd., Bombay	Air pollution equipment	None	2	NA	NA	Subcontractor report mailed 9/93 No response received	Closed	D.K. Kelapure
Jan '95 and 1996	Western-Paques India, Ltd. - X	Waste management technologies	WMX, Biosystems Intl., McGill Environmental DDH Enterprises	5	AEP/TEST	1	2/95 met with EH, Business Exchange Spring 96 Possible tieup with WMX	ICICI action Si followup	E. Harwil, SI S. Ganguli, SI

* Note: TA Level is noted by numbers 1-5, where 1 is lowest level of technical assistance provided by Sanders Intl.; 5 is the highest. The middle columns show who funded envir. business exchanges between the U.S. and India and number of participants.

Sanders has entered all the U.S. and Indian contacts made under the TEST program in a business database called Telemagic. In this binder, we have attached an abbreviated list of all these contacts. This list includes:

»companies contacted as a part of the TEST outreach effort;
»companies contacted through trade fairs;
»companies that made enquires about the TEST program;
»companies that visited the U.S. or India under the US-AEP exchange program;
»companies that received TEST technical assistance, loans, or grants.

Quick List: Contact List
Printed on 11/06/96 17:23:06 by AP1
Index: Company/Contact
Filter: TEST U.S. Contacts

Company	Contact Name	City	Primary Phone	Primary Fax
	A. Lynne Khavari	Washington, D.C.	265-7742	
	Abyd Karmali	Washington, DC	2028621154	
	Adam R. Bennett	Ithaca	800-674-8453	
	Adib Rahounji	Jacksonville	9042627222	9042627222
	Agni Jandhyala	Greenbelt	301-474-2455	301-474-2455
	Alan Gagnet	Dallas	2148213794	2148215360
	Albert Donald Roach	Point Comfort	512-987-2364	
	Alex V. Matveev	Athens	614-593-6035	614-592-6179
	Alexander Bakalian	Bethesda	301897-5498	
	Alexander Levi	Kings Co.	7183777601	7183777601
	Alexander M. Snage, II	High Point	9108123865	
	Andrew Romanov	Toms River	1-908-2558682	1-908-2559053
	Andrew T. Der	Burtonsville	301-490-8772	
	Andrew T. Zador	New York	12128763562	12129967234
	Anthony Z. Wozniczka	Redwood City	415-599-9703	
	Aparna Rao	New York	212-749-0526	
	Armando L. Vargas	Laguna Niguel	7144895992	
	Arnold van Borrayt	Hixson	6158755691	

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2.3.11
2.4.5

Company	Contact Name	City	Primary Phone	Primary Fax
	Arun Nijhawan	Bethesda	301-320-4126	
	B. S. Walia	Morgantown		
	Basil A. Oli	Hyde Park	617-361-7510	617-361-7510
	Ben Pooler	Lafayette	318-989-1601	
	Benedict Aurian-Blajeni	Bellingham	5089664963	5089661271
	Bobby V. Zachariah	Golden	3032793779	
	Boris Doktorov	San Mateo	4155715593	
	Brad J. Mumbrue	Studio City	8189859271	
	Brendan Sweeney	Lusby	410-326-9544	
	Brent D. Wainwright	New Rochelle	9146378463	
	Brian K. Smith	Long Beach	3104357527	3109839822
	Brian Streiffer	Baltimore	410-563-2813	
	Bryan A. Snage	High Point	910-812-3865	
	Bryan T. Reed	Tucker	404-934-8715	
	Byron Swift	Washington, D.C.	939-3808	
	Carl M. Durham	Foster City	4155710360	
	Carlo Zavagno	Milpitas	4089561445	4089561445
	Carmen A. Llewellyn	Washington, D.C.	202-244-5554	
	Carolyn Kadas	Portland	503-234-1386	
	Catherine P. Vial	Washington	2024820616	
	Catherine R. Boyle	Monterey	408-648-1582	
	Chang Feng Liu	Elmhurst	7187601701	
	Charles G. Rees	Fairview	201-943-6731	
	Charles Peterson	Easton	1-610-559-1087	1-610-559-5705
	Charles Schilke	Washington, DC	2440150	
	Chi-I Huang	Irvine	7145099123	
	Christine L. Tripp	Pensacola	904-479-3397	
	Christopher M. Contreras	Annandale	703-256-5807	
	Christopher Stoch	Arlington	703-528-4552	703-528-4552
	Christopher T. Newkirk	Bethesda	301-320-5007	
	Clark Griffith	Virginia Beach	804-467-3806	
	Claudia D'Andrea	Washington, D.C.	202-667-6315	202-667-6315
	Cynthia B. Wilson	Washington D.C.	202 659 2333	202 223 9096
	Daniel Bela Grulich	Baltimore	410-889-3724	
	Daniel Krishock	New York	12127217570	
	Daniel P. Finn	Annapolis	4102634397	4102634397
	Darryl J. Patton	Rockville	301-340-6488	301-340-7451
	David A. Gross	Lake Forest	714-583-9554	
	David A. Miller	North Miami Beach	305-653-1060	
	David G. Jopling	Palm Beach Gardens	407-627-8838	
	David Lehrer	Miami	3055926661	3055920333
	David M. Chase	Modesto	209-544-0245	
	Deam Given	La Mesa	6196600898	6196600898
	Dennis V. Johnson	Silver Spring	301-587-2840	

Company	Contact Name	City	Primary Phone	Primary Fax
	DeWitt John	McLean	703-534-4703	
	Diahanna Lynch	Arlington	202-624-9391	
	Dianne Eppler	Reston	703-391-0060	
	Donald F. Kennedy	Groton	508-448-3419	
	Dorene R. Saltiel	Cambridge	617-876-7904	
	Dwight E. Thomas	Greensboro	9102302226	2102302227
	E. Brett Heernan	Swampscott	617-598-1767	
	E. Dale Litney	Schaumburg	847-330-9199	
	Ed Choo	Annandale	7039141170	
	Edward A. Nyren	Tierra Verde	8138942719	
	Edward J. Bolden	East Orange	2016738538	2016738538
	Elba Agusti	Washington, D.C.	237-2960	
	Elizabeth B. Blair	Roosevelt Island	212-223-0265	
	Ellen D. Harpel	Carrboro	919-967-1608	919-967-1727
	Eva D. Strzelecka	Baltimore	410-235-6248	
	Evan Goldsmith	Washington, D.C.	202-588-0365	
	Frances Anne Nowak	Houston	7135970483	7132931034
	Francis X. Clegg	Weymouth	617-337-8681	
	Frank Radstake	Washington, D.C.	202-337-5953	202-337-5953
	G. Jantina Griffin	Arlington	703-841-1047	
	Gabriela Kernan	Pittsburgh	412-682-4529	
	Gail Charnley	Arlington	703-979-0979	
	Gail Yan Gao	Voorhees	6097700861	6097700861
	Garrick J. Solovey	Williamsburg	804-258-3732	
	Gary M. Bateman	Odenton	4106744157	
	Geoffrey Mazullo	Minneapolis	612-879-0615	
	Gerald C. Hurley	Silver Spring	301-421-1385	
	Gil Bindelglas	Washington, D.C.	202-363-2695	
	Glenn P. Orloff	Hartford	2032311566	2032311642
	Goran N. Svalling	Brighton	617-245-7422	
	Gregory Kheifets	New York	2128880776	
	Gregory M. Carmichael	Milwaukee	4144757140	4144757287
	Hai Van Pham	Renton	2062719296	
	Harsha D.D. Weerasinha	Silver Spring	3019849248	
	Heather Euler	State College	814-867-0775	
	Howard Klee, Jr.	Houston		
	Humberto E. Serna	Florissant	314-838-7631	
	Iftekhar Mahmood	St. Louis	314-432-1928	
	Irina V. Halpern	Arlington	703-524-5416	
	J. George Caldwell	Spartanburg	803-576-8407	
	J. Lange Winckler	Burbank	818-845-4521	
	J. W. Mohlman	Rancho Palos Verde	310-544-0034	
	James A. Davis	Potomac	301-983-8798	
	James A. Moorhouse	Alexandria	703-799-3782	

Company	Contact Name	City	Primary Phone	Primary Fax
	James E. Cole	Alexandria	703-799-9279	
	James Hudson	Aptos	4086887195	
	James J. Broad	Costa Mesa	7147221734	7147221794
	James J. Villalobos	Fairfax	703-978-4426	
	James Sullivan	Goose Creek	8035723226	
	Jane Ellen Bruss	Minneapolis	612-920-8951	
	Janet Hunkel	334200 Yalta Crimea	7-654-32-68-90	7-543-32-88-33
	Jason Dury	Wayne	610-688-4912	610-687-6662
	Javed Azam	Arlington	703-920-5447	
	Jeff D. Ferry	Washington, D.C.	337-1048	
	Jeffrey A. Mattern	Wadsworth	2163367992	
	Jeffrey Kursman	Everett	617-387-1662	
	Jesse M. Floyd		703-768-7551	
	Joanta H. Green	Sausalito	4153318909	4157683580
	Joe Attansio		1-914-226-1745	1-203-972-7672
	John A. Franco	Hurricane	304-562-7407	
	John Byrne	Vienna	703-938-6650	703-319-0648
	John C. Milazzo	Auburn	207-784-0679	
	John J. Stankiewicz	Southlake	8173294133	8173294133
	John J. Tkacik, Jr.	Alexandria	7037865105	7037684325
	John Liu	Ozone Park	7187381553	
	John McGill	Exeter	603-964-6089	
	John W. Peschke	McLean	703-241-8204	
	Joseph A. Baron	Arlington	703-527-6746	
	Joseph A. Crites	Kansas City	8163335561	
	Joseph J. Fairclough	Highland Mills	9149282608	
	Joseph L. Willenbrink	Venice	310-392-9395	310-396-9846
	Joseph R. Adamczyk	Harrisburg	7176529602	
	Julie M. Payne	Glendale	602-439-9095	
	June M. Small	Jupiter	407-575-6001	
	K. Ramesh Kumar	Lakewood	216-475-9842	
	Kamal Raina	Taylor	313-291-0351	
	Kamran H. Baig	San Rafael	4155079226	
	Karan Capoor	Washington, DC	2026677562	2022346049
	Karthik M. Chandran	Auburn	334-826-6606	
	Kathleen Davey-Mistry	Great Falls	703-450-4052	703-450-4519
	Kaushik Vyas	Potomac	301-983-1896	301-983-8058
	Keith Finkenbiner	San Diego	619-674-2250	619-674-2254
	Kendall Frye	Woodstock	703-459-2519	
	Kendra J. Briechle	Falls Church	703-536-5928	
	Kenneth R. Fort	Nucla	3038642295	
	Krishna Ella	Charleston	803-762-3155	
	Krisztina Bordacs-Irwin	Newtown	215-860-4768	215-860-0541
	L. Michael Hooks	Troutdale	5036656630	

Company	Contact Name	City	Primary Phone	Primary Fax
	L. Sandra Garner	Arlington	703-892-1302	
	Langedon Bell	Washington, D.C.		
	Larry Hastings	Fountain Valley	714-432-1877	714-957-1210
	Laslo Vero	New York	212-888-9187	
	Laura Lynn Ziegler	Everett	617-387-1662	
	Lawrence H. Foster	Macungie	6109665339	
	Lawrence K. Barber	Waynesville	704-452-4612	704-452-4786
	Lawrence R. Major	North Hampton	6039642388	
	LeRoy Duvall	Seattle	206-784-6004	206-784-6004
	Lois Smithman	Washington, D.C.		
	Luci Hise	Los Angeles	310-820-7311	
	Lucio Anthony D'Andrea	Fairfax	703-978-7896	703-978-2471
	M. Mihkel Mathiesen	Excelsior	6124706231	6124706232
	M.A. Johnson	Tulsa	9182990013	
	Madhu Dewan	Wadsworth	2163367974	
	Maja Sliwinski	Bensalem	215-741-5615	
	Maralee DeMark	Plant City	813-759-6767	
	Margaret M. Walker	Brighton	617-254-7422	
	Margaret Takaki	Phoenix	6022775135	6029455434
	Maria Paula Carrico	Boston	617-262-7632	
	Marian J. Murawa	Minneapolis	6125619039	6125619039
	Mario A. Camps	Miami Beach	305-381-8964	
	Mark S. Merriman	Hooks	9035472402	
	Mark Shafer	Seattle	2066320870	
	Martin Kearns	Arlington	703-998-3177	
	Martin Vidaeus		1-212-779-9105	1-301-983-0575
	Mary M. Akers	Takoma Park	301-270-4379	
	Matthew W. Addison	Reston	703-758-6778	703-758-6778
	Menyu M. Zhang	Chicago	3125091185	
	Michael A. Nardi	Carmel	3178442160	
	Michael D. Pitluk	Oviedo	4073597384	
	Michael J. Jamiolkowski III	Washington, D.C.	202-659-0370	
	Michael S. Flaherty	Cobb	707-928-4290	
	Mick Weltman	Brattleboro	8022575816	8022577203
	Mikhail M. Ivanov	Washington, D.C.	703-243-3470	202-687-5288
	Mohammad A. Khan	The Plains	614-797-3730	614-593-4089
	Monica Jerbi	Silver Spring	301-587-0885	
	Ms. Farris Dean Gavora	Alexandria	703-719-0568	
	Mujahid Iqbal	Vienna	703-280-0792	703-573-5312
	Myron Robinson	Flushing	718-263-7297	
	N. Duraiswamy		310-544-4178	310-377-4706
	N. Jack Fontenot	Tucson	6027492087	
	Nihar Shah	Arlington	703-243-5349	
	Nirmesh Patel	Idaho Falls		

Company	Contact Name	City	Primary Phone	Primary Fax
	P. Andrew Howard	Cazenovia	315-655-9384	
	Pari Sivakumar	Missouri City	713-499-7238	
	Patty Signorella	Whippany	1-201-267-3777	
	Paul Converse	Vermillion	605-624-7252	605-624-7252
	Paul Studemeister	Menlo Park	4158544698	
	Perry Daily	Midland	915-697-0978	
	Peter Braun	Santa Clara	408-246-3943	
	Peter Simon	Arlington	7033794060	
	Piotr Kacprzak	Farmington Hills	810-737-9409	
	R. Caron Cooper, Ph.D.	Livingston	406-222-8240	406-222-8216
	Radim Jasek	Berkeley	5108487116	
	Ralph Field	Washington, D.C.	722-2783	
	Ramesh Rajagopalan	Herndon	703-734-4043	703-648-1453
	Rebecca L. Wieghart	Albany	518-432-3392	
	Rehman Sharif	Houston	7137897339	
	Renee Stockdale-Homick	Upper Marlboro	301-952-9263	
	Richard C. Dunlap	Keizer	503-390-6657	
	Richard E. Winston	Havertown	610-446-3285	
	Richard J. Skane	Winthrop	617-846-7993	
	Richard M. Henderson	Milton	9046234138	
	Richard Moyer	Tulsa	918-663-4031	
	Richard Searle	Somerville	6176236216	
	Richard W. Tolmie	Kalama	360-673-3106	360-673-3250
	Rick Walawender		1-313-496-7628	1-313-496-8450
	Rickie J. Rabourn	Sugar Land	7132406794	
	Robert Direnzo	Washington	1-703-528-3547	
	Robert J. White	Alexandria	7034618246	
	Robert Kaucher	McLean	7037614355	
	Robert N. Stavins	Newton Center	617-244-1357	
	Robert S. Kossmann	Garland	2142713416	
	Robert W. Doubek	Washington, D.C.	202-244-5266	
	Robert Winter	Williamsburg		
	Roger Aertgeerts	New York	12127522931	12123551032
	Roger Stillwater	Kittredge	303-670-3133	
	Roland R. Wommack	Annapolis	410-889-7224	410-889-7227
	Romualdas Bublys	Mishawaka	2192732441	2192732441
	Ron Holmes	Beverton	503-645-9199	
	Ron Mullins	Concord	5103802886	
	Ron Taylor	Coronado	6195752042	
	Roy B. Rubeli	McLean	703-242-5080	
	Sarah L. Lucey	Washington, D.C.	202-966-3296	
	Scott A. Rosenzweig	Washington, D.C.	202-265-4675	202-265-2172
	Scott Hedges	Oakland	510-482-5140	
	Scott M. Bressler	Rockville	301-816-9456	

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Company	Contact Name	City	Primary Phone	Primary Fax
	Sergey Chuprik	Baltimore	410-653-3518	
	Setsuko Masaki		232-7413	
	Shashi Gupta	Washington, DC	2022324441	
	Shauzab H. Ladha	Old Tappan	2013582745	2013586233
	Sherrie L. Streit		202-338-1583	
	Sherry R. Login	New Haven	203-776-1153	203-432-5995
	Shiying Zhang	Pensacola	904-438-7371	904-438-7371
	Sidhu Satpal		1-206-398-1246	
	Simon J. Cordery	Arlington	703-276-7466	
	Sondra Simpson	Silver Spring	301-871-6997	
	Stephen J. Simko	Silver Spring	301-585-5806	
	Stephen Klein	Silver Spring	301-587-2490	
	Stephenson Lowry	San Diego	619-278-2406	
	Steven Dean Sanders	Trophy Club	8174913524	
	Steven J. Moss	San Francisco	4157316170	4155643661
	Steven Leonard	Chicago	3122440995	
	Steven T. White	Seattle	2064673630	
	Subhash Agrawal	San Jose	408-223-6132	
	Suresh B. Naik	Germantown	3019720985	
	Suresh Subramanian	Huntington Beach	714-965-5968	
	Susan Levin	Arlington	703-522-6890	703-522-9853
	Susan Sherwood	New York	212-517-9367	212-517-9494
	Suseela Gopalswamy	North Potomac	202-458-2580	
	Syed Quadri	Fords	908-417-9730	
	T. K. Tummala	Waldorf	301-870-9288	
	Tamara Raye Crockett	Durham	919-489-8808	919-489-8952
	Tamara Vishkina	Brooklyn	718-996-8460	212-307-7045
	Ted Dean	Roanoke	703-982-2558	
	Theresa M. Kelly	Washington, D.C.	202-686-9406	
	Thomas F. Burola	Ventura	805-647-7256	805-654-1708
	Thomas J. Perkoski	Meadville	8143333696	
	Timothy J. Hoffmann	Irvine	7144748553	
	Timothy J. Kichline	Mrietta	404-640-0907	
	Tomoko Sawada	New York	212-988-2184	212-439-9109
	Tony L. Housh	Washington, D.C.	2023197736	
	Tully W. Brown	Tullahoma	615-393-4663	
	U. V. Rao	Irvine	714-559-4675	714-552-9720
	Ulrich Hottelet	Falls Church	703-536-7525	
	V. James Iannuzzi	Fairfax Station	703-503-9775	
	Valerie Kellogg	Rochester	716-225-8243	
	Vanbakm C. Gopalratnam	Cincinnati	513861860	
	Vidas P. Juzenas	Palos Heights	7084486033	7084482387
	Vijay Dixit	Simsbury	1-860-658-0269	1-860-651-1043
	Vijay Mehta	McLean	703-893-3588	

Company	Contact Name	City	Primary Phone	Primary Fax
	Vivek Date	Plainsboro	609-799-7973	
	Vladimir Burd	Torrance	3105400825	
	Vladimir L. Shehovtsov	Minneapolis	612-321-9876	612-321-9876
	W. C. Alexander McPheeters	Palm Beach Shores	4078637589	
	Wallace W. Migura, Ph.D.	Cypress	713-469-1289	
	Walter A. Szuja	Findlay	4194252031	
	Walter W. Arensberg	Washington, D.C.	202-333-1434	
	Ward Broyles	Rowlett	2144757201	
	Wendy Oden	Ft. Collins	970-416-9768	
	William A. Foy	Alexandria	703-329-8586	
	William A. Ockunzzi	Madeira Beach	8137860456	8133932658
	William E. Simpson	Morehead City	919-726-1592	
	William E. Strathmann	Charlottesville	804-296-5260	
	William R. Bierwith	Quinton	8049328590	
	William Witter	Mountain View,	4159697018	
	Youran Wang	Bellingham	2067384769	
	Yvonne J. Wolna	Laguna Hills	7146431686	7146431686
	Zoltan Gorocs	St. Louis	3144213277	3144213277
3M	Noname	St. Paul	1-800-328-1687	
A.G. Lightenstein & Assoc.	Niket M. Telang	Framingham	508-879-2772	508-879-7813
A.I.W., Inc.	Ashok Wadwani	Houston	713-578-6733	713-578-6764
A.M. Johnson & Associates, Inc	Kenneth I. Brody	Compton	310-537-2266	310-537-6915
Ab.sorb, Inc.	Mr. Jack Wallace	Minnetonka	1-612-939-6623	1-612-933-9664
ABB Environmental Systems	Jack Blazek	Monmouth Junction,	1-908-422-2146	1-908-422-2178
ABC Industries	Kathleen Davey Mistry	Mendota	1-815-539-6721	815-539-5266
Accutech Remedial Systems, Inc	John J. Liskowitz	Keyport	1-908-739-6444	1-908-739-0451
ACDC, Inc.	Thomas McQueary	Milford	1-513-248-1820	1-513-248-0420
ACE Project	Pam Michelle/ Judy Singzon	Washington	1-202-955-3479/3475	
ACS Inc.	Derek Rajtek	The Woodlands	1-713-362-8080	1-713-362-8090
ACS Industries Inc., Separations Tech. Division	David B Rubin	Houston	800-231-0077	713-433-6201
Acurex Enviromental Corp.	Howard L. Morse	Mountain View	1-415-961-5700	1-415-964-6523
Acurex Environmental	Ravi Srivastava	Research Triangle Park	1-919-541-2692	1-919-541-1887
ADA Technologies, Inc.	John Worster	Englewood	303-792-5615	303-792-5633
ADS Environmental Services	Jan Offner	Huntsville	1-205-430-3366 1-80	
Advanced Environmental System	Tom Murphy	Kihei, Maui	1-808-874-0425	1-808-874-8312
Advanced Environmental Systems	David O'Connor	Elkton	1-410-620-1800	1-410-620-1819
Advanced Fuel Development Tech	Thomas A. Simon	Austin	1-512-346-6069	1-512-346-6152
Advanced Industrial Tech. Corp	Jerry Wang	Paramus	201-265-1414	201-262-8457
Advanced Monitoring Systems	Ralph Baker	The Woodlands	1-713-364-7701	1-713-364-9639
Advanced Pollution Instrument.	Neil Charlton	San Diego	619-578-2154	619-578-1833
Advanced Sensor Devices Inc.	Robert Heubel	Mountain View	415-960-3007	415-960-0127
Advanced Technologies Inc	Edward Cooke	Troy	1-810-583-7200	1-810-583-7224
Adwest Technologies Inc.	Joe Terry	Orange	714-997-8722	714-997-8744
AERCOR	Gorge Rushton	Worcester	1-508-756-1020	1-508-756-0110

Company	Contact Name	City	Primary Phone	Primary Fax
AERInc	Ronald E. McIlwain	McLean	1-703-893-4710	1-703-556-0194
AGAR Corporation	Jeanne Barkley	Houston	1-713-464-4451	1-713-464-7741
Agglite	Noname			
AID	Dennis Long	Washington	1-202-647-4729	
AID	Paul Rader			1-301-0251-0843
AIESEC - Georgetown	Nicolas Jacques	Washington, D.C.	687-1756	687-2193
Air Force Center for Environ-	Renee Wesley	Brooks Air Force Base	1-210-536-4347	
Air Pollution Testing, Inc.	Michael J. McNaughton	Lakewood	1-303-232-5213	1-303-232-5313
Air Purification, Inc.	Kurt Johnsson & Frank Faragor	Scotia	1-518-399-7617	1-518-399-1150
Air-Cure Environmental, Inc.	John Fitzpatrick	Minneapolis	612-571-0560	612-571-0426
Airborne Environmental Surveys	Doug Strahl	Santa Maria	1-805-922-1008	1-805-922-9152
AirMetrics	Karene Gottfried	Springfield	503-726-0560	503-726-1205
Akord-Consulting S.C.	Mr. Andrzej Tarocinski	Wroclaw, Poland	48-71 612-321	
Al Technologies (S) PTE LTD	N. Narendranathan	#03-10, Singapore	011 3822889	011 3820005
Alabama Laser Technologies	Don Burney	Munford	1-205-358-9055	1-205-358-4515
Alfa Laval Separation-Sharples	Dick Moll	Warminster	1-215-443-4000	1-215-443-4139
Allied Gator, Inc	Noname	Youngstown	1-216-766-0808	1-216-744-3218
Allied Signal	Brent DeFeo	Morristown	1-800-626-4974	1-201-455-5722
Allied Signal	Stephen Lupton	Morristown	1-800-626-4974	1-201-455-5722
Allied Signal Inc.	Dr. Richard Morrow	Tulsa	1-918-266-1400	1-918-266-3251
Alligator Corporation	Rick Locke	Richland	1-509 375 6167	1-509-375-3114
Alpro Associates	Mr. Amol Hardikar	Indore INDIA	91-731-442834	91-731-490-593
Altis Group, Inc.	Doug Weil	Cambridge	617-556-7767	
Alton Geoscience	Jack Liu	Valencia	805-295-5121	805-295-5979
Am-Re Services	John Reynolds	Princeton	1-609-243-4332	1-609-275-2164
Am-Re Services	Phil Ludvigsen	Princeton	1-609-243-4332	1-609-275-2164
Am-Re Services	Stuart W. Ferguson	Princeton	1-609-243-4332	1-609-275-2164
AME International Inc.	William C. McKinley	Columbia	1-410-997-1249	1-410-997-1341
Amerex	Loran T. Schmidt	Woodstock	1-404-928-0970	1-404-928-2249
America-China Chamber of Comm	Noname			
American Air Filter Intl.	Bert Grohmann	Louisville	502-637-0503	502-637-0113
American Ash Recycling Corp	Noname	JAcksonville	1-904-296-2800	1-904-296-0895
American Electric Power	Howard Humphrey	Columbus, OH	614-223-2980	614-223-2963
American Electric Power Servic	Howard Humphrey/David Mustine	Columbus	1-614-223-2942	1-614-223-2963
American Electric Power Servic	Kay Hennis	Columbus	1-614-223-1387	1-614-223-2963
American Enterprise Institute	Robert Hahn	Washington	1-202-862-5909	1-202-862-7177
American Environmental Int'l	J.S. Tandon	Arlington Heights	1-708-342-8600	1-708-342-8500
American Environmental Tech	Noname			
American Foundrymen's Society	Ezra Kotzin	Des Planines	1-708-824-0181	1-708-824-7848
American Foundrymen's Society	Fred Kohloff	Des Planines	1-708-824-0181	1-708-824-7848
American Iron and Steel Inst.	Bruce A. Steiner	Washington, D.C.		
American Schack	C.P. Natarajan	Wexford	1-412-935-5725	1-412-935-6580
American Sigma	Jim McCrone	Medina	1-716-798-5580	1-716-798-5599
AMETEK	Jim Malone	Newark	302-456-4443	

Company	Contact Name	City	Primary Phone	Primary Fax
AMK Associates	Alexander M. Kratly	Centreville	703-631-3920	703-631-4023
ANDCO Environmental Processes	Jack I. Reich	Buffalo	1-716-691-2100	1-716-691-2880
Andritz-Ruthner, Inc.	Gary A. Hahn	Arlington	1-817-465-5611	1-817-468-3961
ANGI	Anthony Genaro	Cape May	1-609-884-1086	1-609-884-4626
Answer Technology, Inc.	Mr. Subrata Banerjee	Wheaton	1-708-682-5727	1-708-682-5804
Anti Pollution Inc.	Mary Cloutier	Morgan City	1-504-384-9517	1-504-385-3566
Applied Compost Consulting	Barton Blum	Berkeley, CA	510-644-3693	510-644-3691
Applied Energy Systems, Inc.	Vic Ballard	Malvern	1-215-647-8744	1-215-647-8744
Applied Resource Associates	Dave Russell	Vancouver	604-681-7577	
Aqua Chem, Inc.	Scott Whittaker	Milwaukee	414-997-6682	414-577-2723
Aqua-Chem	Joseph Creaghead	Milwaukee	1-414-359-0600	1-414-577-2723
ARD, Inc.	Ian Desmukh	Burlington	802-658-3890	802-658-4247
Argonne National Laboratory	Donald O. Johnson	Argonne	1-708-252-3392	1-708-252-7288
Argonne National Laboratory	Norm Peterson	Argonne	1-708-252-3392	1-708-252-7288
Arizona Public Service Company	C.V. Mathai	Phoenix	602-250-3569	602-250-3813
Arkansas Economic Devel. Offic	Scott Hancock	Little Rock	501-682-1121	501-682-7341
ASEI - American Society of	Chandrika Prasad	Bowie	1-301-464-5042	
ASM International	Stanley C. Theobald	Materials Park	1-800-336-5152	1-216-338-4634
Astech / MCI Manufacturing	Stephen J. Queen	Santa Ana	1-714-250-2141	1-714-250-2135
Astrotech	Kent Rockwell			
AT&T Testing Services	Jose Martinez	Union	1-908-851-3000	1-908-851-3360
Atlantic Ctr. for Environment	Jessica Brown	Ipswich	508-356-0038	508-356-7322
August Mack Environmental, Inc	Noname	Indianapolis	1-800-579-0770	1-317-579-7410
Automatic Filters Inc (AFI)		Los Angeles	1-213-6651-0530	1-213-651-5236
AVMC Group	Tim Hasan	Denver	303-861-8182	303-861-8366
Avny Industries	Joseph Attanasio	Poland		
AWT (Air & Water Tech.)	Eric Darmstaedter	Honolulu	1-808-521-3051	1-808-524-8677
Aztec Machinery Company	Joseph A. O'Leary	Ivyland	1-215-672-2600	1-215-441-0289
Babcock & Wilcox	Jane M. Piepho	Barberton	1-216-753-4511	
Baltimore Resco	Noname	Baltimore	1-410-234-0808	
Barr Engineering	Slava Macakova	Minneapolis	612-832-2600	612-832-2601
Barrett Consulting	Frank Barrett	Menlo Park	1-415-854-7090	1-415-854-7724
Batta Environmental Associates	I.P. Singh	Newark	1-302-737-6376	1-302-737-5764
Batta Environmental Associates	Naresh Batta	Newark	1-302-737-6376	1-302-737-5764
Bayliss Technologies, Inc.	Ray Schwarten	Randallstown	1-410-521-4700	1-410-521-4799
Bayou Ash	Dennis Kilborn	Baton Rouge	1-800-969-5634	
BAYTRADE	Tony Livoti			
Beckart Environmental, Inc.	Gail Tostrud	Kenosha	1-414-656-7680	1-414-656-7699
Bee Line Software	Richard A. Perry	Dallas	1-214-BEE-LINE	1-214-BEE-FAXX
Beltran Associates, Inc.	Dave Meier	Brooklyn	1-718-258-6887	1-718-253-9028
Beltran Associates, Inc.	Steven Ravinsky	Brooklyn	1-718-258-6887	1-718-253-9028
Beltran Associates, Inc.	Swapan Mitra	Brooklyn	1-718-258-6887	1-718-253-9028
Besser	Heidi Francis	Alpena	517-354-4111	517-356-1432
BHA Group Inc.	Michelle Jarnevic	Kansas City	1-816-356-8400	1-816-353-1873

Company	Contact Name	City	Primary Phone	Primary Fax
BHA Group Inc.	Mike Sebasto	Kansas City	1-816-356-8400	1-816-353-1873
Big River Industries Inc.	Mr. Barkely Burks	Atlanta	1-614-804-8070	
Bihler of America Inc	Brian Robinson	North Branch	1-908-725-9000	1-908-725-0457
Bio-Reaction Industries, Inc.	Noname	Tualatin	1-503-691-2100	1-503-692-1597
Bio-Systems Corporation	Francis Saunders	Roscoe	1-815-623-7411	1-815-623-7251
Bio-Systems Corporation	Malcom Peacock	Beloit	1-800-232-2847	
Bio/Scent	Hinsilblon Laboratories	Washington	625-0777	
Bioclimatic, Inc.	Michelle Zitin	Moorestown	800-394-3458	609-273-2848
Bioremediation Service, Inc.	David D. Emery	Lake Oswego	1-503-253-9579	1-503-
BioSafe	Bob Rivkin	Cambridge	1-617-497-4500	1-617-497-6355
BioSafe	John Cappadona	Cambridge	1-617-497-4500	1-617-497-6355
BioSafe	Phil Strauss	Cambridge	1-617-497-4500	1-617-497-6355
BioSafe	Richard Rosen	Cambridge	1-617-497-4500	1-617-497-6355
BioStim, Inc.	David L. Johnson	San Antonio	210-281-5977	210-822-7717
Biotech Environmental	Wallace Chavkin	New York	1-212-736-1580	1-212-967-4076
Biotechs Application International Center Inc.	Scott Stoodley	Waco	1-817-753-0322	1-817-756-0776
Biothane	Denise Johnson	Camden	609-541-3500	609-541-3366
Biothane	Nadine DeSanto	Camden	609-541-3500	609-541-3366
BioTrol	Michael S. Gratz	Eden Prairie	1-612-942-8032	1-612-942-8526
Bird Machine Company	Mr. Bohan	South Walpole	1-508-668-0400	1-508-668-6855
Bird Machine Company	Tim L. Davis	South Walpole	1-508-668-0400	1-508-668-6855
Black & Veatch	W.W. Reynolds	Raleigh	1-919-851-0500	1-919-859-2326
Blue Pacific Distributors Inc	Michael Clark	Keaau	1-808-966-6463	1-808-982-5303
Blue Plains WWT PLant	Noname	Washington		
BMT Ltd-PRAHA	Ken Macek		1-510-987-8297	1-510-893-1321
BOC Gases	Bob Zeiss	Murray Hill	908-464-1406	908-771-1672
BOC Gases	Michael Heil	Murray Hill	908-464-1406	908-771-1672
Bohn Biofilter Corporation	Heinrich Bohn	Tuscon	1-520-624-4644	1-520-621-1647
Booz-Allen & Hamilton, Inc.	Marie Lerch	McLean	1-703-917-2447	1-703-902-3555
Booz-Allen & Hamilton, Inc.	Smita K. Siddhanti	McLean	1-703-917-2447	1-703-902-3555
Booz-Allen & Hamilton, Inc.	William C. Hannon	McLean	1-703-917-2447	1-703-902-3555
Borlick & Associates	Robert L. Borlick	Bethesda	(301)907-4615	(301)907-4771
Born Inc.	Chris Parker, Mr. Sidney Born	Tulsa	1-918-852-2186	1-918-582-5163
Boyer Laboratories	Robert Boyer	Lake City	1-616-839-3452	1-616-775-9630
BPM, Inc.	Boni Philip Martinez, P.E.	New Castle	1-302-328-6420	1-302-322-6062
Bran & Luebbe, Inc.	NoName	Buffalo Grove	708-520-0700	708-520-0855
Branch Environmental Corp.	Don Detweiler	Somerville	908-526-1114	908-526-2881
Braun Intertec	Bruce Randall	Mendota Heights	1-612-683-8790	1-612-683-8888
Brentwood Industries, Inc.	Anani K. Upadhyaya	Reading	1-215-374-5109	1-215-376-6022
Bridges: Russian-American	Noname			
Briggs Associates	Ms. Swati Sinha	Columbia	410-381-4434	410-290-5499
Brinkmann Instruments, Inc.	Linus Seckel or Debbie Moon	Westbury	1-800-645-3050	1-516-334-2206
Brookhaven National Laboratory	Vale P. Myles	Upton	1-516-282-3312	1-516-282-3729
Brownsville City Commissioner	Jackie Lockett	Brownsville	210-546-1161	210-982-1876

Company	Contact Name	City	Primary Phone	Primary Fax
Brownwell Electro Inc.	Luis Reichman	Congers	1-914-267-3978	1-914-267-3999
Bruel & Kjaer	Bruel & Kjaer	Denmark	45 42 80 0500	45 42 80 1405
BSI	James Wolfram	Idaho Falls		
Bureau Veritas Quality Intl	Herve Wilczynski	Houston	1-713-875-4077	1-713-875-4080
Burg Engineering	Bob Burdett	West Chester	610-430-8685	610-430-6169
Burlington Environmental	Burlington Environmental	Seattle	1-206-223-0500	
Burner & Energy Systems (BESI)	Heinz Bednarzick	Placentia	1-714-572-8290	1-714-572-8296
Business Council for	Andy Mangan	Austin	1-512-794-8813	1-512-794-8815
BVS, Inc.	Robert Blechman	Honey Brook	610-273-2841	610-273-2843
BW/IP International, Inc.	Zohar Ziv	Long Beach	1-310-491-5029	1-310-435-6427
C&W Manufacturing Co.	D. Beakley	Mansfield	1-800-294-3371	1-817-483-6495
CA Environ'l Protection Agency	Nguyen Van Hanh	Sacramento	916-255-2437	916-255-2222
CABNIS -- Consortia of America	Noname			
CAC International, Inc.	Catherine Anne Clerf	Seattle	1-206-365-1864	1-206-286-3858
Cadence Environmental Energy	Kim Bramble	Michigan City	1-219-879-0371	1-219-879-0390
Cal Associates	Dr. Arkal Shenoy	Del Mar	1-619-755-1613	
Caldwell Sugars	Kenneth Peltier		504-447-4023	
Calgon Carbon Corporation	Vipin Kuckreja / Andrea Bracal	Pittsburgh	1-412-787-6700	1-412-787-6676
California Waste Removal	Blake Tresan	Lodi, CA	209-369-8274	209-369-8274
Cameron Carbon Inc.	David Ainsworth	Baltimore	800-394-6844	410-254-8254
Camet Products	Phil Smith	Columbia	1-410-531-4727	1-410-531-4440
Cane Separation Sytems	Wayne Long			
Canyon Creek Industries	Mac Shearer	Woodinville	1-206-402-1859	1-206-402-1769
Capital Controls Co., Inc	Richard Mitman	Colmar,	215-997-4000	215-997-4062
Capital Controls Co., Inc.	James Martin	Colmar	215-997-4018	
Capsule Enviro. Engineer.,Inc.	Michael K. Vennewitz	St. Paul	1-612-636-2644	1-612-636-3106
Car Sound Exhaust System, Inc.	Peter Nitoglia	Rancho Santa Margarita	1-714-858-5900	1-714-858-3600
Carbtrol Corporation	Denise Walsh	Westport	1-800-242-1150	1-203-226-5322
Carnot	Bob Finken	Tustin	1-714-259-9520	1-714-259-0372
Carpco	Frank Knoll/ P. Venkatraman	Jacksonville,	1-904-353-3681	1-904-353-8705
Carylon Corporation	Noname	Chicago	1-800-621-4342	
Castleton Beverage Corporation	George Dorion	Jacksonville	1-904-757-1290	
Castone Int'l Ltd.	Paul Hamm	Memphis	1-901-755-1223	1-901-754-2703
Catalyst International Corp.	Charles Manger	Seattle	1-206-622-0708	1-206-622-0543
Catalytic Combustion Corp	Mark Ruff	Bloomer	1-715-568-2882	1-715-568-2884
CECO Filters, Inc.	Marie Moore	Conshohocken	800-295-3851	610-825-3108
Cegelec Automation, Inc.	Bob O'Melia	Linden	908-486-1272	908-486-9316
Center for By-Products Utiliz	Shiv S. Singh	Milwuakee	1-414-229-6696	1-414-229-6958
Center for Clean Air Policy		Washington	202-624-7709	
Center for Environmental Engee	George P. Korfiatis	Hoboken	1-201-216-5326	1-201-8303
Center for Global Change	Curtis A. Moor / Alan Miller	College Park		
Center for the New West	Noname	Denver		
CERA	Don Mathsen/Bhaskar Patel	Grand Forks	701-777-5128	701-777-2339
CERA	Don V. Mathsen	Grand Forks	1-701-777-3132	1-701-777-2339

Company	Contact Name	City	Primary Phone	Primary Fax
CH2M Hill	Mark G. Hodges	Gainesville	1-904-331-2442	1-904-331-5320
Chem-Sol Company, Inc.	Noname	Houston	1-713-622-6456	1-713-3920
Chemical Manufacturers Ass'n	Anthony Wagner	Arlington		
Chemical Safety Corp.	Joanne S. Levy	Richmond	1-510-231-5641	1-510-233-8926
Chemical Separation Technology	R.H. Yingling	McMurray	412-942-0679	412-942-0436
Chemineer Inc.		Dayton	1-513-454-3200	1-513-454-3379
Chemonics	Jeff Gaull	Washington		
Chemonics International, Inc.	Gordon Bremer	Washington	1-202-955-3300	1-202-955-3400
Chemonics International, Inc.	Stasys V. Rastonis	Washington, DC	955-3300	955-3400
Cherokee Enviromental Group	Zachary D. MacRunnels	Sanford	1-800-774-5330	1-919-774-5300
CICAT Networks	Bryant R. Dunetz	Fairfax	703-323-7696	703-323-4683
CIESIN	Gerald S. Barton	Washington	1-202-606-6628	1-202-606-6622
City of Newport Beach Plan'g	Leslie Daigle	Newport Beach	714-640-2586	714-476-5072
Clean Air Engineering	Alex Mathew	Palatine	1-708-991-3300	
Clean Fueling Technologies	Curtis J. Donaldson	Georgtown	1 512-869-8737	1-512-869-8840
Clean Fuels	Alex Purcell	Issquah	1-206-391-2201	1-206-391-2009
Clean Harbors (CESE)	Arun Lakhani	Baltimore	1-410-685-3910	1-410-685-3061
Clean Harbors (CESE)	Lisa McCann	Baltimore	1-410-685-3910	1-410-685-3061
Clean Sites	Shawn Luetchens	Alexandria	1-703-739-1215	
Clean Water Technology, Inc.	Alec Purcell	Issaquah	206-391-1951	206-391-2009
Coastal Climate Company		Seattle	1-206-682-6048	1-206-682-5658
Coastal Video Communications	Ana English	Virginia Beach	1-804-498-9014	1-804-498-3657
Cole-Parmer Instrument Company	Noname	Vernon Hills	1-708-549-7600	
College of Management	Aundrea Kelley	Boston	1-617-287-7723	1-617-287-7725
Colorado Internat. Trade Off.	Rachel Bloombaum		1-303-892-3850	1-303-892-3820
Colorado State University	Ms. Jamie Yost	Fort Collins	303-491-7240	303-491-7801
Colorado State Unversity	Wilbur LaPage	Fort Collins	303-491-7393	303-491-2255
Coltec Industries	Thomas J Reder	Beloit	1-608-364-4411	1-608-364-0382
Columbia Analytical Services	Abbie Spielman	Kelso	1-206-577-7222	1-206-636-1068
Combustion Associates	Mukund Kavia	Corona	909-272-6999	909-272-8066
Commodity Resource & Environ'l	Larry DeWitt	Burbank	818-843-2811	818-843-2862
Commonwealth of Massachusetts	Ivy Valerie Schram	Boston	1-617-727-9530	1-617-727-2754
Compliance Systems International	Mr. Steve Taub	Conshohocken	1-800-220-8021	1-610-825-3108
Comprehensive Environ Services	Karen Meadows	Newport Beach	1-714-724-1234	
Computer Support Group	Larry Whitehead	Annandale	703-658-1307	703-658-2217
Computer Systems Technology	Coogan Preston	Huntsville	205-837-7610	205-837-7613
Concessions: Natl. Park	Allan Howe	Washington	202-682-9507	202-682-9509
Consolidated Engineering	Jim Garrett	Kennesaw	1-800-486-6836	1-404-422-6968
Consortia of American Business	E.A. Cimon			
Consucontrol LTDA #8125	Julio Hurtado	Miami	571-253-5322	571-248-8829
Consulting Partners Intl Assoc	Noname			
Consumers Applied Technologies	Bruce Rubin	Kalispell	1-406-756-2601	1-406-756-2603
Consumers Applied Technologies	Ted Lund	Kalispell	1-406-756-2601	1-406-756-2603
Contech Construction Technolo	Gene D. Pellillo	Cleveland	1-216-572-8300	1-216-572-5533

Company	Contact Name	City	Primary Phone	Primary Fax
Continental Group	Tibor Elek	Forest Hills	718-263-6367	718-263-6367
Conversion Systems, Inc.	Robert Hilton	Horsham	1-215-784-0990	1-215-784-0970
Cornell Univ. Hotel School	Chekitan Dev	Ithaca	607-255-9169	
COSMOS Gas Detection Systems	NoName	Seattle	800-394-5410	206-789-5414
Cost Control Inc.	Joseph Weiss	Ramsey	1-210-327-4982	1-201-818-8843
Coverdale	Katherine Goddard			
Creative Engineering Corporation	Walter Hammond	Huntsville	1-205-883-2414	1-205-882-0003
Creston Financial Group	Eric T. Ashdown	Oakland	510-987-8500	510-893-1321
CRINC	Greg Grant	Capitol Heights, MD	301-499-1707	301-499-7138
Croll-Reynolds Company, Inc.	James (Buzz) Reynolds	Westfield	1-908-232-4200	1-908-232-2146
CRS Inc.	George (Chip) Argentes	S. Hamilton	1-508-468-3315	
CSM Environmental Systems	Don Ciccolella	Union	1-908-688-1177	1-908-688-1045
CSSC Czech & Slovak Service Ce	Paul Costigan	Washington	638-5505	638-5308
CT & E Environmental Services	Eugene T. Yonkin	Anchorage	907-562-2343	907-562-0119
CTC/ETF	M. A. Qazi	Johnstown	814-269-2726	814-269-2798
CTL Engineering Inc.	Dan Leavell	Columbus	614-276-8123	614-276-6377
Ctr. for Hazard. Materials Res	Stanley J. Kabala, Ph.D.	Pittsburgh	412-826-5320, ex.238	412-826-5552
Custom Biologicals Inc.	Dr. Clarence Baugh	Boca Raton	1-407-392-0546	1-407-392-8823
CVT America, LLC	Noname	Lawrenceville	1-609-936-0075	1-609-936-0085
Cytec Industries	Joe Luzzo	West Patterson	1-201-357-3286	1-201-357-3078
Cytec Industries	Steve Lauer	Indianapolis	1-317-243-7305	
D. Glass Associates, Inc.	David J. Glass	Needham	617-726-5474	617-726-1668
Dames & Moore	David Einolf	Atlanta	1-404-262-2915	1-404-233-2271
Dasibi Environmental Corp.	Keith Gosselin	Glendale	818-247-7601	818-247-7614
Davis Instrument Mfg. Co., Inc	Paula Harmon	Baltimore	800-548-9409	410-358-0252
Davis Water & Waste Industries	Mike Bennett	Thomasville	1-800-841-1550	1-912-228-0312
Davy International	John Sedlak or Paul Mahoney	San Ramon	510-866-6404	510-866-6225
Davy International	Tom Diener	Pittsburgh	1-412-566-5556	1-412-566-3761
Dependable Foundry Equipment	Chester Lasik	Tualatin	1-503-692-5552	1-503-692-4477
Dependable Foundry Equipment	Roger Hayes	Tualatin	1-503-692-5552	1-503-692-4477
Dept. of Public Works-Fairfax	Amarjit S. Riat	Fairfax, VA	703-324-5230	703-324-3950
DERT	Noname	Conroe	1-409-760-3399	1-409-760-1055
Detroit Stoker Company	Mark A. Eleniewski	Monroe	313-243-4554	313-241-9500
DOD Naval Facilities Engin'g	DeAnna L. Dunbar	San Diego	619-532-24446	619-532-1242
DOE - Dept. of Energy, 6B-052	Peter Salmon-Cox	Washington DC	202-586-2380	202-586-9234
Donaldson Company, Inc.	Kevin Lindquist	Minneapolis	1-612-887-3539	1-612-887-3843
Dorr Oliver Inc.	Dr. Richard Giberti	Milford	1-203-876-5418	1-203-876-5779
Dow Environmental	Noname	Rockville	1-301-948-0040	1-301-948-6094
Draper Aden Associates	Ashok Katyal	Blacksburg	540-961-3236	540-552-0291
Dravo Lime Company	Anthony Licata	Pittsburgh	1-412-566-5550	1-412-566-5551
DRE Environmental Services,	Noname	Brentwood,	1-615-373-1373	1-615-373-3107
Drew Products	Mario Fabro	Berkley	1-510-527-7100	1-510-527-7817
Ducon Environmental Systems	Aron Govil	Farmingdale	1-516-420-4900	1-516-420-4985
Dupont	Sathya Yalvigi	Newark	302-292-8995	302-292-8996

Company	Contact Name	City	Primary Phone	Primary Fax
Dupont De Nemours Inc.	Paul Kates	Newark	1-302-451-9681	1-302-451-9686
DURCO Engineered Systems Group	Gerald W. Scull	Angola	1-716-549-2500	1-716-549-3950
Durr Industries, Inc.	Ajay Gupta	Plymouth	1-313-459-6800	1-313-459-5837
Durr Industries, Inc.	Jason Valia	Plymouth	1-313-459-6800	1-313-459-5837
Dust Free, Inc.	Lloyd Davidson	Port St. Lucie	1-407-336-0139	1-407-336-5515
Dynamation, Inc.	NoName	Ann Arbor	800-959-0329	313-769-1888
Dynaphore, Inc.		Richmond	1-804-672-3464	
Dyncorp	Jim Easterly		1-703-998-3719	
DynCorp	John Franke	Alexandria	1-703-461-2000	1-703-461-2020
EA Engineering, Science and Technology	Stephen Hammalian	Hunt Valley	1-410-584-7000	1-410-771-1625
Earth Resource Mapping	Paul B. Levine	San Diego	1-619-558-4709	1-619-558-2657
Earth Science Laboratories	Gary Anderson	Oceanside	619-722-5516	
East-West Technical & Business	Mathew George	Houston	713-530-2608	713-789-4672
EBC (formerly ETEC)	James M. Murray	La Jolla	1-619-456-1861	1-619-454-7858
EBW International	Thomas Hinken/Dan Courtney	Muskegon,	616-755-1671	616-755-7201
Eclipse Systems	Darren Elg	Franklin	1-201-827-7878	1-201-827-4613
ECO LOGIC	Wayland Swain, Ph.D.	Ann Arbor	1-313-973-2780	
Ecological Engineering Associates	Mr. Ted Fuist	Marion	1-508-748-3224	1-508-748-9740
Ecological Systems, Inc	Joseph Snodgrass	Indianapolis		
Ecology and Environment, Inc.	Roy Elmore	Arlington	1-703-522-6065	1-703-558-7950
Ecometrics, Inc.	Jack Devlin	Silverdale	800-755-2904	215-453-1000
Econ Corporation, Inc.	Harold H. Mehr	Pittsburgh	412-761-6696	412-766-9588
Econenergy International Corp	Patrick Adcock	Washington	1-202-9665-6177	1-202-965-6049
Econometrics, Inc.	Jack Devlin	Silverdale		
Ecotech International	Andre Doumitt	Basa	602-807-3713	602-891-7006
ECS Underwriting, Inc.	Noname	Exton	1-610-458-0570	1-610-458-8667
EDS	Willian I. Webster	Maryland Heights	1-314-344-5365	
EEAF - Environmental	Tammy Newmark	Arlington	1-703-522-5928	1-703-522-6450
EER: Energy & Envir. Research	Dr. Anu Sanyal	Orville	216-682-4007	216-684-2110
EERPF	Al Van Huyck	Washington	202-383-1296	202-383-7594
EFX Sytems, Inc.	NONAME	Lansing	1-517-336-4650	1-517-337-4610
EG&G Environmental, Inc.	Dr. Fred Reinhard	Bloomington	612-888-5175	612-888-5321
EIC/Econergy	Rick Renner	Washington	331-1117	466-2961
EIMCO	Mr. Jeff McBride	Salt Lake City	1-801-526-2000	1-801-526-2005
EIT	Ken Eichelman	Exton	800-872-8008	610-363-0167
Ekato Corporation	Eugene L. Smith	Ramsey	1-201-825-4684	1-201-825-9776
Electric Power Research Inst.	David Eskinazi	Washington, D.C.	872-9222	293-2697
Electric Power Research Inst.	Karl Van Orsdol	Palo Alto	415-855-2001	415-855-2800
Electric Power Research Inst.	Steven P. Lindenberg	Washington	1-202-872-9222	1-202-293-2697
Electrokinetics, Inc.	Noname	Baton Rouge	1-504-388-3992	1-504-388-3928
Eli Lilly & Co.	David Crozier	Indianapolis		
Elsner Engineering Works, Inc.	Frank Elsner	Hanover, PA	717-637-5991	717-633-7100
Elvac	Bill Korff	Fredericksburg	540-891-2800	540-891-2233
Embassy of Mexico, NAFTA offic	Raul Urteaga-Trani	Washington		202-296-4904

Company	Contact Name	City	Primary Phone	Primary Fax
Embassy of Mexico, NAFTA offic	Tatiana Ramos	Washington		202-296-4904
EMC, Inc.	Joginder Sira	Gilberts	708-426-3331	708-426-1961
EMCON Engineering & Consulting	Ajit Kher	Sacramento	1-916-928-3300	1-916-928-3341
Empire State Development Co.	Linda Jacobs		1-518-486-6261	
EMR Inc.	Raghu Chatrathi	Duluth	218-723-8140	218-723-8132
Emtrol	Bob Russell	Hauppauge	1-516-582-9700	1-516-234-8445
Emtrol	Brian Flynn	Hauppauge	1-516-582-9700	1-516-234-8445
Enders Process Equipment Corp	Joseph Enders	Glen Ellyn	1-630-469-3787	1-630-469-3793
Energon Company (The)	E.J. Hoffman	Laramie	1-307-742-3485	
Energy & Enviro Technology	Shack Qader	Alta Loma	909-466-6266	909-944-1398
Energy Conversion Devices	Nancy M. Bacon	Troy	1-313-280-1900	1-313-280-1456
Energy Systems	Hasna Khan	Newport News	1-804-872-9921	1-804-872-9921
Energyworks	Mr. Pat DeLaquil	Landover	1-301-918-7367	1-301-459-2842
Eng Mobile Systems	Dick Glass	San Fransisco	510-798-4060	
Enmet Corporation	Elwood Boomus	Ann Arbor	800-959-0651	313-761-3220
ENSCO, Inc.	Greg Young	Springfield	1-703-321-9000	
ENSR	Suman Rao	Acton	508-635-9500	508-635-9180
Entech Global, Inc.	Mahesh Jha	Golden		
Entoleter, Inc.	Gary G. Unke	Hamden	1-203-787-3575	1-203-787-1492
Entropy Associates, Inc.	Larry J. Douglas		1-303-985-9935	
Envirex Ltd.	Mr. Walt Hallen	Waukesha	1-414-547-0141	1-414-547-4120
Envirex Ltd.	Tom Schultz	Waukesha	1-414-547-0141	1-414-547-4120
Enviro Engineering	Vincent Maier	Tucson	520-792-4394	520-792-4716
Enviro-Chem Systems, A Monsanto Company	Steve Medvete	St. Louis	1-314-278-5775	1-314-275-5987
Enviro-Consultants Group	Brij M. Garg	Newark	1-302-292-8995	1-302-292-8996
Enviro-Reps International	Bob Friedman	Ventura	1-805-650-3563	1-805-650-4816
Enviro-Technology, Inc.	William Doherty	Shiloh	1-800-449-6546	1-609-455-7222
Enviro. Software & Systems Inc	Roger Weith	Bowling Green	1-419-353-8540	1-419-353-8540
Envirochem Analysers	Noname	Bombay		
Envirocon International	Avijit Dasgupta	Cumberland	207-829-3797	207-829-5544
Enviromental Engineering Consu	Sherwood C. Reed, P.E.	Norwich	1-802-649-1230	1-802-649-5729
EnviroMetrics Software Inc.	Brian W. Simpson	New Castle	1-302-324-9136	1-302-324-9138
Environment International	Valerie Lee	Seattle	1-206-525-3362	1-206-525-0840
Environmental & Professional Services, Inc.	Kruti Patel	Idaho Falls	1-208-529-5361	1-208-529-5361
Environmental Communications	June Taylor	Washington	1-202-939-3390	Same
Environmental Concerns	Patrick Tan	Seattle	1-206-486-0957	1-206-486-1308
Environmental Data Systems	Ronald Smith	Denver	1-303-892-8819	1-303-892-8817
Environmental Defense Fund	Peter M. Emerson	Austin	512-478-5161	512-478-8140
Environmental Elements Corp	Bradford Smith	Baltimore		
Environmental Greening, PLC	Michele Saranovich	Washington, DC	333-5635	625-0442
Environmental Information	John Quackenboss	Alexandria	1-703-683-0774	1-703-683-3893
Environmental Maintenance Sys.	Todd Hiatt	Cullowhee	704-293-9396	704-293-1206
Environmental Research & Technology	Harilal L. Patel	Pittsburgh	1-412-325-1806	1-412-327-6265
Environmental Restoration Systems, Inc.	Frank Capitani	Middletown	1-800-944-5515	1-717-944-4551

Company	Contact Name	City	Primary Phone	Primary Fax
Environmental Services Ltd.	Rajesh Gantla	Anchorage	1-907-563-1912	1-907-562-1824
Environmental Systems Corp.	Mark A. Cherninsky	Knoxville	1-423-688-7900	1-423-687-8977
Environmental Systems Corp.	Susan Wolf-Hall	Knoxville	1-423-688-7900	1-423-687-8977
Environmental Technologies Grp	Mr. Allen Bickel	Baltimore	1-410-339-3146	1-410-321-5255
Environmental Technologies, In	Ronald G. Conrad	Magnolia	1-713-356-6224	1-713-356-6038
Environmental Training, Inc.	Gary Sober	Austin	512-258-7021	512-258-7961
Enviropro	Rashmi Shah	Concord	510-685-782	510-825-0720
Enviros Technologies Company	Thomas Duffy	Dublin	1-510-551-5053	1-510-551-5105
EOSAT	Anthony Shupin	Iselin	1-201-603-9595	1-201-321-6562
EP3	Betsy Marcotte / Jim Gallup	Arlington	1-703-351-4004	1-703-351-6166
EPA	Doug Turner		1-202-260-5593	
EPA	Kurt Roos		1-202-233-904	1-202-233-9569
EPA	Martin Dieu	Washington	260-4174	2604470
EPA	Michael G. Moore	Washington	1-202-260-7671	1-202-260-0036
EPA	Ron Hoffer	Washington,	1-202-260-7096	1-202-260-4383
EPA	Steve James	Cincinnati	1-513-569-7877	
EPA TIES	Walt Kovalek	Washington		
Epcon Industrial Systems, Inc.	Samir Karandikar	Conroe	1-409-273-1774	1-409-273-4600
Epoleon Corporation of America	Noname	Torrance	1-800-376-5366	1-310-782-0191
EPR	BrianSmith	West Springfield	413-746-0023	413-746-0027
EPR	Francis Renkowicz	West Springfield	413-746-0023	413-746-0027
EPS	Douglas Esse	Baltimore	1-410-882-1566	1-410-882-2910
EPS	John Johns	Baltimore	1-410-882-1566	1-410-882-2910
EPS Eco Purifications Systems	John Johns	Falls Church	1-703-847-8264	
Equis Environmental Software	Luis Montojo	Fairfield	707-468-1978	707-468-5194
Ergonomic Technologies Corp.	Cynthia Roth	Oyster Bay	516-922-2828	516-922-2876
ERI (Enviro. Remediation, Inc.	C. Raymond Smith	Baton Rouge	504-291-4459	504-292-6665
ERIM	Sharon R. Baller	Ann Arbor	1-313-449-2181 Ext.	1-313-994-6070
ERM Inc.	Amir A. Metry	Berwyn	610-644-6649	
ES3	Karen L. Jones	Arlington	703-532-6983	703-532-7369
ETG Environmental Technologies	Orman Simpson	Norcross	1-404-242-0977	1-404-242-1982
ETUS Inc. -Environ. Technology	Richard Dunkel	Sanford	1-407-321-7910	1-407-321-3098
European Bank for Recon./Dev.	Armando D'Amico	London,	071 338 6000	071 338 6100
Ex-Im Bank of the United State	Laurence Ibrahim	Washington	202-565-3900	202-565-3931
Export Import Bank of the U.S.	Kevin G. O'Connor	Washington	5653924	5653931
Exsorbent	Gary Cotten	Mulberry	1-800-377-6449	1-501-997-8396
Extra Engineer, Inc.	Peter Schram	San Antonio	1-210-349-7812	
Federal Quality Institute	Don Mizaur	Washington		
Ferro-Tech	Carl A. Holley	Wyandotte	1-313-282-7300	1-313-282-7305
Fisher Klosterman, Inc.	David Amrein	Louisville	502-776-1505	502-774-4157
Flare Industries	Roy Singer	Austin	800-880-3527	512-836-3025
Flo Trend Systems, Inc.	W. Gerald Lott	Houston	1-713-699-0152	1-713-699-8054
Florida Department of Commerce	Ray Reddish	Tallahassee	1-904-922-8767	1-904-487-1407
FLOTECH	Stefan Hrabiak		42 38 259 83	

Company	Contact Name	City	Primary Phone	Primary Fax
FloWind Corporation	Robert Harmon	San Rafael	1-415-721-1300	1-415-721-1325
FMC Corporation	Bruce Goldberg	Pine Brook	1-201-808-1224	1-201-808-1242
FMC Corporation (FranRica Systems)	Lloyd Hay	Marshfileld	209-948-3158	209-948-5198
Foreign Commercial Service	Kevin Mulvey			1-202-482-5013
Foreign Trade Services	Mr. Andrzej Nowicki	Nashua,	1-603-886-6779	
Foremost Solutions	Ted Meiggs	Lakewood	303-986-8011	303-986-8227
Foss Environmental		Seattle	1-206-767-0441	1-206-767-3460
Foster Group	Art Foster			(503) 284-5507
Foster Wheeler	Bill Bishop	Clinton	1-908-236-1236	
Franklin Environ'l Products	Carlos Franklin			510-237-5706
Frisby Group	Tom Frisby	Mt. Pleasant	1-803-856-9800	1-803-856-9462
Fuji Bank	Kathleen Kargoll	New York	212-898-2043	
GAI Consultants, Inc.	Dennis W. Okorn	Monroeville	412-856-6400	412-856-4970
GAI Consultants, Inc.	Precha Yodnane	Monroeville	412-856-6400	412-856-4970
Gas Tech, Inc.	No Name	Newark	1-510-745-8700	
Gauntlett Group	Stephan Bogner		1-510-658-9013	1-510-658-3834
Gelman Sciences	Charles Gelman	Ann Arbor	1-313-665-0651	1-313-913-6114
Gelman Sciences	Eric Cooper	Ann Arbor	1-313-665-0651	1-313-913-6114
Gelman Sciences	Tim Gelson	Ann Arbor	1-313-665-0651	1-313-913-6114
General Electric	William Starr	Schenectady	518-385-0906	518-385-3725
General Electric Environmental Services	Gerard Gorman	Lebanon	1-717-274-7000	1-717-274-7145
General Electric Environmental Services	Ruth Miller	Lebanon	1-717-274-7000	1-717-274-7145
General Monitors	Charles Womack	Lake Forest	714-581-4464	714-581-1151
Genesis Energy Systems Inc.	Edward Borray	Los Angeles	1-310-442-3667	1-310-442-3670
Genesis Energy Systems, Inc.	Edward Borray	Los Angeles	1-310-442-3667	1-310-442-3670
GEO-CENTERS, Inc.	Bruce N. Nelson	Newton Center	1-617-964-7070	1-617-527-7592
Geo-Con, Inc.	Christopher R. Ryan	Monroeville	1-412-856-7700	1-412-373-3357
Geo-Con, Inc.	Linda Ward	Monroeville	1-412-856-7700	1-412-373-3357
Geochem	Noname			
GIS Trans, Ltd.	Peter Cook	Cambridge	617-354-2771	617-354-8964
Glenro, Inc.	Dick Majka	Paterson	1-800-922-0106	1-201-279-9103
Global Resource Consultants	Richard W. Fox	Manassas	703-330-3889	703-330-3889
Global Trading Services	Jim Carnicom	San Diego	1-619-525-8194	1-619-692-9771
GMD Environmental Systems, Inc	Gerald J. Reier, P.E.	Fort Worth	1-817-926-9294	1-817-923-0035
Gnesys, Inc. Engineering	Roger Brown,	Memphis	1-901-743-4994	1-901-744-6093
Golder Associates. Inc.	Noname	Amharest, NEW York	1-716-691-1156	
GraceTec Systems	Thomas Piskor	De Pere	1-414-337-1465	1-414-339-2784
Graver Water	Dennis Anthony	Union	908-964-7770	908-964-2500
Graver Water	Dennis Anthony	Union	908-964-7770	908-964-500
Great Lakes Industrial	Joe Ray	Cleveland	216-734-0094	216-734-0686
Grede Foundry	Ed Kaczmarek	Reedsburg	1-608-524-9504	1-608-524-9504
Green Bay Packaging	Brian Duffy	Green Bay	1-414-433-5111	1-414-433-5150
Green Earth Technologies	Dr. Vasant Bhat	Cincinnati, OH	513-679-4022	
Green Industries Initiative	Amy Schoch	Albany	518-486-6291	518-474-1512

Company	Contact Name	City	Primary Phone	Primary Fax
Groundwater Foundation	Susan S Seacrest	Lincoln	1-402-434-2740	1-402-434-2742
Groundwater Technology, Inc.	John Henderson	Norwood	1-617-769-7600	1-617-769-7992
Groundwater Technology, Inc.	Kevin Sullivan	Concord	510-671-2387	510-685-9148
Groundwater Technology, Inc.	Mr. Walter Barber	Norwood	1-617-769-7600	1-617-769-7992
Groundwater Technology, Inc.	Richard W. Lewis	Norwood	1-617-769-7600	1-617-769-7992
GSF Energy Inc.	Jean P. Desnouee	Allentown	1 215-481-4363	
GTEL Environmental Labs	Rashmi M. Shah	Irvine,	714-551-5254	714-551-1313
GTM	Charles Weiss	Bethesda,	1-301-913-9755	1-301-913-9844
Gulfex, Inc	Noname	South Houston	1-713-946-6614	1-713-946-1877
Gundle Lining Systems Inc.	Christopher H. Swires	Houston	1-713-443-8564	1-713-875-6010
H & H Eco Systems, Inc.	Terry Horn	North Bonneville	1-509-427-7353	1-509-427-7157
Hach Co.	Michael England	Loveland	303-669-3050	303-669-2932
Hach Company	Neil Schauland	Loveland	1-303-669-3050	1-303-669-2932
Halliburton NUS Environmental	Charles Jones	Gaithersburg	1-301-258-8614	1-301-258-8764
Hanby Enviro. Lab. Procedures	John Hanby	Wiberley	1-512-847-1212	1-512-847-1454
Harding Lawson Associates-CTA	John Pinion	Orlando	1-407-851-1484 ?	1-407-855-0369 ?
Harlingen County Commissioner	Jim Matz	Harlingen	210-427-8030	210-427-8031
Harmony Products, Inc	Noname	Chesapeake	1-804-523-2849	1-804-523-9567
Hart Crowser	John Funderbunk, Arlene Brook	Seattle	1-206-324-9530	1-206-328-5581
Harvard Inst. for Int'l Dev.	Theodore Panayoutou	Cambridge	617-495-9173	617-495-0527
HARZA Engineering Company	Henry H. Chen, P.E.	Chicago	1-312-831-3000	1-312-831-3999
Hawkins, Delafield & Wood	Brad C. Johnson	Washington	1-202-682-1493	1-202-682-1497
Hazmat America Inc.		Arlington	1-617-646-4564	1-617-646-4564
HBTI	Irvin Barash		212-581-8787	212-397-4126
Heritage Research Center, Ltd.	Phil McCreedy	Missoula	1-406-721-1913	1-406-721-4220
Hi TecMetal Group	Carmen Paponetti	Cleveland	216-881-8100	216-881-2252
Hi TecMetal Group	Terence Profughi	Cleveland	216-881-8100	216-881-2252
Hi-Tech Group Inc.	Arun Gupte	St. Louis	1-314-878-1953	1-314-525-7124
High Temperature Technologies	D. Sen	Somerville	1-617-628-1440	1-617-625-8130
Highland Tank	Morgan Dickard	Baltimore	1-410-335-4895	1-410-335-4976
Hiller Group Inc.	Wesley T. Hiller	Tampa	1-813-882-3313	1-813-882-4294
HMCRI	Robert Day	Rockville	1-301-251-1900	1-301-738-2330
HNU Systems Inc.	Mr. Bob Sterry	Newton	1-617-964-6690	1-617-558-0103
Holometrix, Inc.	Steve Smith	Bedford	1-617-275-3300	1-617-275-3705
Hooper and Hawcker	Allan Hooper		1-202-363-3831	1-202-363-3831
Horiba Instruments Inc.	Tim Scott	Irvine	1-800-446-7422	1-714-250-0924
HPD Incorporated	Robert G. Gorgol	Naperville	708-357-7330	708-717-2247
HSQ Technology	Henry Hoge	South San Francisco	-415-952-4310	1-415-952-7206
Hughes Santa Barbara Research	Michael Gray	Goleta	1-805-562-2000	1-805-562-4568
Hull Environmental Products	Robert Duxbury	Hatboro	215-672-7800	215-672-7807
Humbolt Decanter Inc.	Clement L. O'Donnell	Worcross	1-404-448-4748	1-404-416-9377
HVS Eco Services	Cindy Rushmore	Mineola	516-248-8828	516-742-3059
Hydranautics	Lynn Gulizia	San Diego	1-619-536-2500	1-619-536-2578
Hydro-Aerobics, Inc.	Randy Wolfe	Milford	1-513-575-2800	1-513-575-2896

Company	Contact Name	City	Primary Phone	Primary Fax
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IAETL Int'l Asso. Env. Testing	Jacqueline Sher	Alexandria	1-703-739-2188	1-703-739-2556
Icara Limited LLC	Mark R. Durand	Arvada	303-424-2010	303-424-2009
ICF Kaiser Engineers	Casey McGeever	Pittsburgh	412-497-2000	412-497-2212
ICOLP - Intl Cooperative for	Allison Morrill	Washington	1-202-737-1419	1-202-296-7442
IDEA	Firas Chaieb	Piscataway	908-878-0417	
IDEA, Inc.	Ramir Chatterjee	Washington, D.C.	202-289-4332	202-371-9015
Idreco USA Ltd	Giuseppe Giacobone	North Oxford	1-508-987-6474	1-508-987-3747
IE Engineering Company	Paul F. Rahill	Orlando	407-886-5533	407-886-5990
IEF: Intl. Envir. Federation	Krish Krishnan	Washington	1-614-227-7038	1-614-841-1664
IES	Rick Germain		1-301-907-6877	1-301-907-6547
IESC - Intl Executive Services	Hobart Gardiner			
IFC	Carolyn Cain	Washington	1-202-473-0418	1-202-473-5706
IFC	Lakhdeep Babra	Washington	1-202-473-0418	1-202-473-5706
IFC	Promodh Malhotra	Washington	1-202-473-0418	1-202-473-5706
IFREE(Int'l Fund for Ren.Energy)	Christopher Dyamond	Washington		
IIM Associates	Navjeet Singh	Frederick		
Imbibitive Technologies	Richard H. Hall	Midland		
Indeck Energy Services, Inc.	Gerald F. DeNotto	Buffalo Grove	708-520-3212	708-520-3235
India Abroad	Aziz Haniffa	Washington		
Indian Dept. of Commerce	Karen Northrop	Indianapolis	317-232-0160	317-233-5123
Indiana University	Mr. Ed Vandall	Bloomington	812-855-2672	812-855-3998
Indo-U.S. International	Mr. Arun Puri	Newport Beach	1-714-476-1901	1-714-476-1909
Industra, Inc.	William W. Austin	Greenville, SC	803-370-9906	803-370-9824
Industrial Ecosystems	Jack Wilson	Pacifica	1-415-355-4050	1-415-355-4517
Industrial Technical Services	John Wood	Langhorne	1-800-220-3057	1-215-943-4640
Industrial Technical Services	Mark Deissinger	Levittown	800-220-3057	215-943-4640
Innerasia Consulting Group	Stacey Standley	San Francisco	1-415-922-0448	1-415-346-5535
Instrumentation Northwest, INc	Ms. Romey Gilbert	Redmond	206-885-3729	206-867-0404
Int'l Business & Technologies	Noname	Arlington	703-522-7604	703-522-7604
Int'l Management Solutions Ltd	Len Jornlin	Denver	303-751-6160	303-751-6160
Intalco Aluminum Corp.	Keith Fontaine	Ferndale	360-384-7308	360-384-6412
Intech				
Intech One-Eighty	John Taft Benson	North Logan	801-753-2111	801-753-8321
Integrated Chemistries	Tony Grooms	St. Paul	612-636-2380	612-636-3106
Inter Am. Development Bank	Larry Mellinger		1-202-623-1031	
Interbio, Inc.	Peter Perez	Baton Rouge	504-291-4459	504-292-6665
Interna Information Tech. Inc.	Harvey S. Price	Denver	1-303-985-9900	1-303-985-4111
Internat'l Sensor Technology	NoName	Irvine	714-452-9000	714-452-9009
International Casting Corp	Noname	New Baltimore	1-810-293-8220	1-810-725-9230
International Connection	Mr. DeJuan Williams	Oakland	1-510-568-9989	1-510-568-2256
International Finance Corp.	Jerome Esmay	Washington, D.C.	473-7954	676-9495
International Imaging Systems	Jacques Huyghe	Milpitas	1-408-432-3400	1-408-433-0965
International Resources Group	David W. Joslyn	Washington, D.C.	202-289-0100	202-289-0145

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International Technology Corp	Prakash Acharya	Knoxville	1-615-690-3211	1-615-690-3626
International Technology Corp	Richard Ellis	Knoxville	1-615-690-3211	1-615-690-3626
International Waste Management Systems	Susan Wolf-Hall	Knoxville	1-423-689-1395	1-423-687-8977
Interscan Corporation	Richard Shaw	Chatsworth	800-458-6153	818-341-0642
Intl. Envir & Energy Consultan	Dr. Anu Sanyal	Oakbrook Terrace	708-495-5930	708-495-5930
Ionics	Ark Pang	Watertown	1-617-926-2500	1-617-926-4304
Ionics	Tam Tran	Watertown	1-617-926-2500	1-617-926-4304
ISCO	Lorance Newburn, Elie Dick	Lincoln	1-402-474-2233	1-402-474-4186
Jana Zimmer & Associates	Jana Zimmer	Santa Barbara	805-563-1591	805-687-4156
JE Jacobs Engineering Groups	Noname	Pasadena	1-818-499-2171	
Jenbacher Energiesysteme Ltd	Noname	Plymouth	1-508-747-6200	1-508-746-1630
Jetline Engineering	Mervyn Roberts	Irvine	1-714-951-1515	1-714-951-9237
JMD International	Sushil Bhatia	Framingham	508-620-0563	508-620-7563
John Zink Company	Jon Young	Tulsa	1-918-234-1800	1-918-234-2700
John Zink Company	Keith McCartney	Tulsa	1-918-234-1800	1-918-234-2700
John Zink Company	William Herman	Tulsa	1-918-234-1935	1-918-234-2700
Johnson Matthey	Paul D. White	Wayne	1-215-971-3100	1-215-293-1284
Johnson Matthey	Wilson Chu	Wayne	1-215-971-3100	1-215-293-1284
Joint Overseas Group	Cesar Patulot	Ontario	1-909-980-5000 ext 31	1-909-594-9583
Joy Environmental Technologies	John M. Valkunias	Houston	1-713-878-1053	1-713-591-2295
Joy Environmental Technologies	Mr. D.J. Garg	Houston	1-713-878-8333	1-713-878-8398
Joy Environmental Technologies	Mr. Mark Elliott	Houston	1-713-878-1054	1-713-591-2295
JRP Consulting Services	Joel Pointon	Hopkinton	508-435-5480	508-435-8731
K & T Electrical Contractors	Avinash K. Kagade	Cliffwood	1-908-583-1133	1-908-583-1186
K3 Corp.	Mr. Kris Kudrnac	Great Falls	1-703-759-0365	1-703-759-3799
KDP Group International	Philip D. Dodge	Novato	1-415-897-0034	1-415-897-0162
Kenan Institue of Private Ente	Noname	Chapel Hill	1-919-962-8201	1-919-962-8202
Kentucky Cabinet for Econ Dev	Brett Barnes	Frankfort	502-564-7140	502-564-3256
Kentucky Intl Trade Office	Peggy Pauley	Frankfurt	1-502-564-7140 ext.	1-502-564-3256
Kimre, Inc.	William Schott	Miami	1-305-233-4249	1-305-233-8687
Kinetic Recovery Corporation	Dr. Fred Reinhard	Edina	1-612-941-0739	1-612-941-9142
Kinetico Engineered Systems	Mr. Steve Harnsberger	Newbury	1-415-454-3366	
Kinetico, Inc.	Andrew Warnes	Newbury	216-564-9111	
Klages, Carter, Vail	Preben Kent	Costa Mesa	1-714-641-0191	
Kloster Corporation	Craig Fredrickson	Minneapolis	1-612-559-2018	1-612-559-1121
Knowledge Express Data Systems	Noname	Berwyn	1-610-251-8000	1-610-251-8001
Koch Membrane Systems Inc.	Dr. Bill Cooper	Wilmington	1-508-657-4250	1-508-657-5208
Komline-Sanderson	C.L. Komline	Peapack	1-908-234-1000	1-908-234-9487
KOURCO Environmental Services	John Koury	Lafayette	318-989-2347	318-981-4591
KRR Group	Phil Graves	Knoxville	1-615-691-2518	1-615-470-0050
Krupp Wilputte	Max Hooper	Ridgeville	1-412-257-8277	1-412-257-8344
Kurz Instruments, Inc.	Ramesh Shamarao	Monterey	800-424-7356	408-646-8901

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Lamar University	Aleemuddin Husain	Houston	713-778-0863	
Lamar University	Ku-Yen Li	Beaumont	1-409-880-8784	1-409-880-8404
Lamson Corporation	Richard Hart	Syracuse	1-315-433-5509	1-315-433-5441
LaserComp	Kevin Collins	Lynnfield	1-617-334-6035	1-617-334-2650
Law Engineering & Environ. Srv	Gaye Van der Eerden	Kennesaw	1-404-590-4600	1-404-499-6661
Leaktek	Chris E. Leauber	Nashville	1-800-829-4597	1-615-333-8232
Lean Power Corp.	Stephan D. Bryen	Silver Spring	1-301-588-2200	1-301-558-9271
Legacy International	Ira Kaufman	Alexandria	703-549-3630	703-549-0262
Lemna Corporation	Viet Ngo	St. Paul	1-612-688-0836	1-612-688-8813
Lemna Corporation	Walter Lambert	St. Paul	1-612-688-0836	1-612-688-8813
Lemna Mid-Atlantic	Peter Kalaris	Mechanicsville	1-804-730-2282	1-804-730-3212
Lenzing Performance Inc	Stephen Felix	Charlotte	1-704-551-1439	1-518-784-2247
LICON Inc.		Pensacola	1-904-434-5088	1-904-438-2040
Lifesource Internat'l Ltd.	Jan Dorfman	Newport	1-401-8496926	1-401-849-6448
Lindale Industries	Mr. Ed Wallace	Lindale	903-882-7539	903-882-7006
Lockheed Environmental Systems	Noname	Las Vegas	1-702-361-3955	1-702-361-8146
Los Alamos Technical Assoc.	James Prather	Fairfax	703-698-5580	703-6980523
Louisiana State University	R. Richard avent	Baton Rouge	1-504-388-8442	1-504-388-5990
LSR Technologies, Inc.	S. Ronald Wysk	Acton	1-508 635 0123	1-508 635 0058
Lumonics Corporation	Terry VanderWert	Eden Prairie	1-612-941-9530	1-612-941-7611
Lupatin Welding Inc.	Noname	Fraser	1-313 294 0620	1-313-294-2635
LV PETRO	Mr. Ben Motion	San Francisco	1-415-346-3738	1-415-928-5130
M.Cubed	Steven Moss	San Francisco	1-415-564-3661	1-415-564-3661
M.L. Sheldon Plastics Corp.	Malcolm L. Sheldon	New York	1-212-687-8670	1-212-6798
M4 environmental L.P.	Noname	Oak Ridge	1-615-220-4173	1-615-220-4179
Magnavox	Scott McCreery	Bellingham	360-676-0837	360-676-0847
Margan MLS Ltd.	Dan Ezra	Dunwoody	770-390-9950	770-394-3950
Marlin Diversified Systems	Lou Filippi	Blissfield	1-517-486-3181	1-517-486-5061
Martin Kurz & Co., Inc.	Cliff Campbell	Minneola	1-516-746-7337	1-516-746-1818
Martin Marietta Energy Syst.	Thomas L. Mayfield	Oak Ridge,	1-615-576-7589	1-615-574-9241
Maryland, International Div.	Scott M. Blacklin	Baltimore,	1-401-333-8180	1-401-333-8200
Maxymillian Technologies	Christy Uchida	Boston	1-617-557-6077	1-617-557-6088
McDonnell Douglas Spac. Sys.CO	Gonzalo Montoya	Houston,	1-713-280-1513	
McGill Environmental Systems	Jim McGill	Easton	1-910-532-2539	1-910-532-2542
McGill Environmental Systems	Lynn Lucas	Easton	1-910-532-2539	1-910-532-2542
McIlvaine Company (The)	Robert McIlvaine	Northbrook	1-708-272-0010	1-708-272-9673
McIlvaine Company (The)	Ross Ardell	Northbrook	1-708-272-0010	1-708-272-9673
McLaren/Hart and MBT Environme	Gary M. Carlton	Rancho	1-916-638-3693	1-916-638--2842
McNab, Inc.	John Burns	Mount Vernon	914-699-1616	914-699-1671
McNeill International, Inc.	NoName	Mentor	800-MCNEILL	216-953-1933
MCS Calibration Inc.	Mr. Ken Lamar	Holbrook	1-516-471-6900	1-516-471-6902
MCTTC	Alok Pant	College Station	1-409-845-8762	
MDA Scientific, Inc.	NoName	Lincolnshire	800-632-0063	708-634-2800
MEC Company	Tom Currie	Neodesha	1-316-325-2673	1-316-325-2678

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MEG Productions	Rick Dunetz	Fairfax	703-323-7791	703-323-4683
Mega-Tech	Dolores Fisk	Falls Church		
Membran Corporation	Charles J. Gantzer	Minneapolis	1-612-378-2160	1-612-378-6091
Memtek Corporation	Previous contact left	Billerica	617-667-2828	
Metreon	John Mahoney	Hiram	216-569-7600	216-569-7650
Metric Systems Corporation	William R. Beaulieu	Fort Walton Beach	904-244-9600	904-833-5856
Metropolitan Water District	Mr. Sajal Mitra	Los Angeles	213-217-7724	213-217-6951
MHF-Logistical Solutions Inc.	Noname	Zelienople	1-412-452-3900	1-412-452-3753
Microbe Masters	Noname	Baton Rouge	1-800-469-2847	1-504-293-8192
Mid-Atl. Tech Applic. Center	Lani S. Hummel	Pittsburgh	1-800-257-2725	1-412-648-7003
MIDAC Corporation	Dennis Glennon	Irvine	1-714-660-8558	1-714-660-9334
Miles Inc.	Brian Peterson	Pittsburgh	1-412-777-4649	1-412-746-1334
Min. of Trans, Tele, & H20 Mng	Ms. Pinter			
Minnesota Dept. of Econ. Devel	Dentley Haugesag	Saint Paul	800-657-3858	612-296-1290
Minnesota Trade Office	Barbara Mattson	St. Paul	1-612-297-4222	1-612-296-3555
Minstry of Agriculture	Ms. Mchacsi			
Misonix Incorporated	Chris Thomas	Farmingdale	1-800--645-9846	1-516-694-9412
Mission Research Corporation	Gaurav Rajen	Albuquerque	1-505-768-7704	1-505-768-7601
Mistry Enterprises	Kathleen Mistry	Great Falls	1-703-450-4052	1-703-405-4519
MITKEM Corporation	Noname	Warwick	1-401-732-3400	1-401-732-3499
Mobil Oil Corporation	Raghavan Ramanan	Pennington		
Modern Equipment Co., Inc	Don Donner	Port Washington	1-414-284-9431	1-414-284-9433
Modular Environmental Tech	Calvin LeFevre	The Woodlands	1-713-362-8282	1-713-364-9482
Monex Resources	Gary Shelton, P.E.	San Anthonio	1-210-349-4069	1-210-349-8512
Monitor Labs, Inc.	Cindy Stevens	Englewood	303-792-3300	303-792-3237
Monsanto Enviro-Chem Systems, Inc.	Chris Roach	St. Louis	1-314-469-8843	
Monsanto Enviro-Chem Systems, Inc.	John Kilkenny	St. Louis	1-314-469-8843	
Monsanto Enviro-Chem Systems, Inc.	John W. Schnarre	St. Louis	1-314-469-8843	
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Montana State University	James H. Wolfram	Bozeman	4069944770	4069946098
Montgomery Watson	Sher Singh	Pasadena	818-796-9141	818-568-6898
Morrison & Kibbey Ltd.	Brian A. Morrison	New York	1-212-935-4300	1-212-935-4301
Morrison & Kibbey Ltd.	Turner Kibbey	New York	1-212-935-4300	1-212-935-4301
Morrison Knudsen Corp	Christopher Shallice	Woburn	1-617-937-5610	1-617-937-5610
MRK, Inc.	Chip Efferson	Baker	1-504-775-5091	1-504-775-5095
MSI Engineering, Inc.	Mr. Skip White	Mishawaka	1-219-259-0633	1-219-258-0633
MTC Modern Technologies	Ashwarin Dhaul	Dayton	1-513-252-9199	1-513-252-9227
MTI-Mechanical Technology, Inc	Robert Rose	Latham	1-518-785-2211	1-518-785-2420
MTR -Membrane Tech. & Research	Jane Stoner	Menlo Park	1-415-328-2228	1-415-328-6580
Murray Turbomachinery	Darin Schlatter	Burlington	1-319-753-5431	1-319-752-1616
MV Technologies	Vijay Rastogi	Akron	216-864-7450	216-864-8136
N-VIRO	June Taylor	Washington	1-202-939-3390	
NAO Inc	John Moorehouse	Philadelphia	1-215-743-5300	1-215-743-3018

Company	Contact Name	City	Primary Phone	Primary Fax
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NASA Lewis Research Center	Joseph M. Savino		216 433-5531	
NASDA	Daniel Waterman	Washington	1-202-898-1302	1-202-898-1312
NATEC Resources Inc	Paul Chaffee	Houston	1-713-552-2221	1-713-552-2538
National Parks Service	Sharon Cleary	Washington, D.C.	343-7063	343-7059
NCEL, Naval Civil Eng. Laborat	Jerry Dummer		1-805 982-1599	
NEETC - National Environmental	Noname	Indiana		
NETAC - National Environmental	Robb Lenhart	Pittsburgh	1-412-826-5511	1-412-826-5552
NETCSC - National Environment	Mike Aiton	Morgantown	1-304-293-4191	
Netzsch Incorporated	Noname	Exton	1-215-363-8010	1-215-363-0971
Neutronics Enterprises, Inc.	Keith Finkenbiner	San Diego	619-674-2250	619-674-2254
New England Fertilizer	Stan Jackson	Quincy	1-617-376-2500	1-617-984-0953
NIE - National Institute For	Neal Dobbs	Washington	1-202-628-4303	1-202-628-4311
NIIT - National Information	Noname	Washington	1-800-299-9973	
Nikro Industries, Inc.	Stephen Larson	Villa Park	708-530-0558	708-530-0740
Niro, Inc.	Theodore R. Fix	Columbia	410-997-6682	410-997-5021
North East Environmental Products, Inc.	Barry Clarke	West Lebanon	1-603-298-7061	1-603-298-7063
North East Environmental Products, Inc.	Michael Yacavone	West Lebanon	1-603-298-7061	1-603-298-7063
Northeast Research Institute	Irving Einhorn		1-202-677-9666	1-203-677-7008
Northwest EnviroService Inc.	Noname	Seattle	1-206-622-1090	1-206-467-7358
Nova Analytical Systems, Inc.	NoName	Niagara Falls	800-295-3771	
NTPA -- Naitonal Trade and	Noname			
NTTC - National Technology	Noname	Wheeling	1-304-2455	
NuKem Development	Saeed Darian	Houston	1-713-520-9494	1-713-630-0715
NW Technologies Inc	Terry Fowler	Houston	1-713-680-1234	1-173-680-1608
NY State Dept. of Econ. Devel.	Jim Jacob	Albany	518-431-7000	518-462-0230
Ocean City Research Corp.	James A. Ellor	Ocean City	1-609-399-2417	1-609-399-5233
Office of Science and Technology Policy	Tom Houlihan	Washington	1-202-408-5399	
Ogawa & Co., USA, Inc.	Donald Schaeffer	Pompano Beach	305-781-6223	305-781-6224
Ogden Env. & Energy Services	Edward F. Wonder	Fairfax,	1-703-246-0439	1-703-146-0594
Ohio Dept. of Development	Don Clark	Columbus	614-466-5188	614-644-1789
OHM Corporation	Carlos Tseng	Houston	1-713-821-3600	1-713-821-9500
OHM Remediation Services Corp.	Ashok Gopinath	Pleasanton	510-227-1105	510-227-0307
Oil Skimmers, Inc.	William Townsend	Cleveland	1-216-237-4600	1-216-582-2759
Oppenheimer Wolff & Donnelly	Paul M. Laurenza	Washington	202-293-6300	202-293-6200
Orbital Sciences Corporation	Bruce Fergson	Dulles	1-703-406-5000	1-703-406-3502
Oregon Envir. Technical Assn	Bill Snyder	Eugene	1-503-344-0746	1-503-484-0657
Organic Waste Technologies	Randy Chapman, Ray Mardelli	Middleburg Heights	1-216-891-0300	1-216-891-8288
Organica, Inc.	Raj Mehta	Great Neck	516-289-3700	610-539-8300
ORS Environmental Equipment	Mr. Hal Levine	Greenville	1-800-228-2310	1-603-878-3866
Osmonics Inc.	Amy Powell	Minnetonka	1-612-933-2277	1-612-933-0141
Osmonics Inc.	Ken Jondahl	Minnetonka	1-612-933-2277	1-612-933-0141
Overseas Private Invest. Corp.	R. Bosworth Dewey	Washington, DC	336-8658	408-5155
Ozone Research & Equipment Cor	John M. Overby	Phoenix	1-602-931-7332	1-602-931-7727

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Pacific Intl. Center for High	Andrew Treska	Honolulu	808-539-3868	
Pacific Rim Institute	Matt Morrison	Bellevue	1-206-451-1980	1-206-820-6865
Pacific Treatment Environ'l	Nimisha Amin	El Cajon	619-441-1818	619-441-2535
Paget Equipment Co., (Div. of JBL, Inc.)	Jim Reigel	Marshfield	800-234-3158	715-387-0720
Palmer Manufacturing and Supply, Inc.	Jack Palmer	Springfield	1-513-323-6339	1-513-323-2709
Panametrics	Dave Jewett	Richmond	1-804-794-7667	1-804-794-6828
Panametrics, Inc.		Waltham	1-800-833-9538	1-617-894-8582
Parkson Corporation	Mr. Walter Molawka	Fort Lauderdale	1-305-974-6610	
Parsons	Sukomal K. Talukder	Fairfield	1-513-870-8274	1-513-870-0444
Parsons Brinckerhoff	C.G. Balachandran	New York	212-465-5421	
Parsons Engineering Science	Jude T. Francis	Pasadena	818-585-6279	818-585-6336
PBR Industries	Mike Robbins		1-800-842-1630	
PCP, Inc.	NoName	West Palm Beach	407-683-0507	407-683-0507
PDC Environmental Services	Joe D. Walker	St. Louis	1-314-842-8003	1-314-842-9007
PDM Pitt-Des Moines Inc.	Luke Scorsone	Pittsburgh	1-412-331-3000	1-412-331-7403
Pennsylvania Govenor's Action	Janet Gerhard	Harrisburg	717-787-8199	717-772-5419
Pentek	George Harris	Coraopolis	1-412-262-0725	1-412-262-0731
Perforated Tubes	Alan Niemeyer	Ada	616-676-9127	616-676-1307
Performance Analytical, Inc	Keri Stephens	Canoga Park	1-818-709-1139	1-818-709-2915
PESCO Pragmatic Env. Sol. Cntr	Bob Hollins	Roanoke	1-703 342 1852	1-703 342 1654
Petrogas Enviromental Systems		Angleton	1-409-849-1206	1-409-848-0313
Pfaudler Inc.	Howard Hartley	Rochester	716-464-4830	716-235-3048
PHH Fantus Consulting	Kevin Rushton	Hunt Valley	410-771-2643	410-771-2002
Philadelphia Mixers Corp.	Noname	Palmyra	1-717-838-1341	1-717-838-8146
Phoenix Consulting, Inc.	Fred J. Zoepfl	Leesburg	703-729-8669	703-729-4706
PIO	R. Courville	Houston	713-960-0782	713-960-8947
PIXE International Corp.	Bill Nelson	Tallahassee	904-574-6469	904-574-6469
Plasteel, Inc	Noname	Escondido	1-619-745-0333	1-619-746-9515
PMI - Power Marketing Intl	Anil Shanbhag	Moreno Valley	909-924-6762	
Pneumafil Corp.	Mr. Ugo Bert	Charlotte	704-399-7441	704-398-1533
Pollar-BEK	Charles Silverstein	Atlanta	1-205-972-6600	
Pollution Control Exports USA	Alfred Brouillet	Somers	203-763-5810	203-763-5937
Pollution Control Inc.	Steve Deiters	Florence	606-282-2200	606-282-2205
Pollution Prevention Int'l	Azita Yazdani	Brea	1-714-2251650	1-714-255-9702
Polybac Corporation	John Biesz	Bethlehem	1-215-867-7338	1-215-861-0991
Porter/Novelli	Dana Faulkner	Washington, D.C.	202-973-5848	202-973-5858
Praxis Engineers, Inc.	Vos Choudhry/Steve Hadley	Milpitas	1-408-945-4282	1-408-263-2821
PRC Environmental Management	Colleen Brecker	McLean	703-556-2591	703-556-2852
PRC Environmental Management	Raj Rajaram	Rolling Meadows	708-255-4166	708-255-8528
Premier American Technologies	Carl Fazler	Bellefonte	814-353-0600	814-353-0605
Prestige Environmental, Inc.	Girish Mehta, P.E.	Edison	1-908-757-9700	1-908-757-5050

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Process Analyzers, Inc.	Harold Carter	Fallsington	215-736-2596	215-736-8194
Process Combustion Corp.		Pittsburgh	412-655-0955	412-655-0961
Process Engineering Services, Inc.	Michael Fasci	Raynham	1-508-880-6969	1-508-822-3099
Process Equipment Company	Bob Zimmerman	Tipp City	1-513-667-7105	1-513-667-2591
Professional Environmental Systems	Robert Mentore	Brooklyn	1-718-857-3371	1-718-789-8111
ProgressMaterial, Inc.	Peter D. Hay	St. Petersburg	1-813-824-6689	1-813-824-6411
Proquip, Inc	Noname	Macedonia	1-216-468-1850	1-216-467-3724
Prototech Company	Scott MacKenzie	Needham	1-617-444-5188	1-617-444-0130
Prudential Relocation Managmnt	Michael J. Lythcott	Atlanta	1-404-621-6105	1-404-612-6170
Pruett-Schaffer Chemical Co.	Joe Growall	Pittsburgh	1-412-771-2000	1-412-771-2205
Pure Air	Paul Ashline		1-610-481-5094	1-610-481-2762
Purity Control, Inc.	Jack Realmuto	Bohemia	1-516-244-8175	1-515-244-8177
Purus, Inc	Mike Kennedy	San Jose	1-408-955-1984 or 10	1-408-955-1010
PVS Chemicals	D.Sosnoski & D.Rutkowski(asia	Detroit	1-313-921-1200	1-313-921-1378
QED	Robyn Wooley	Ann Arbor	313-995-2547	313-995-1170
Quality Analytical Labratories	David Charles Lawrence	Gainesville,	1-904-331-2442	1-904-373-3593
Quality Industries, Inc.	Jules A. Dornier (Jay)	Thibodaux	1-504-447-4021	1-504-447-4028
Quantum Tech Inc.	Rajah Kulkarni	Houston	713-933-8448	713-941-0659
Quests Unlimited International	Pat Hennessey	Bellevue	1-206-451-0227	
Radian Corporation	Avi N. Patkar	Mason	1-513-459-9048	1-513-459-9248
Radian Corporation	Charlie Davis, Gwen Eklund	Austin	1-512-454-4797	1-512-454-7129
Radian Corporation	John Williams/Nancy Edwards	Herndon,	1-703-713-1500	1-703-713-1512
Radian Corporation	Murray Wells	Austin	1-512-454-4797	1-512-454-7129
Radian Corporation	Ron Bell	Austin	1-512-454-4797	1-512-454-7129
Rails to Trails Conservancy	Hal Hiemstra	Washington	202-797-5400	202-797-5411
Randall & Associates	M.L. Randall	Houston	1-713-783-3038	1-713-952-8301
Rasco, Inc.	Noname	Woodbridge	1-703-643-2952	1-703-497-2905
RaySolv, Inc.	Jules Varga	Bound Brook	1-908-302-0111	1-908-356-3629
Raytheon/Ceres	Ernie Jackson	Arlington	1-703-271-5800	1-703-271-5900
Razor & Associates, Inc.	William Razor	West Chester	513-777-3326	
RC Systems	Roger A. Carter	Santa Fe	1-409-925-7808	1-409-925-1078
RECO Group	A. J. Palermo	Houston	713-583-5295	713-583-5299
Recon Systems, Inc.	Dr. Norman J. Weinstein	Raritan,	1-908-526-1000	1-908-526-7886
Reef Industries	Noname	Houston	800-231-6074	713-947-2053
REF-OX	John Burns	Houston	1-713-895-9454	1-713-690-8461
Reid & Priest	Mark Riedy	Washington	508-4323	5084321
Renaissance Partners	Mark Baraz	Santa Monica	1-310-451-2436	1-318-458-6646
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Research Cottrell	Mr. Degnar	Somerville	1-908-685-4000	1-908-685-4587
Research Cottrell	Prakash Dhargalkar	Somerville	1-908-685-4000	1-908-685-4587
Research Triangle Institute	Frederick de Serres, B. Somers	Research Triangle Park	1-919-541-6516	1-919-541-2194
Research Triangle Institute	Jack Farmer	Research Triangle Park	9195418007	
Research+able	Dale A. Sawaya	Vienna	703-281-3963	703-281-4954

Company	Contact Name	City	Primary Phone	Primary Fax
Resource Alliance	C. Preston Clements	Albuquerque	505-898-4764	505-897-7413
Resource Applications, Inc.	Dr. Tara Singh	Falls Church	1-703-698-2000	1-703-698-2030
Resource Applications, Inc.	Mr. Satish Shah	Falls Church	703-698-2000	
Resource Management Associates	Charles H. Fafard	Madison	608-283-2880	608-283-2881
Resource Management Associates	Melinda Goodrich	Madison	608-283-2880	608-283-2881
Resource Management Int'l (RMI	Christopher J. Perine	Sacramento, CA	916-852-1300	916-852-1073
Resource Management Int'l Inc.	Kimberly Clennan	Washington, DC	202-429-8615	202-659-2926
Resource Recycling Inc.	Noname	Pinellas Park	1-813-573-2482	1-813-573-2527
Resource Restoration Int'l	Patricia S. Honeycutt	Portland	503-222-1015	503-243-2538
Resources Development Found'n	Tom Wahman	New York	212-514-8464	212-514-8676
Restek Corporation	Noname	Bellefonte		
RETEC	Alfred Leuschner	Concord	1-508-371-1422	1-508-369-9279
RGF Environmental System	David Glynn	West Palm Beach	1-407-848-1826	1-407-848-9454
Rigel Corporation	Mr. Raj Abel	McLean	1-703-790-8795	1-703-821-2562
Rike Service, Inc.	Anne Marie Stephens	New Orleans	1-504-827-0161	1-504-822-7599
Riordan Materials Corp.	Thomas Schell	Crofton	1-301-858-0609	1-301-721-2151
Riverside Company	Bela Szigethy	New York	212-932-0510	212-932-1317
RMT Engineering & Enviro. Mgmt	Jeet Radia	Dublin	1-614-793-0026	1-614-793-0151
RNA	Donna Lewein	Madison		
Roediger Pittsburg Inc.		Allison Park	1-412-487-6010	1-412-487-6005
Rofin Sinar	Bill Weston	Pottstown	1-610-326-4866	1-610-326-4872
Romic Environmental Technologi	Noname	East Palo Alto	1-415-324-1638	1-415-462-2311
Ronald T. Dodge Company	Ronald Versic	Dayton	1-513-439-4497	1-513-439-1704
Ronstadt Group Companies	Rolf D.J. Ronstadt	St. Charles	708-377-2584	708-377-5521
Rosemount Analytical	Bud Keyes	Orrville	1-216-684-4435	1-216-682-7016
Rosemount Analytical	Dick Sobel	Orrville	1-216-684-4435	1-216-682-7016
Rosemount Analytical	H.R. Emerick	Orrville	1-216-684-4435	1-216-682-7016
Rosenblad Design Group,Inc.	Axel E. Rosenblad	Leonardo	908-641-9122	908-646-3981
Roush Industries	Mr. Ronald Woodard	Livonia	313-591-7755	313-591-4373
Roy F. Weston	Kevin Hanson	Newark		
Roy F. Weston	Paul Osimo	Philadelphia	215-841-2036	215-841-2040
Royce Instrument Corporation	Jim Dartez	New Orleans	504-254-8888	504-254-8855
RST Systems, Inc.	Rodney Whitney	Larose	1-504-798-7522	1-504-798-7511
RTI Laboratories	Gerry Singh	Livonia	313-422-8000	313-422-5342
RTP Environmental Associates	Sunil Hangal	Green Brook	1-908-968-9600	1-908-968-9603
Rubber Research Elastomerics	Fred Stark	Minneapolis	1-612-572-1056	1-612-572-2357
Russian-American CoC	Noname			
S&N Trading Co.	Paul Singh	Solon	1-216-349-2869	1-216-498-0042
SAIC	Dr. Dash Sayala	Reston	1-703-318-4644	1-703-709-1038
SAIC	Mr. David Williamson	Reston	1-703-318-4644	1-703-709-1038
Sanborn	Mark Rizzone	Wrentham	1-508-384-3181	508-384-5346
Sand systems, Inc.	Karl Daukss	Twinsburg	1-216-425-3210	1-216-425-2442
Sandia National Laboratory	Michael Prairie		1-505 844-7823	
Santa Clara University	Gregory A. Baker	Santa Clara	1-408-554-4086	1-408-554-5167

Company	Contact Name	City	Primary Phone	Primary Fax
Sarp Industries	Noname	Houston	1-713-785-8777	1-713-785-6699
Schiller Associates	Steven R. Schiller	Oakland	510-444-6500	510-444-6502
Sci-Tec Instruments (USA) Inc.	David Cutts	Stafford	713-240-0404	713-240-0428
Sciences International, Inc.	Charles O. Shore	Alexandria	1-703-684-0123	1-703-684-2223
Scott Environmental	Eric Aynsley	Plumsteadville	1-215-766-7230	1-215-766-2051
Scott Paper Company	Kathleen Walters	Philadelphia		
SE2T International LTD	Sergio C. Trindade	Scarsdale	914-725-8230	914-723-8994
Search Incorporated	Leale E. Strubin	Norman	1-405-364-0900	1-405-329-0002
Seevers Associates, Inc.	William J. Seevers	Centerport	1-516-757-2397	1-212-447-5546
Sellers Engineering Co.	Tom Sellers	Danville	1-606-236-3181	1-606-236-3184
Sensidyne, Inc.	Hal Jones	Clearwater	813-530-3602	813-539-0550
Serec Corp., Division of Impco, Inc.	J.P. Schuttert	Providence	1-401-421-6080	1-401-521-5690
Servomex Company Inc.	Susan K. Deutsch-O'Hearn	Norwood	1-617-769-7710	1-617-769-2834
Shapins Associates	Ann Moss	Boulder	303-442-4588	303-444-9334
Siegmund Environmental	Lazslo Siegmund	Providence	1-401-785-0130	1-401-785-3110
Siemens Industrial Automation	Sandy Patterson	Alpharetta	800-964-4114	404-740-3998
Sierra Monitor Corp.	Steve Ferree	Milpitas	408-262-6611	408-262-9042
Simonds Manufacturing Corp.		Aburndale	1-813-967-8566	1-813-967-8538
Simplicity Engineering	Bob Conrad	Durand	1-517-288-3121	1-517-288-4114
Simpson Technologies Corporation	Timothy McMillin	Aurora	1-708-978-0044	1-708-978-0068
Sippican	Tony Bracken		1-508-748-1160	
SITEX Enviromental Inc.	Edward Edgerley	St. Louis	1-314-569-1119	1-314-569-0051
Sloan Equipment & Sales Co.Inc	Larry Sloan	Owings Mills	1-410-581-0555	1-410-581-0551
Small Flows Clearinghouse	Anish Janprania	Morgantown	1-800-624-8301	
Smith & Loveless	Stuart B. Marschall	Lenexa	1-913-888-5201	1-913-888-4230
Smith, Stratton, Wise	Richard J. Pinto	Princeton	1-609-924-6000	1-609-987-6651
Soil Technologies	Richard G. Sheets	Bainbridge Island	1-206-842-8977	1-206-842-9014
Solar Energy Industries Ass'n	Kathy McGee	Washington, D.C.	383-2600	383-2670
Solvay Interox	Noname	Houston	1-713-525-6500	1-713-524-0932
Solvent Kleene	Itmar T. Kutai	Peabody	1-508-531-2279	1-508-532-9304
Sonic Environmental Systems	Ricard Sereni	Parsippany	1-201-882-9288	1-201-882-1486
Southern Engineering	Mike Mehrman		1-404-352-9200	1-404-351-1196
Southern Research Institute	Herbert Miller	Birmingham	1-205-581-2513	1-205-5812888
Southwest Research Institute	E. Robert Fanick	San Antonio	1-210-684-5111	1-210-522-3496
Spectra-Tech	Joan K. Panagos	Shelton	1-203-926-8998	1-203-926-8909
Spokane Industries	Mr. Greg Tenold	Spokane	1-509-924-0440	1-509-924-9448
SRC International	Dilip R. Limaye	Bala Cynwyd	610-667-2160	610-667-5593
SRC: Synergic Resources Corp.	International Sales	Bala Cynwyd	1-215-667-2160	1-215-667-5593
SRI International	John Normand	Arlington	703-247-8418	703-247-8410
SRI International - Washington	Kathleen Vickland	Arlington	703-247-8414	703-247-8410
SRS Technologies	Janice Van Mullem	Los Angeles	310-338-1128	310-338-1128
Standard Chartered Bank	Noname	New York	212-612-0295	212-514-0295
Stanely Associates	Tanya Haut	Alexandria		
State of Colorado	Joy Carey	Denver	303-892-3850	303-892-3820

Company		Contact Name	City	Primary Phone	Primary Fax
State of New Mexico		Edgar Thornton		505-827-2855	
State Water Resources Control		Janis Lee	Sacramento	916-653-0424	
States Engineering Corporation		Richard Butzow	Fort Wayne	1-219-747-6195	1-219-747-4990
Stelter & Brinck, Inc		Noname	Harrison	1-513-367-9300	1-513-367-1524
Stephens & Associates		Rick Stephens	Kiowa	1-303-621-2674	1-303-621-2674
Stewart & Stevenson Services		Lloyd Austin	Commerce City	1-303-287-7441	1-303-287-4936
Stone Container		Mr. Charlie Ackel	Tucker	404-621-6706	404-621-6733
Stord, Inc. (An Aker Company)	3	Jeffrey N. Johnson	Greensboro	919-668-7727	919-668-0537
Stranco Inc,		Jim Marcukitis	Bradley ,	1-800-882-6466	1-815-932-0674
Strategic Energy Services, Inc		Raymond M. Pasteris	Yardley	1-215-736-8170	1-215-736-8171
Stringfellow Energy		Thomas E. Stringfellow	Denver	1-303-753-0573	1-303-753-0617
Struthers Corporation		Gordon Price	Pittsburgh	1-412-281-4434	1-412-281-4436
Summations		Gail Levine	Washington, D.C.	686-4281	686-4281
Summit Analyzers		Bob Schraeder	Livermore	510-443-4210	510-443-0251
Sun Coal Jewel		Dave Everest	Knoxville	1-615-558-0300	1-615-558-3280
Sun MicroSystems, Inc.		Timothy Dwyer	Mountain View	1-415-688-9365	1-415-688-9006
Support Services, Inc.		Mr. Peter Banner	Malibu	310-456-1374	310-456-3174
Surface Combustion Inc.		Thomas J Schulte	Maumee	1-419-891-7150	1-419-891-7151
Svedala Industries		Frank Kohanowski	Waukesha	1-414-798-6200	1-414-798-6211
Swemco, Inc.		Mr. Jim O'Farrell	New York	212-645-0440	212-463-9821
SwiftShips, Inc.		Leslie Lallande	Morgan City	1-504-384-1700	1-504-384-0914
Sybron Chemicals Inc.		Herbert Jernigan/Michael Scalz	Birmingham	1-800-678-0020	1-609-894-8641
Synetics		Jacqueline Richardson	Vienna	703-848-2550	703-847-3121
Synosys, Inc.		Rajiv Datar	New Brunswick	1-908-418-9008	1-908-545-0120
Syntel Inc		Achyot S. Godbole	Troy	1-810-828-7200	1-810-828-3307
Taitem Engineering		Ian Shapiro	Spencer	607-277-1118	607-277-2119
TDA US Trade & Development Age		Alison S.K. Arnstein	Washington	1-703-875-4357	1-703-875-4009
Technologies & Management Svcs		John T. Stone, III	Gaithersburg	1-301-670-6390	1-301-670-1942
Technology Commercialization		Noname	Chicago	1-312-567-4303	
Technology Transition Office		Air Force TTO		1-513-255-5940	
TEIN - Technical Entrepreneurs		Avi Dey	Vienna	1-703-242-0312	
Teledyne Brown Engineering		Ajit Thakur	Huntsville	205-726-1000	205-726-1033
Teledyne Brown Engineering		Mr. Chandra Sankar	Huntsville	205-726-6132	
Tenneco Automotive		Paul J. Kotowicz	Monroe	313-243-8252	313-243-8099
Tennessee Valley Authority		Brij B. Singh	Chattanooga	423-751-8680	423-751-4270
Tensa Services, Inc.		Paul Tripathi	Houston	713-789-5156	713-789-0907
Tess-Com, Inc.		Louis Colonna	Clairton	1-412-233-5782	1-412-233-8354
Testo, Inc.		Debra Castellucci	Flanders	800-227-0729	201-252-1729
Tetra Technologies		Dave Slack	Woodlands	1-713-367-1983	1-713-364-2240
Tetra Technologies		Rich Dennis	Woodlands	1-713-367-1983	1-713-364-2240
Tetrahedron, Inc.		E.C. Donaldson	Baltimore	1-410-837-0512	1-410-727-6460
Texaco Inc.		William P. Volk	White Plains	914-253-4037	914-253-7744
Texas Coal Ash Utiliztion Grp		Kenneth Cobb	Bastrop	1-800-776-5272	
Texcel, Inc.		Larry S. Derose	Westfield	1-413-562-7593	1-413-568-9469

Company	Contact Name	City	Primary Phone	Primary Fax
Texcon Environmental (Now: Air & Noise Products)	William Gould	West Chester	1-610-429-4575	1-610-429-4576
TF Purifiner	Richard C. Ford	Boynton Beach	407-547-9499	407-547-4025
The Alliance To Save Energy	Joe Loper	Washington, D.C.	857-0666	331-9588
The Alliance To Save Energy	Theodore W. Jones	Washington	1-202-857-0666	1-202-331-9588
The Chase Manhattan Bank, N.A.	Philip M. Chen	New York	212-552-6624	212-552-6276
The Ecotourism Society (TES)	Megan Epler Wood	N. Bennington	802-447-2121	802-447-2122
The Global Navigators	S. Preston Adams III	Englewood	303-220-8100	303-220-8606
The National Assoc.	Cem Basman	Fort Collins	303-491-7393	303-491-2255
The Technical Group, Inc.	Mr. Chris Bryant	Washington, D.C.	202-962-8531	202-962-8599
The World Bank	Joe Gilling	Washington	473-3230	
The World Bank	Nobuko Ichikawa	Washington, D.C.	202-458-0518	202-477-2733
ThermAll Inc.	Gordon Blizard	Peapack	1-908-234-1776	1-908-234-2941
Thermatrix Inc	Berkeley Buchanan	San Jose	1-408-944-0220	1-408-944-0292
Thermatrix Inc	Mr. John Schofield	San Jose	1-408-944-0220	1-408-944-0292
Thermo Environmental Instr.	Frank Duckett	Franklin	508-520-0430	508-520-14460
Thermo Process Systems	S.N. Prakash	Livonia	313-953-5473	313-591-6443
ThermoChem, Inc.	Mr. K. Durai-Swamy	Columbia	410-997-9671	410-997-0898
Tidewater Management Group	Thomas L. Rinker	Phoenix	410-771-0875	410-771-0876
Time Tech Inc.	Tom Rogers or Mr. De Paul	Glenolden	1-610-461-8162	1-610-461-8162
Ting Corporation	Pratek Dokania	Lindenhurst	516-225-7189	516-225-7190
TIPS - Technological Info	Eric Russi	Rockville	1-301-871-2836	1-301-460-3908
TNRCC	Joe Youngblood	Austin	512-239-3607	
Toma International	Tony Livoti	Santa Cruz	1-408-464-8585	1-408-464-0558
Trailworks	Ruben Rajala	Gorham	603-466-5521	603-466-3668
Tri-Bio Inc	Curtis McDowell	Allentown	1-610-395-8309	
Tri-Mer Corporation	John Pardell	Owosso	1-517-723-7838	1-517-723-7844
Trident Environmental	Michael E. Heckathorn	Antioch	1-510-778-0648	1-510-778-9067
Trinity Consultants Inc.	Mark Johnson	Overland Park	1-913-491-9100	1-913-491-0083
Trinity Consultants, Inc.	Richard Schulze	Dallas,	1-214-661-8100	1-214-385-9203
Tripodi & Wood Associates	Susan T. Wood	Washington, D.C.	234-8625	387-4123
Tropical Research & Develop't	Noname	Gainesville	904-331-1886	904-331-3284
TUELECTRIC	Jacob Gonzales	Dallas	1-214-812-8328	
Tufts Center for Environmental Management	David Gute	Medford		
Turner EnviroLogic, Inc.	Eugene Hoffman	Deerfield Beach	1-305-422-9787	1-305-422-9723
Twin Rivers Technologies	Mr. Steven M. Mello	Quincy	1-617-472-9200	1-617-472-5460
TWO-Poland Ltd.	Dennis G. Monroe	Arlington	703-528-6965	703-528-6965
U.S. Agency for Int'l Devel't	Melody Bacha	Washington, D.C.	647-7315	647-6962
U.S. Biotech, Inc.	Tom Fergus (for co. president)	Teterboro	1-201-393-0099	1-201-393-0778
U.S. Department of Commerce	Anne L. Alonzo	Washington	482-5225	482-5665
U.S. Department of Energy	Scott Smouse	Pittsburgh	412-892-5725	412-892-4775
U.S. Filter Corporation	Kenneth Norcross	Palm Desert	1-619-340-0098	1-619-341-9368
U.S. Filter Corporation	Mr. Larry Olear	Palm Desert	1-619-340-0098	1-619-341-9368
U.S. Filter Corporation	Richard J. Heckman	Palm Desert	1-619-340-0098	1-619-341-9368
U.S. Filters Corporation	Craig Rogers	Warrendale	1-412-772-0086	1-412-772-1360

Company	Contact Name	City	Primary Phone	Primary Fax
U.S. Geological Survey	Christopher Wnuk	Reston	703-648-6418	
U.S. Trade & Develop't Agency	Geoffrey R. Jackson	Washington, DC	703-875-4357	703-875-4009
UEC Environmental Systems, Inc	J.K. Peterson	Pittsburgh	1-412-433-6552	1-412-433-6473
Ultrasol International, Inc.	Mr. Gary Spriggs	Miamisburg	513-859-7337	
Umpqua Research Company	Mr. David Putnam	Myrtle Creek	503-863-7770	503-863-7775
Unisorb Corp.	Dave Schmittgens		1-713-943-3753	
United Airlines	Saleem Zaheer		1-202-833-6380	
United Emission Catalyst	Jan Roberts	Canton	1-704-648-9660	1-704-648-9616
United Emission Catalyst	Michael Hobbs	Canton	1-704-648-9660	1-704-648-9616
United McGill Corporation	Robert Kirkland	Columbus	1-614-443-0192	1-614-445-8759
United McGill Corporation	Tom Maurer	Columbus	1-614-443-0192	1-614-445-8759
United Nations	Tarcisio Alvarez-Rivero	New York	212-963-5708	212-963-1267
Universal Energy, Inc.	Jerry Evans	Houston	1-713-338-6778	1-713-338-0011
University of Berkeley	Shih-Ger(Ted) Chang	Berkeley	1510-486-5125	1-510-486-5401
University of Delaware	Costel d. Denson	Newark	1-302-831-8056	1-302-831-2085
University of Denver	Gene Ellis			
University of Illinois	Mark J. Rood	Urbana	1-217-333-6963	1-217-333-9464
UOP	Noname	Mt. Laurel	1-609-727-9400	1-609-727-9545
Urban Conservation & Design	Robert Bruce Anderson	San Francisco	415-981-4010	
Urea Technologies, Inc.	Nathaniel H. Glade	Hackensack	201-488-0700	201-488-1062
US Department of Energy	M. Salim Akhtar	Washington	1-202-586-8672	1-202-586-0823
US Dept. of Commerce	Rizwan Khaliq	Washington	482-2589	482-5665
US-ASEAN Council for Business	Noname	Washington	202-289-1911	202-289-0519
USAEP	Maria Chen	Washington	202-663-2674	202-663-2760
USAID Bureau for Latin America	Robert E. Navin	Washington, D.C.	647-6982	647-6962
USCO	Noname	Medford	1-617-395-9023	
USNPS: National Parks Service	Robert (Bob) Yearout	Washington	202-343-3784	202-343-3731
Utilase Systems	Daniel Gherasim	Detroit	1-313-521-2488	1-313-521-4695
Vanaire	Raghu Rao	Louisville	1-502-491-3553	1-502-491-5182
Vapex Environm. Technologies	Sally Hulsman	Canton	1-617-821-5560	1-617-821-4967
Vara International	U. Sengupta/ Michael Morley	Vero Beach	1-407-567-1320	1-407-567-4108
Vencon Management, Inc.	Irvin Barash	New York	1-212-581-8787	1-212-397-4126
Vermont Dept. of Econ. Devel.	Jim Griffiths	Montpelier	800-341-2211	802-828-3258
VFL Technology Corp	Noname	West Chester	1-610-918-1100	1-610-918-7222
VICI Metronics, Inc.	Tom Williams	Santa Clara	800-707-0083	800-707-0084
Vigilant Technologies, Inc.	Kenneth R. Dunlap	Hackettstown	908-852-2943	908-852-2943
Viking Systems International	Noname	Pittsburgh		
Village Marine Tec.	Bill Conry	Gardena	1-310-516-9911	1-310-538-3048
Virginia Econ. Devel. Office	Robbins Buck	Richmond	804-371-8100	804-371-8112
Visionex, Inc.	Mike Wach	Warner Robins	800-896-9907	912-953-3169
VNG Associates	R. K. Gupta	Neptune	1-908-988-9300	1-908-988-9301
Vortec Corporation	Dilip K. Darooka	Blue Bell		
W. VA Development Office	Rolland Phillips	Charleston	800-982-3386	304-558-0449
W.C.S Waste Control Services	Larry Friday	Channelview	1-713-457-6494	1-713-457-0966

Company	Contact Name	City	Primary Phone	Primary Fax
W.W. Sly Manufacturing Company	Bill Kruz	Strongsville	216-891-3200	
Wahlco Environmental Systems	Alan Scarsella	Santa Ana	1-714-979-7300 x3141	-714-979-0114
Wahlco Environmental Systems	Ann Anderson	Santa Ana	1-714-979-7300 x3141	-714-979-0114
Wahlco Environmental Systems	Barry Southam	Santa Ana	1-714-979-7300 x3141	-714-979-0114
Walker Process Corp.	Lane Sheldon	Aurora	1-708-892-7921	1-708-892-7951
Walters Cincinnati Technical	Richard A. Walters	Fairfield	1-513-860-4294	1-513-860-4253
Ward Automation Inc.	Al Rawlins	Buffalo	716-856-6966	905-732-3310
Warren Environment, Inc.	R.M. Warren III	Atlanta	1-404-843-8333	1-404-843--0089
Washington Dev. Cap. Corp.	Rick Tropp	Washington	1-202-775-0355	
Waste Policy Institute	Julie H. Leap	Gaithersburg	301-990-3130	301-990-6150
Water & Power Technologies, Inc.	Chuck Berg	Sale Lake City	1-801-974-5500	1-801-973-9733
Water Protection, Inc	Noname	Miami	1-305-591-3143	1-305-594-9371
Waterman Asia	Daniel Nease	Tempe	1-602-820-4234	1-602-897-2491
WB Wolverine Bronze Company	D. I. Smith	Roseville	1-810-776-8180	1-810-776-4510
Wedgewood Technology	David Moreno	San Carlos	415-593-1598	415-593-0235
WEIC	Mike Raghavan	Newark	1-510-793-8264	1-510-793-3410
Weiss Associates	Betsy Codding	Emeryville	1-510-450-6000	1-510-547-5043
Weiss Associates	Richard Wiss	Emeryville	1-510-450-6000	1-510-547-5043
Weldlogic Inc	Robert Elizarraz	Chatsworth	818-709-6006	818-709-6780
WEMA: Water & Wastewater Equip. Manufact Asso	Dawn Kristof		1-703-444-1777	
West Virginia	Jack Burlingame		1-304-273-5367	
Westech Engineering Inc.	Dave Elgrin	Salt Lake City	1-801-265-1000	1-801-265-1080
Western Advanced Systems &	Dale Harris	Chino	1-909-627-5901	1-909-627-2741
Western Ash Company	Gary Hunt	Phoenix	1-602-248-7946	1-602-248-7964
Western Filter Company	Greg...	Denver	1-303-288-2617	1-303-286-9328
WESTEX International, Inc.	Varghese Robert George	Washington	1-202-463-6066	1-202-463-0305
Weston International	Bob Biggs	West Chester	610-701-3610	610-701-3651
Weston International	M.N. Bhatla	West Chester	610-701-3610	610-701-3651
Weston International	Steven Vorndran	West Chester	610-701-3610	610-701-3651
Wheelabrator	Delmar J. Doyle	Pittsburgh	1-412-562-7010	1-412-562-7617
Wheelabrator	Joe Millen	Pittsburgh	1-412-562-7010	1-412-562-7617
Wheelabrator Clean Air Systems	Bernard Seguy	Schaumburg	1-708-706-6900	1-708-706-6996
Wheelabrator Clean Air Systems	Dan Ramshaw	Schaumburg	1-708-706-6900	1-708-706-6996
Wheelabrator Environmental Sys	Noname	Hampton	1-603-929-3000	
Whyte & Hirschboeck	G. Hans Moede	Milwaukee	414-273-2100	414-223-5000
Wilkens-Anderson Co.	Mark Weinberg	Chicago	312-384-4433	312-384-6260
Wisconsin Department of Devel.	Victor Grassman	Madison	608-266-1018	608-266-5551
WISE	Paul Yaniga	Chadds Ford	1-215-558-2120	1-215-558-2123
WMI - Prague	Dave Dahlem		42-2 69 269 64	42-2 69 269 40
WMX Technologies, Inc.	Donald Wallgren	Oak Brook	1-630-572-2464	1-630-792-9207
WMX Technologies, Inc.	Lisa DiGnazio	Oak Brook	1-630-572-2464	1-630-792-9207
Wolverine (Massachusetts) Corp.	Eric Long	De Pere	1-414-336-5231	1-414-336-5360
Woodward-Clyde	Laurie LaPat	Phoenix	602-225-0150	602-225-0024
World Bank	Mahesh Sharma	Washington, D.C.	202-473-2296	202-473-8163

Company	Contact Name	City	Primary Phone	Primary Fax
World Enviro Systems, Inc.	Lionel E. Turner	Shawnee, OK	405-275-7565	405-275-3900
World Resources	Mike Raghavan	Newark	1-510-793-8264	1-510-793-3410
World Resources Institute	Pradeep Monga	Washington, DC	2026386300	2026386300
World Water Systems, Inc.	Vic Karian	Tustin	800-779-4997	714-222-5770
World Wildlife Fund	Richard Liroff			1-202-293-9211
WPI Waste Policy Institute	Karon Gilmore	Washington,	1-202-554-1354	1-202-554-1452
WPI, Inc.	Jacquie L. Kay	Cambridge	617-864-2042	617-864-7757
Wrib Inc.	Mr. Rick Reuben	Veedersburg	1-317-294-2841	1-217-446-9800
Yankee Manufacturing Inc.	Captain Christian Lint	Seattle	1-206-382-1549	1-206-365-1864 (CAC)
Yellowstone Environmental Scie	Joan Wu-Singel	Bozeman	1-406-586-2002	1-406-8818
Zimpro	Rob Lawson	Rothschild	1-715-359-7211	1-715-355-3219
TOTALS				

1,419 records printed.

Trade in Environmental Services and Technologies (TEST)

Press Release
February 20, 1996

USAID New Delhi Launches
Trade in Environmental Services and Technologies (TEST)
Internet Website
http://www.info.usaid.gov/TEST/

The USAID New Delhi Mission's Trade in Environmental Services and Technologies (TEST) program is pleased to present its TEST World Wide Web (WWW) site on the Internet. The TEST program has taken advantage of the Internet as the most rapidly growing global information medium to create a website that serves as a business link and information center for Indo-U.S. environmental partnerships.

The overall objectives of the TEST program are to forge market-oriented solutions to India's increasingly serious industrial pollution problems through joint ventures and other business collaborations; to create a two-way information network between India and the Unied States; and to create sustainable relationships between Indian and U.S. multiplier organizations, including associations, chambers of commerce, and state development offices.

To fulfill these objectives, the TEST website has been developed as a one-stop-shop for finding and retrieving information on environmental market opportunities in India and on U.S. environmental technology providers, information resources, and available government assistance programs. The website offers detailed information on the TEST program, including its mission and objectives, completed and ongoing projects, and success stories. It provides information on and links to financing agencies, other related government programs, and other useful Internet resources. The site also provides information on India's environmental market opportunities and India's environmental laws, regulations and policy. Of particular interest is an Indian environmental market study recently prepared by the Confederation of Indian Industries (CII) and Sanders International for the USAID TEST program which will be available on the website in the near future. This study estimates that the environmental market in India in 1994 amounted to US $1.2 billion and projects fast growth rates into the next century. The website will also allow users to identify U.S. environmental technology and service providers active and interested in India and will provide detailed information on Indian companies looking for U.S. partners.

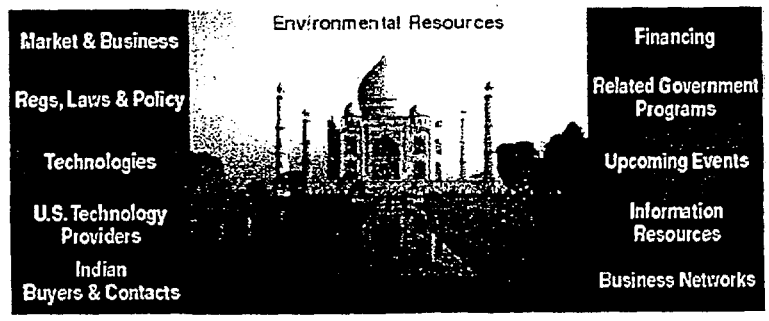
Information from this website can be easily browsed, downloaded, and printed. The site is being updated continuously, and new features, such as on-line conversation tools, will be added over time. Besides providing decision-relevant information, the objective of the TEST website is to create an electronic business forum in which Indian companies and potential U.S. partners can directly communicate with each other, exchanging company information, business leads, and environmental solutions, faster and more economically.

-over-

Why TEST on the Internet?

The Internet is the largest collection of interconnected computers that are able to communicate with each other. Anyone with a PC, modem, and software or link to an Internet service provider can access the Internet. A number of tools and services (such as e-mail, telnet, FTP, WWW) make information and resources available to millions of users. The World Wide Web (WWW) is one of the many Internet tools and its hottest growth area. It is with the WWW that data, images, sounds and automatic "links" to other Internet sites are available. Because of this capability the WWW is increasingly used as a marketing and business vehicle by companies and government agencies around the world. Quality and technical features are improving daily, making access easier, faster and more versatile. It is increasingly becoming a robust tool for finding and retrieving large amounts of information, instantly and globally.

TEST is a U.S. Agency for International Development (USAID) funded program to improve environmental protection in India while increasing the productivity of Indian industry on a sustainable basis, and to encourage and facilitate profitable business linkages between U.S. and Indian firms in the environmental sector



The TEST website is located at *http://www.info.usaid.gov/TEST/*

For further information on the website or the TEST program in general, contact:

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Fax: +11 686-8594
e-mail: aray@usaid.gov

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Scindia House, 5th Floor
N.M. Marg, Ballard House
Bombay, India 400 038-50
Tel: +22 261-8244
Fax: +22 262-5444
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Sanders International
TEST Program
1616 P Street, N.W.
Washington, D.C., 20036
Tel: (202) 939-3485
Fax: (202) 939-3487
e-mail:ceiff@sandersint.com.

ICICI INFORMATION RESOURCES REPORT, January 1994 -May 1996

The following resources have been mailed to ICICI as of May 1996:

Title	Date Mailed
Books:	
Applications for Coal-Use Residues	Mar 11, 1994
Agriculture, the Environment and Trade	Mar 11, 1994
Fueling Development: Energy Technologies	Apr 25, 1994
Environmental Strategies for Industry	Jul 19, 1994
Solid Waste Handbook	Jul 19, 1994
Cool energy	Jul 19, 1994
Standard Handbook of Haz. Waste Treatment and Disposal	Jul 19, 1994
In Situ Bioremediation	Jul 19, 1994
Environmental Science and Technology Handbook	Apr 18, 1995
Innovative Process Assessment: Sludge Processing, Disposal, Reuse	Apr 18, 1995
Biosolids: Document Long-Term Experience of Biosolids Land Application	Apr 18, 1995
Environmental TQM	Sept 25, 1995
Industrial Pollution Prevention Handbook	Sept 25, 1995
Directories:	
Environmental Software Directory	Jan 19, 1994
Environmental Management Sourcebook	Jan 19, 1994
Tapping Federal Laboratory Technology	Jan 19, 1994
The Export Yellow Pages	Jan 19, 1994
EPA Access	Mar 11, 1994
California Environmental Technologies and Services	Apr 25, 1994
Directory of Environmental Information Sources	Jul 19, 1994
US Dept. of Energy Technology Catalogue 1994	Oct. 11, 1994
Directory of US Coal and Technology Export Resources	Nov. 1, 1994
EPA Pollution Prevention Directory	Jul 5, 1995
Buyer's Guides:	
Environmental Protection Buyer's Guide 1993	Mar 11, 1994
Textile Technology Source Book	Apr 25, 1994
National Small Flows Clearinghouse Product Guide	Apr 25, 1994
New Pig, May	Jun 7, 1994
Hazmat World 1994 Literature Guide	Jun 7, 1994
Waste Age 1994 Industry Buyer's Guide	Oct. 11, 1994
Waste Age 100	Oct. 11, 1994
1994 Recycling Vehicles Guide	Oct. 11, 1994
Pollution Equipment News 1995 Buyer's Guide	Dec. 6, 1994
Waste Age 1995 Yellow Pages	Mar 3, 1995
EM Product Catalogue	Apr 18, 1995
USCO Catalog	Apr 18, 1995

Qualimetrics Sensor Catalog 1995	Jul 5, 1995
The Stevens Environmental Sourcebook	Sept 25, 1995
Pollution Equipment News Buyer's Guide 1996	Dec 12, 1995
Chemical Week 1995 Buyer's Guide 1995	Dec. 12, 1995
Environmental Protection 1996 Buyer's Guide	Feb. 12, 1996

EPA Publications:

EPA/Global Market for Environmental Technologies	Jan 19, 1994
EPA/Pollution Prevention News	
- back issues	Jan 19, 1994
- Jan-Feb	Apr 25, 1994
- Mar-May	Jul 19, 1994
-Aug-Sept	Nov. 1, 1994
- May-June 1995	Sept. 19, 1995
EPA/Contaminated Sediment News	
- Feb 1994	Jan 19, 1994
- May 1994	Jun 7, 1994
- Sept 1994	Dec. 6, 1994
- April 1995	Jul 5, 1995
EPA Green Lights	
- May 199	Jul 5, 1995
- Jul 1995	Sept 19, 1995
EPA Ground Water Currents	
- April 1995	Jul 5, 1995
- July	Dec 12, 1995
EPA Journal	
- Winter 1994	Apr 25, 1994
- Winter 1995	Jul 5, 1995
- Spring 1995	Dec. 12, 1995
EPA Pollution Prevention News	
- Mar-April 1995	Jul 5, 1995
- July-Aug	Dec 12, 1995
EPA Small Flows	
- back issues	Jan 19
- Fall 1994	Dec. 6, 1994
- Winter 1995	Apr 18, 1995
- Spring 1995	Jul 5, 1995
- Summer 1995	Sept 19, 1995
- Fall 1995	Dec12, 1995
EPA Tech Trends	
- June 1995	Sept 19, 1995
- Aug	Dec 12, 1995

DOE Publications:

DOE Technology Transfer 1994	Oct. 11, 1994
DOE Rocky Flats Compliance Program	Nov. 1, 1994
DOE Pollution Prevention Program	Nov. 1, 1994
DOE Innovation Investment Area	Nov.1 , 1994
DOE Morgantown Energy Technology Center	Nov. 1, 1994
DOE Technology Summaries (14 separate reports)	Nov. 1, 1994

Misc Publications:

Sandia Technology Bulletin	
- March 1994	Jun 7, 1994
- Sept 1994	Nov.1, 1994
- Feb 1995	Apr. 18, 1995
RFF Resources Newsletter	
- Fall 1994	Dec. 6, 1994
- Spring 1995	Jul 5, 1995
Cities International Newsletter	Mar 11, 1994
Environment Business Journal	Mar 11, 1994
PC Product Update	Mar 11, 1994
Energy and Environment, October 1993	Mar 11, 1994
Manufacturing Technology, August & December 1993	Mar 11, 1994
Various brochures on wetlands, lead, water, and air pollution	Mar 11, 1994
Power-Gen News	Apr 25, 1994
USERBEP Update	Apr 25, 1994
Innovative Treatment Technologies	Apr 25, 1994
Medical Waste	Apr 25, 1994
Accessing Federal Data Bases for Contaminated Site Clean-Up Technologies	Jul 19, 1994
Resources for the Future, No. 115	Jun 7, 1994
Earth Enterprises, May 1994	Jun 7, 1994
Environmental Systems Newsletter Fall 1994	Nov. 1, 1994
Water Innovation Vol. 2, Number 2	Nov. 1, 1994
Fuel Line Fall 1994	Nov. 1, 1994
The Aquifer Sept 1994	Dec. 6, 1994
Technology for a Sustainable Future	Dec. 6, 1994
The Environmental Forum	Mar. 3, 1995
NTIS Newsline	Mar. 3 , 1995
Stranco Water Innovation	Apr 18, 1995
Biotechnology Technical Bulletin	Jul 5, 1995
Pollution Prevention Northwest	Jul 5, 1995
EXIM Bank Bulletin May 1995	Jul 5, 1995
The Environmental Benchmarker, Aug 1995	Dec 12, 1995
GAO "Electric Vehicles"	Dec 12, 1995
EP2 News, Sept-Oct 1995	Dec. 12, 1995
ISO 14000 Information (Perry Johnson Inc.)	Feb. 12, 1996

Misc Articles:

- HazWaste, Wastewater, Methane Recovery, etc	Oct. 11, 1994
- India and PET recycling	Nov. 1, 1994
- Remediation, wastewater, pollution prevention	Dec. 6, 1994
- Various technologies	Mar. 3, 1995

Newsletters and Magazines:

Air Issues Review

- back issues	Jan 19, 1994
- Feb issue	Apr 25, 1994
- May issue	Jul 19, 1994
- August issue	Oct. 11, 1994
- Nov. 1994	Mar 3, 1995
- Mar 1995	Apr 18, 1995
- June 1995	Jul 5, 1995

Air & Waste

- March 1994 issue	Apr 25, 1994
- April issue	Jun 7, 1944
- Jun-Jul issues	Jul 19, 1994
- Jan-Feb, 1995	Mar. 3, 1995
- Mar 1995	Apr 18, 1995
- June 1995	Jul 5, 1995
- Jul-Aug	Sept 19, 1995

Biodiesel Report (formerly "Alert")

- back issue	Jan 19, 1994
- Feb issue	Mar 19, 1994
- Mar issue	Apr 25, 1994
- Apr-May issues	Jun 7, 1994
- Jun-Jul issues	Jul 19, 1994
- Aug-Sept issues	Oct. 11, 1994
- Oct.	Nov. 1, 1994
- Jan-Feb 1995	Mar. 3, 1995
- Mar 1995	Apr 18, 1995
- April-May 1995	Jul 5, 1995
- Sept	Dec 12, 1995

BNA Environment Reporter

- sample issues	Mar 11, 1994
- issues from Feb - April, and binders	Apr 25, 1994
- Apr 22 - May 20 issues	Jun 7, 1994
- May 27 - Jul 20	Jul 19, 1994
- Aug 26 - Sept 16	Oct. 11, 1994
- Sept - Oct.	Nov. 1, 1994
- Nov.	Dec. 6, 1994
- Dec-Feb 1995	Mar. 3, 1994
- Feb-Mar	Apr 18, 1995
- Mar-May	Jul 5, 1995
- May-Aug	Sept 19, 1995

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- Aug-Oct	Dec. 12, 1995
- Oct-Jan	Feb 12, 1996
Chemical Week	
- Mar 16 - Apr 20 issues	Apr 25, 1994
- Apr 27 - Jun 8 issues	Jun 7, 1994
- Jun 15 - Jul 20 issues	Jul 19, 1994
- Aug. 31 -Oct. 5	Oct. 11, 1994
- Oct. 12 - Oct. 20	Nov. 1, 1994
- Nov	Dec. 6, 1994
- Dec 1994 -Feb 1995	Mar. 3, 1995
- Mar	Apr 18, 1995
- Apr-June	Jul 5, 1995
- June-Aug	Sept 19, 1995
- Sept-Oct	Dec. 12, 1995
- Oct-Jan	Feb 12, 1996
Environment Today	
- April-May 1995	Jul 5, 1995
- Jul-Aug	Sept 19, 1995
- Aug-Sept	Dec. 12, 1995
- Oct	Feb 12, 1996
Environmental Business Journal	
- Aug-Sept 1994	Dec. 1, 1994
Environmental Engineering	
- Apr 1995	Jul 5, 1995
Environmental Engineering World	
- Sept-Oct 1995	Dec. 12, 1995
- Jan-Feb	Feb 12, 1996
Environmental Manager	
- Feb 1995	Apr 18, 1995
- Apr-June 1995	Jul 5, 1995
- Oct	Dec. 12, 1995
Environmental Protection	
- back issues	Jan 19, 1994
- Jan-Feb issues	Mar 11, 1994
- Mar-Apr issues	Apr 25, 1994
- Jun issue	Jul 19, 1994
- Sept	Oct. 11, 1994
- Oct	Nov. 1, 1994
- Nov	Dec. 6, 1994
- Dec 1994 -Feb 1995	Mar. 3, 1995
-Apr-May 1995	Jul 5, 1995
- Jun-Aug	Sept. 19, 1995
- Sept-Nov	Dec.12, 1995
- Nov-Jan	Feb 12, 1996

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Environmental Solutions	
- June issue	Jul 19, 1994
- Sept	Oct. 11, 1994
- Oct	Nov.1, 1994
- Nov	Dec. 6, 1994
- Dec-Feb	Mar. 3, 1995
- Mar 1995	Apr 18, 1995
- April-May 1995	Jul 5, 1995
- Jun-Jul	Sept 19, 1995
- Aug-Sept	Dec. 12, 1995
- Dec-Jan	Feb 12, 1996
Hazmat World (discontinued, replaced by Environmental Solutions)	
- back issue	Jan 19, 1994
- Mar issue	Apr 25, 1994
- Apr issue	Jun 7, 1994
- May issue	Jul 19, 1994
Infrastructure Finance	
- Feb-Mar 1995	Apr 18, 1995
- Jun/Jul	Sept 19, 1995
- Aug-Sept	Dec. 12, 1995
- Oct-Jan	Feb 12, 1996
MSW Management	
- Jul-Aug 1995	Sept 19, 1995
Pollution Engineering	
- Apr-May 1994	Jun 7, 1994
- Jun-Jul	Jul 19, 1994
- Sept	Oct.11, 1994
- Oct.	Nov. 1, 1994
- Nov.	Dec. 6, 1994
- Dec-Feb 1995	Mar. 3, 1995
-Mar	Apr 18, 1995
- April-May	Jul 5, 1995
- Jul	Sept 19, 1995
- Aug-Oct	Dec. 12, 1995
- Dec-Jan	Feb 12, 1996
Pollution Equipment News	
- Mar 1994	Apr 25, 1994
- Apr	Jun 7, 1994
- Jun	Jul 19, 1994
- Sept	Oct. 11, 1994
- Oct.	Nov. 1, 1994
- Nov.	Dec. 6, 1994
- Dec.1994 -Feb 1995	Mar. 3, 1995
- Mar	Apr 18, 1995

- April-June	Jul 5, 1995
- Aug	Sept 19, 1995
- Sept	Dec. 12, 1995
- Oct-Dec	Feb 12, 1996
Waste Age	
- Mar-Apr issues	Apr 25, 1994
- May issue	Jun 7, 1994
- Jun-Jul issues	Jul 19, 1994
- Sept.	Oct. 11, 1994
- Oct	Nov. 1, 1994
- Nov	Dec. 6, 1994
- Dec. 1994 -Feb 1995	Mar. 3, 1995
- Mar	Apr 18, 1995
- April-May	Jul 5, 1995
Waste News	
- Nov 1995 -Jan 1996	Feb 12, 1996
Water and Waste Digest	
- Jan 1995	Mar. 3, 1995
- Jul	Sept 19, 1995
- Nov-Dec	Dec. 12, 1995
- Jan	Feb 12, 1996
Water World Review	
- Mar/Apr issue	Apr 25, 1994
- May/Jun issue	Jun 7, 1994
- July/August	Nov. 1, 1994
- Mar/Apr 1995	Apr 18, 1995
- Sept-Oct	Dec. 12, 1995
- Nov-Feb 1996	Feb 12, 1996

Database Information and Software:

Information sheet on EPA/ATTIC	Jan 19, 1994
Information sheet on EPA/PIES	Jan 19, 1994
Bioremediation in the Field Search System (BFSS) BBS Description	Oct. 11, 1994
EPA VISITT 2.0 Diskettes and Manual	Apr 25, 1994
VISITT 3.0 Disks and manual	Nov. 1, 1994
Version 4.0 EPA VISITT database	May 2, 1996
Dialogue Database Catalogue	Jan 19, 1994
Dialogue ABI/Inform Titles list	Jan 19, 1994
Catalogue of Dialogue on Disc products	Mar 11, 1994
Dialog Chronolog, Oct. 1994	Oct. 11, 1994
Dialog Update and FEDRIP Search Guide	Dec. 6, 1994
Dialog January 1995 Price List and Chronolog	Mar. 3, 1995
Dialog Catalogue 1995	Jul. 5, 1995
KR/Dialog Chronolog Sept 1995	Dec. 12, 1995
Dialog Price List Sept 1995	Dec. 12, 1995

Dialog Price List Jan 1996	Feb 12, 1996
KR/Dialog Catalogue 1996	May 2, 1996
1994 Corptech Directory	Mar 11, 1994
Corptech Growth Forecaster	
- April 1994	Jun 7, 1994
- Sept, Oct	Oct. 11, 1994
- Nov.	Dec. 6, 1994
- Dec-Feb 1995	Mar., 1995
- Mar-Apr	Apr 18, 1995
- May	Jul 5, 1995
- Sept-Nov.	Dec. 12, 1995
Information on Database and Directory of World Chemical Producers	
- 1994/1995 Description	Nov. 1, 1994
- 1995/1996 Description	Jul 5. 1995
Environment Abstracts Aug. 1994 CD-ROM	Dec. 12, 1995
Environment Abstracts CD-ROM No. 4	May 2, 1996
Predicast Newsletter Database Source Guide	Mar 11, 1994
Chemical Strategies on CD-ROM product description	Oct. 11, 1994
Bridge to a Sustainable Future CD-Rom	Dec. 12, 1995
Industry Leadership for a Sustainable Future CD-ROM	Dec. 12, 1995
National Trade Database 1993 CD-Rom	Dec. 12, 1995
Telemagic TEST contact printout as of 11-21-95	Dec. 12, 1995
Acroread software	May 2, 1996
Zip and Unzip files	May 2, 1996

OTHER:

Recommendation to purchase Thomas Register CD-ROM	Feb 24, 1994
Folder with sample of newsletters	Mar 11, 1994
Directory of Short-Term Environmental Courses	Mar 11, 1994
National Academy Press Catalogs, Spring/Summer/Fall,'94	Jul 19, 1994
Subscription Renewal Recommendation of NETAC Technology Profiles	Aug 8, 1994
Recommendation to purchase McGraw Hill EST CD-ROM	Aug 12, 1994
National Academy Press, UDI, GI book catalogues	Dec. 6, 1994
Waterworld 1995 Calendar of Events	Mar. 3, 1995
Recommendation to purchase Environment Abstracts on CD-ROM	Mar. 3, 1995
CRC Press/Lews Publisher Environmental Sciences Publications Catalogue	Feb 12, 1996
1996 Guide to Products and Services, National Small Flows Clearinghouse	Feb 12, 1996
Technomic Publishing Company book reviews	Feb 12, 1996
Guide to Internet Resource Articles	May 2, 1996

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SANDERS
INTERNATIONAL

Environmental Business Development & Consulting

1616 P Street, NW, Suite 410 **Telephone: (202) 939-3480**
Washington, DC 20036 **Telefax: (202) 939-3487**

FACSIMILE MESSAGE

To: Felipe Manteiga **From: Jeff Hallett**

Date: November 16, 1995 **Total Pages (including cover): 2**

MESSAGE:

I wanted to get back to you some thoughts on the TEST information system, what our vision is, what we have done and what we propose to do. This can perhaps lay the basis for discussions on the TEST information system specifically and our perspective on how the Mission can use both existing and emerging environmental information resources and technologies to meet its present and future objectives. In lieu of a multi-volume series, I will keep this short and try and capture the essence.

I realize this is a difficult areas because so much is being written and said about the info superhighway, the "Web", etc., it is very confusing, and it is difficult to cut through the hype. I also am fully aware of your and the Mission's concerns that TEST not waste a lot of money on computer-based gimmicks that do not contribute to either TEST or Mission goals or that duplicate what others are doing or have done. We're not. Some thoughts.

1. Our guiding principle in approaching the big question of the TEST environmental information system is whether a particular book, database, CD, piece of equipment or software can help contribute to the closure of environmental business linkages. There really is no one else, inside or outside the government, that is doing this or has this particular, specialized mandate. In that the future of the U.S. environmental industry is really overseas, we also think this is a very important service.

2. Over the past two years we have developed substantial understanding and insights on how environmental information resources can be used to promote and facilitate environmental business linkages between the U.S. and India. We have tried to share these insights through reports and publications to the Mission, ICICI, U.S. and Indian business associations, companies, other government programs, and believe we can do even more.

3. As we move through the last year of technical assistance funding for TEST, it is clear to us that we are going to leave behind a substantial pipeline of "deals in progress". We are eager to put in place some tools that will assist the parties to these business linkages to continue their commercial dialogs and hopefully move toward deals. Thus, we have pushed aggressively to implement our Internet/Worldwide Web effort. See our 3/27/95 memo on info system development and our 1995-96 workplan.

4. We think the various services and resources we call the TEST information system will be a very important, perhaps the most important, contribution and self-sustaining deliverable from the TEST program. See the tri-fold color brochure, in the folder we created for the February 1995 Bio-treatment delegation for a snap-shot of what the TEST information system is and will be.

Coordination efforts:

We know about and have met and remain in contact with all other USAID environmental and energy program representatives that are doing things with information technologies and the Internet. As far as we can tell, we are not and have not duplicated anything that anyone else is doing or has done. Relatively speaking, and especially compared to USAEP work, our efforts are modest and very tightly focussed. The bottom line is what we are doing relates specifically to the TEST program and its goals. Everything we do is shared with and can be accessed by anyone inside or outside of the U.S. government that is interested in environmental business between the U.S. and India.

Have a happy Thanksgiving and I look forward to seeing you again soon in New Delhi.

/

(Workplan 95-96)
II. Information System

A. Purpose and Assessment of Task: 1) To establish a permanent information network responding to Indian demand for technical information on U.S. environmental services, technologies and sources of financing, and U.S. commercial interest in developing business opportunities in the environmental/industrial pollution sector in India. 2) To create and or strengthen networks whereby U.S. and Indian firms, associations and technology development organizations can learn of one another, exchange information on environmental problems, solutions, opportunities and events, match technology and service providers with importers and promote technology transfer arrangements that lead to sustained flows of U.S. environmental technologies into India for the resolution of industrial pollution problems. This is perhaps the most important component of the TEST program in that it is the structure that will be left in place at the conclusion of TEST program funding.

B. Strategy

Systems Development

SI will continue to evaluate and selectively acquire printed, computer disk, and CD-ROM environmental information resources and transfer these to ICICI's TEST Group for incorporation in the TEST Group's environmental library. This information supplements the materials on U.S. environmental firms that are being sent to ICICI for incorporation in the TEST information system and library.

SI will also continue its efforts to further develop and improve the information system to meet the above objectives. Specific tasks include:

-- Implement Phase 2 Information System Development as outlined in our Memorandum (see annex X). This means exploring and developing Internet capabilities to 1) transfer large amounts of information to and from India, to 2) conduct business using Internet's live conversation channels, and 3) set up a TEST presence on the Internet by developing a World Wide Web (WWW) TEST Homepage and linkages.

-- Coordinate effort with USAID's plans to get on the information superhighway and create linkages to other USAID environmental and energy programs.

-- Develop information on other US government and private information networks, such as EP3's information clearinghouse and EnviroSense, the Global Network for Environmental Technology (GNET), the International Business Exchange (IBEX), and the Asian and Pacific Centre for Transfer of Technology (APCTT). As appropriate, incorporate into TEST homepage and develop sustainable relationships.

-- Receive and evaluate information products from CII commissioned under last year's workplan and determine future relationship and follow-up work. Integrate information into the TEST information system.

-- Receive and evaluate the VOC Technology Database commissioned from Dyncorp, and determine future assignments and follow-up work. Integrate into the TEST information system.

-- Develop information on public and private sources of financing for environmental projects and integrate into TEST information system.

Transfer of Resources and Training

We intend to work more closely with Dr. Jain and ICICI in terms of setting up their own in-house capability, subject to TEST Group's interest in managing and keeping up the information system after the TEST program funding. We will ensure that ICICI has the appropriate equipment and resources for the above stated goals. We will also transfer all relevant portions of SI's in-house "Telemagic" database.

Work with the Global Energy and Environment Network (GLEEN) in order to develop sustainable information systems capabilities in India at ICICI and other possible institutions and organizations if necessary.

At end of workplan year, summer '96, consider bringing over delegation from apex Indian business groups and ICICI for a week of training here, 2 days with us and 2-3 days of Internet and Dialog type seminars.

Information Dissemination and Promotion

We have reached a certain level of unique capability to find and evaluate environmental technologies using the TEST information system. We think that we can now promote the system as one of the major contributions of the TEST program that will remain after conclusing of TEST funding.

We will augment efforts to promote and explain the TEST Information System as a set of information resources and an approach to learning about environmental technologies and vendors.

We will develop a resource package that we can possibly offer to businesses, associations and Indian organizations. This could be done in print, electronically (on disk or CD-ROM), and/or by making the information available on the Internet. We will coordinate this effort with USAID and possibly GLEEN.

2.3.4

FAXED

Updated September 25, 1996

T.E.S.T. CALENDAR
OF ENVIRONMENTAL TRADE EVENTS, CONFERENCES and COURSES

* New additions since last update
•*Italics*• Major events

1996 U.S. Events

ISO 14000 Environmental Auditor Training
Around the country/ April - Dec. 1996
contact: Perry Johnson, Inc., tel. (810) 356-4410, fax. (810) 356-4822
e-mail: pji@wwnet.com, http://www.pji.com

ISO 14000 for Managers
Around the Country / Aug. - Dec. 1996
contact: ASTM. Kristina Falkenstein, tel. (610) 832-9686, fax. (610) 832-9668

ISO 14000 Environmental Auditor Training
Around the Country / Aug. - Dec. 1996
contact: Perry Johnson, Inc, tel. (810) 356-4822, fax. (810) 356-4822
e-mail: pji@wwnet.com, http://www.pji.com

***Infrastructure For the Future: Private Finance, Public Partnership, and Sustainable Development**
Washington, DC / Sept. 28 - Oct. 1, 1996
contact: World Bank Group, IMF, tel (202) 473-3394, fax (202) 623-4100

***Environmental Remediation Technologies: Strategies for Success**
Houston, TX / Sept. 30 - Oct. 1, 1996
contact: Eesi, tel. (713) 737-5674
e-mail: jmhowell@rice.edu

Florida Environmental Expo
Tampa, FL / Oct. 1-3, 1996
contact: Judy Foster, tel. (813) 725-8202

WEFTEC '96 69th Annual Conference and Exhibition
Dallas, TX / October 5-9, 1996
contact: WEF, tel. (703) 684-2452, fax. (301) 694-5124, http://www.wef.org

***ISO 1400 Simplified**
Baltimore, MD / ISO 14000
contact: Chemical Industry Council, Annette Kassa, tel. (410) 354-6007

Hazwaste World Superfund XVII
Washington, DC / Oct. 15-17, 1996
contact: E.J. Krause & Associates, tel. (301) 986-7800, fax. (202) 966-4818
http://www.ejkrause.com/enviroshows

***Fourth Annual Environmental Management Forum**
Atlanta, GA / Oct. 21-23, 1996
contact: Enterprise Communications, fax. (770) 859-1985

***Internet/WWW Environmental Resources**
San Francisco, CA / Oct. 22, 1996
contact: Environmental Education Enterprises, fax (617) 792-0006

***Water Pollution Control**
Piscataway, NJ / Oct. 22-24, 1996
contact: EOHSI, tel (908) 235-5063

Advanced Oxidation Technologies for Water and Air Remediation
Cincinnati, OH / Oct. 26-29, 1996
contact: Science and Technology Integration, tel. (519) 858-5055, fax (519) 858-5056
e-mail: sti.ekabi@info.london.on.ca

TiO2 Photocatalytic Purification and Treatment of Water and Air
Cincinnati, OH / Oct. 26-29, 1996
contact: Science and Technology Integration, tel. (519) 858-5055, fax (519) 858-5056
e-mail: sti.ekabi@info.london.on.ca

World Environmental Congress: Promoting the Science, Technology and Business of the Environment
Cincinnati, OH / Oct. 26-29, 1996
contact: Science and Technology Integration, tel. (519) 858-5055, fax (519) 858-5056
e-mail: sti.ekabi@info.london.on.ca

Environmental Business '96: West
Pasadena, CA / Oct. 28-29, 1996
contact: World Information Center, tel. (800) 666-4430

***12th Annual Industrial Environmental Conference and Expo**
San Diego, CA / Nov. 4-5, 1996
contact: Industrial Environmental Associations, tel (619) 544-9684

***Eco-Informa '96: Global Networks for Environmental Applications**
Lake Buena Vista, FL / Nov. 4-7, 1996
contact: Environmental Research Institute, tel (313) 994-1200

***Hazardous Waste Handling**
Pittsburgh, PA / Nov. 4-8, 1996
contact: Center for Hazardous Materials Research, tel (412) 826-5320

HazMat '96 West
Long Beach, CA / Nov. 5-7, 1996
contact: Advanstar Expositions, tel. (216) 243-8100

ETE Environmental Technology Expo
Atlanta, GA / Nov. 6-8, 1996
contact: ETE Exhibit Manager, tel. (770) 279-4388

Water Technologies '96
Colorado Springs, CO / Nov. 6-9, 1996
contact: Association of Water Technologies, tel. (703) 524-2000

9th International Conference on Ash Management and Utilization
Crystal City, VA / Nov. 12-13, 1996
contact: the Coordinate Group, tel. (540) 347-4500, fax (540) 349-4540
email: rwill@mnsinc.com

***Incineration Systems**
Atlanta, GA / Nov. 13-15, 1996
contact: Environmental Education Enterprises, fax (614) 792-0006

***Sanitary Landfill Design**
San Diego, CA / Nov. 13-15, 1996
contact: Intl Network for Environmental Training

***Waste Minimization**
Atlanta, GA / Nov. 13-15, 1996
contact: Environmental Education Enterprises, fax (614) 792-0006

***Envirocom 1996**
Palm Beach Garderns, FA / Nov. 17-20, 1996
contact: tel (617) 439-0333, fax (617) 439-9174

***Biofiltration Systems for VOC and Odor Treatment**
Orlando, FL / Nov. 17-18, 1996
contact: Intl Network for Environmental Training, tel. (301) 299-1150

***Federal Laboratory Consortium, National Technology Transfer Meeting**
Albuquerque, NM / Nov. 18-21, 1996
contact: FLC Management Support Office, tel (360) 683-1005, fax (360) 683-6654

AWMA Clean Air '96: New Business Opportunities with Clean Air Technologies
Orlando, FL / Nov. 19-22, 1996
contact: AWMA, tel. (412) 232-3444

National Groundwater Association 48th Annual Convention & Expo
Las Vegas, NV / Dec. 8-11, 1996
contact: NGWA, tel. (800) 551-7379, fax (614) 761-3446

1997 International Containment Technology
St. Petersburg, FL / Feb. 9-12, 1997
contact: Loreen Kollar, tel. (904) 644-5524, fax. (904) 574-6704
e-mail: ICTCE@mailer.fsu.edu

1996 - 1997 Non-U.S. Events

Life 2000 - U.S. Pavilion for Environment and Energy
Nehru Center, Mumbai, India / Oct. 2-5, 1996
contact: American Center, tel. 011-91-22-265-2511, fax. 011-91-22-262-3850

Nowea International, Envitec Seoul '96
Seoul/Korea / October 10-13, 1996
contact: Duesseldorf Trade Shows, tel. (212) 356-0404

ICEM '97: The Sixth International Conference on Radioactive Waste Management and Environmental Remediation
Beijing, China / October 12-16, 1997
contact: Laser Options, Inc., tel. (520) 624-7008, fax. (520) 624-9312,
e-mail: laseropt@basix.com

***World Infrastructure Forum - Asia 1996**
New Delhi, India / Oct. 28-31, 1996
contact: tel (65) 323-2623, fax (65) 323-2557
e-mail: dfapte@singnet.com.sg

Opportunities for the Chemical Industry in India
Mumbai (Bombay), India / Oct. 30 - Nov. 1, 1996
contact: Pamela Week, Chemical Week, tel (212) 621-4923, fax (212) 621-4970
e-mail: pblock@chemweek.com

***New Earth '96**
Osaka, Japan / Nov. 13-16, 1996
contact: Intnernational Access Corp, tel.(202) 223-7040, fax (202) 296-5373

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES (TEST)

Contract No. 386-0530-C-00-3219-00

Period of Performance: July 1, 1993 through July 31, 1996

Category	***Budget Amount	Expended Year I Jul 93/Jun 94	Expended Year 2 Jul 94/Jun 95	Expended Year 3 Jul 95/Jul96	Total Expended	Variance
Salaries and Wages	562,608.55	142,731.59	182,119.79	237,610.82	562,462.20	146.35
Fringe Benefits	167,819.51	41,504.93	56,329.70	69,937.27	167,771.90	47.61
Total Salaries/Fringe	730,428.06	184,236.52	238,449.49	307,548.09	730,234.10	193.96
Travel (Fares)	136,695.01	37,586.87	75,039.84	24,068.30	136,695.01	0.00
Per Diem	93,107.00	22,570.97	52,709.58	17,826.45	93,107.00	0.00
Other Direct Costs	215,696.94	37,664.98	109,805.62	65,937.68	213,408.28	2,288.66
Total Direct Costs	1,175,927.01	282,059.34	476,004.53	415,380.52	1,173,444.39	2,482.62
Indirect Costs	681,104.12	189,387.76	229,591.82	261,097.63	680,077.21	1,026.91
Total Costs	1,857,031.13	471,447.10	705,596.35	676,478.15	1,853,521.60	3,509.53
Fixed Fee	110,674.60	28,499.11	41,823.45	40,047.51	110,370.07	304.53
Total Costs + Fee	1,967,705.73	499,946.21	747,419.80	716,525.66	1,963,891.67	3,814.06

*** As per Contract Modification No. 6 effective June 1, 1996

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES (TEST)

Contract No. 386-0530-C-00-3219-00

July 1, 1993 through July 31, 1996

Category	Budget Amount	Expended Tech Assist	Expended Support	Expended Tours	Expended Promotion	Expended Info System	Expended Total
Salaries and Wages	562,608.55	526,257.20	36,205.00				562,462.20
Other Direct Costs	445,499.00	57,705.00	88,955.00	175,265.00	52,835.00	68,450.00	443,210.00

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES (TEST)				
Contract No. 386-0530-C-00-3219-00				
Level of Effort				
	Budgeted LOE .Person Months	Actual LOE Person Months	Variance	
Technical Coordinator	29.64	29.57	0.07	
Short Term TA-US	81.76	81.66	0.10	
Short Term TA - Local	1.50	1.50	0.00	
Administration	16.00	16.18	(0.18)	
TOTAL	**128.90**	**128.90**	**(0.00)**	

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES (TEST)

Contract No. 386-0530-C-00-6134-00
Period of Performance: August 1, 1996/January 31, 1997

Category	Budget Amount	Expended as of 9-30-96	Variance
Salaries and Wages	71,421.00	22,271.00	49,150.00
Fringe Benefits	23,355.00	7,283.00	16,072.00
Total Salaries/Fringe	94,776.00	29,554.00	65,222.00
Travel (Fares)	9,600.00	2,048.00	7,552.00
Per Diem	3,176.00	1,801.00	1,375.00
Other Direct Costs	11,850.00	1,308.00	10,542.00
Total Direct Costs	119,402.00	34,711.00	84,691.00
Indirect Costs	87,674.00	27,108.00	60,566.00
Total Costs	207,076.00	61,819.00	145,257.00
Fixed Fee	12,254.00	3,658.00	8,596.00
Total Costs + Fee	219,330.00	65,477.00	153,853.00
Level of Effort (Person Days)	372	108	264

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES (TEST)

Contract No. 386-0530-C-00-6134-00

Period of Performance: August 1, 1996 through January 31, 1997

Category	Budget Amount	Expended as of 9-30-96 Tech Assist	Expended as of 9-30-96 Support	Expended as of 9-30-96 Tours	Expended as of 9-30-96 Promotion	Expended as of 9-30-96 Info System	Expended Total
Salaries and Wages	71,421.00	20,936.15	1,335.00				22,271.15
Other Direct Costs	24,626.00	10.00	155.00	2,507.00		2,485.46	5,157.46

Repayment terms up to 8 years, including a two-year grace period.

Conditional Grants:

TEST will provide conditional grants up to 50% of the project cost, on a case-by-case basis, and where the prospective U.S. technology transfer has significant commercial potential in the Indian market, but needs adaptation, further development or re-design to meet Indian market requirements. Grants will be repaid to ICICI from an agreed percentage of the venture's sales, up to 200% of the grant amount.

Technical Assistance:

U.S. and Indian firms participating in the TEST program can receive valuab assistance, counselling and other services from the U.S. based TEST coordinator, Sanders International. Technical Assistance includes:

* Identification of technologies that are competitive and appropriate for the Indian market.
* Selection of best market opportunities for U.S. environmental firms.
* Assistance in locating and qualifying potential partners.
* Support for promotional activities to inform Indian companies about U.S. environmental technologies.

TEST: Priority Areas

The TEST Program has been designed to identify and close technology gaps — areas where India's indigenous technological capability is insufficient — in India's current environmental protection and pollution control/abatement industries. These technology gaps include:

* Removal/reduction of dissolved solids from waste water streams.
* Recovery and reuse of resources from waste water streams, atmospheric emissions and solid wastes.
* Introduction of systems for removal of special pollutants from waste water, atmospheric emissions and manufactured products.
* Better and more efficient handling and management of hazardous wastes.
* Reduction of color, odor and biochemical/chemical oxygen demand load in waste water.
* Reduction of particulates, sulfur dioxide and oxides of nitrogen emitted to the atmosphere from industrial processes.
* Enhanced availability and quality of air and water pollution monitoring and analytical instrumentation.

Implemented in India by:
The Industrial Credit & Investment Corporation of India Limited

Funded by the:
United States Agency for International Development (USAID)

Technical assistance provided by:
Sanders International, Washington D.C.

For more information contact:

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91-22-266-1371
Fax: 91-22-262-5444

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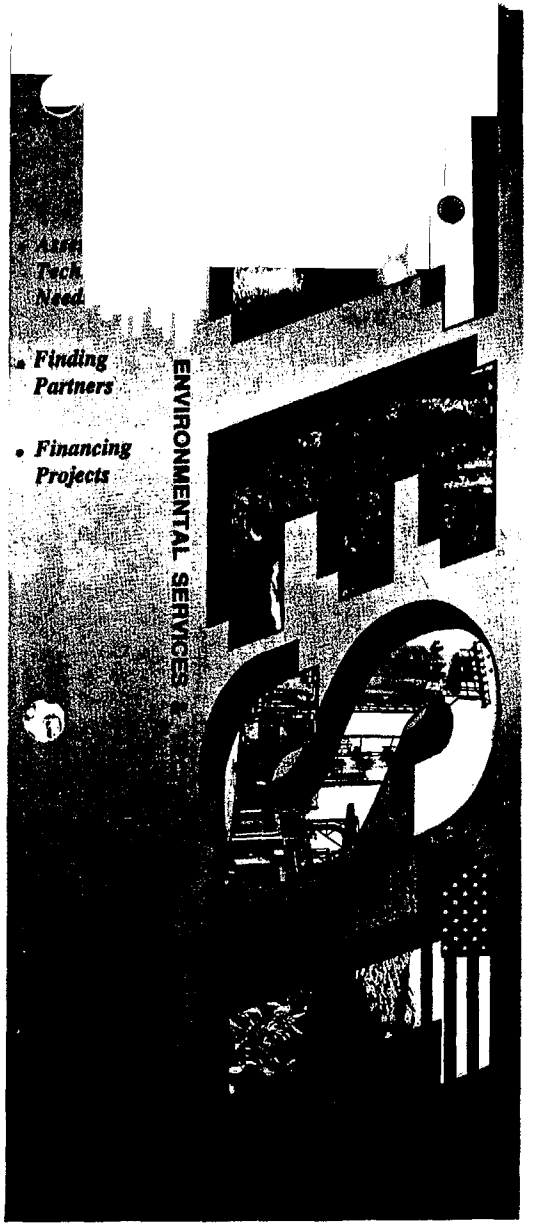

INDIA: AN EMERGING ENVIRONMENTAL MEGA-MARKET

TEST : Mission Statement

To improve environmental protection in India while increasing the productivity of Indian industry on a sustainable basis, and to encourage and facilitate profitable business linkages between U.S. and Indian firms in the environmental sector.

The United States government, through the U.S. Agency for International Development (USAID), has begun a new and innovative economic development program, the Trade in Environmental Services & Technologies (TEST) program. TEST is aimed at assisting India to address its increasingly serious industrial pollution problems by encouraging and facilitating sustainable and profitable business linkages between Indian firms and U.S. environmental equipment and service providers. TEST supplements other U.S. export and environmental trade promotion programs with a focussed set of services and resources for Indian and U.S. firms to draw upon in pursuit of environmental transactions and business linkages.

TEST Provides:

* Evaluation of a firm's environmental/ pollution control product, technology or service against opportunities and needs in In[illegible]

* Assistance in locating and contacting interested, qualified and capable Indian companies with whom you can do business.
* Assistance in meeting with prospective Indian clients or partners, understanding the Indian market, business practices and the Indian environmental sector.
* Financial assistance in the form of advantageous loans or conditional grants to qualified projects.

The TEST program is implemented in India by the Industrial Credit and Investment Corporation of India, Ltd., India's top development finance institution. USAID has provided a grant of $25 million to ICICI under the TEST program to help stimulate and finance joint ventures and other projects between U.S. and Indian firms that increase environmental protection and enhance the productivity of Indian industry on a sustainable basis.

India is Open for Environmental Business

Since independence in 1947, India has pursued a development strategy based on rapid industrialization, with resulting rapid urbanization. Today India possesses a large and diversified industrial base in metals,

mining, petrochemicals, textiles and in almost every other sector. Like most developing countries, until recently India has been unable to place much emphasis on pollution control or environmental conservation. The result is that today India's three major cities, Delhi, Bombay and Calcutta rank among the ten most polluted cities in the world. Other parts of India are equally threatened by industrial pollutants and untreated municipal waste.

India is also the world's largest democracy. Driven by the demands of the Indian people, including a growing middle class numbering as many as 300 million, for improved and healthier standards of living, the Indian government (including its state and local governments) has enacted and begun to enforce pollution control and other environmental protection laws and regulations. While much more remains to be done, the trend is clear that the Indian people are committed to achieving a cleaner environment through government action and through the deployment of cleaner and more efficient technologies throughout India's rapidly modernizing economy.

India's two-year-old economic reform program is re-making the Indian economy, opening unprecedented opportunities for U.S. firms to share in the untapped potential of

the Indian market. The United States is India's largest trading partner, its largest source of foreign investment and Indian business is eager to expand Indo-U.S. ties. The TEST program was created to help American business help Indian industry deal with its staggering environmental problems while creating sustainable and mutually beneficial business linkages and technology transfers.

TEST: Building Long-term Business Linkages

Loans:

ICICI will provide loans to Indian firms for:

Purchase of U.S. sourced environmental services and technologies.

* Indo-U.S. joint ventures for the manufacture of pollution control or abatement equipment or the establishment of analytical and testing facilities.
* Indo-U.S. joint ventures to establish new, or to enhance the capabilities of existing Indian environmental engineering or service firms.
* Other approved Indo-U.S. environment-related projects and ventures.

Loan assistance available for up to 65% of the project cost[illegible]avorable rates.

of the damage to the Taj has been traced to the
ır dioxide emissions from Agra-area furnaces
las). Although sulphur dioxide is the major
nt causing damage, other polluting emissions from
as include particulates, metallic oxides, unburnt
carbons, and carbon monoxide, all of which have
buted to air pollution problems in the Agra area.
ition, other aspects of foundry operations,
ing molding, sand preparation, metal core making,
nishing, generate pollutants in the form of metals-
foundry sand, dust and carbon monoxide.

f the Indian Foundry Delegation's mission is to
propriate and cost-effective technological
ons that will both save the Taj and the Agra
ry industry.

AT IS TEST?

in Environmental Services and Technologies
') is an innovative economic development program
d by the **U.S. Agency for International**
opment (USAID) in New Delhi. The TEST
am is implemented by the **Industrial Credit and**
tment Corporation of India, Ltd. (ICICI),
s top development finance institution. USAID has
ded a grant of $25 million to ICICI under the TEST
am to help stimulate and finance joint ventures
ther projects between U.S. and Indian firms that
ase environmental protection. Technical assistance
ST is provided by **Sanders International**, a
'ngton, D.C.-based environmental business
opment and consulting firm.

has sponsored visits to and from India, provided
ical assistance and financed deals in areas such as
e source emission reduction; bio-treatment for air,
water, soil and sludge; hazardous waste
eration; flyash disposal and reuse; and paper mill
water treatment.

For more information regarding the TEST program contact:

- **In New Delhi:**
  Mr. Amitabha Ray
  TEST Project Officer
  USAID-New Delhi
  B-28 Institutional Area
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  New Delhi, India 110016
  Tel: 91-11-686-5301
  Fax: 91-11-686-8594
  e-mail: aray@usaid.gov
- **In Bombay:**
  Mr. K. Harinathan
  Manager-TEST Group
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  Tel: 91-22-261-8251
  Fax: 91-22-262-5444
  e-mail: ivenkat@shakti.ncst.ernet.in
- **In Washington, D.C.:**
  Mr. Jeff Hallett
  TEST Project Manager
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  Washington, D.C., 20036
  Tel: 202-939-3480
  Fax: 202-939-3487
  e-mail: jhallett@sandersint.com

For further information on the Indian Foundry Delegation contact Emily Harwit, Swarupa Ganguli or Catherine Eiff at Sanders International, tel. 202-939-3480 / fax. 202-939-3487.

Implemented by **the Industrial Credit and Investment Corporation of India, Ltd.**

Funded by **the United States Agency f ernational Development**

INDIAN FOUNDRY DELEGATION

TO THE UNITED STATES

JUNE 1995

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

TA provided by Sanders International, Washington, D.C.

Implemented by ICICI

Funded by USAID

TEST Mission Statement:

To improve environmental protection in India while increasing the productivity of Indian industry on a sustainable basis, and to encourage and facilitate profitable business linkages between U.S. and Indian firms in the environmental sector.

The Trade in Environmental Services and Technology (TEST) program is pleased to sponsor the first Indian Foundry Delegation visit to the United States. TEST, a United States Agency for International Development (USAID)-funded program, is aimed at assisting India to address its increasingly serious industrial pollution problems by encouraging and facilitating sustainable and profitable commercial linkages between Indian firms and U.S. environmental equipment and service providers. The Indian Foundry Delegation is one of the several delegations sponsored by TEST to address specific industry related pollution problems. Previously, TEST has sponsored an Indian boilers manufacturer's visit to the U.S. and a U.S. bio-treatment delegation to India. These delegation visits have led to concrete and successful business ventures between U.S. and Indian firms.

The purpose of the Indian Foundry Delegation is to:

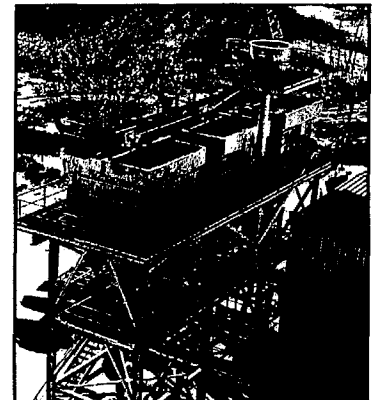
- assess appropriate and cost-effective U.S. processes, technologies and equipment that will be applied in India to prevent or control harmful emissions from the Indian foundry industry;
- create awareness within the U.S. environmental industry of Indian environmental problems, environmental business opportunities in India, and the support available through the TEST and other U.S. government programs to assist U.S. and Indian companies in forming commercial linkages; and
- provide opportunities for U.S. environmental companies to offer solutions to pollution problems in the Indian foundry industry as well as in other industry sectors.

The primary emphasis of the delegation will be on low-cost and appr[redacted]e technologies to treat air emissions from foundrie[redacted] delegation will, however, examine other critical problems relevant to their industry such as [redacted]hnologies for sand re-use and reclamation, water [redacted]servation and re-use in foundry applications, and energy efficient and less polluting foundry component designs.

Suraj Foundry, Agra, India, 1995

While in the United States, the group will:

- participate in the annual American Foundrymen's Society (AFS) seminar on "Environmental Concerns of the Foundry Industry" in Chicago, IL, June 11-13;
- attend the Air & Waste Management Association's (AWMA) annual convention and trade exhibition in San Antonio, TX, June 18-21; and
- meet with various U.S. private companies that specialize in environmental technologies relevant to the foundry industry, and tour facilities where these technologies have been installed.

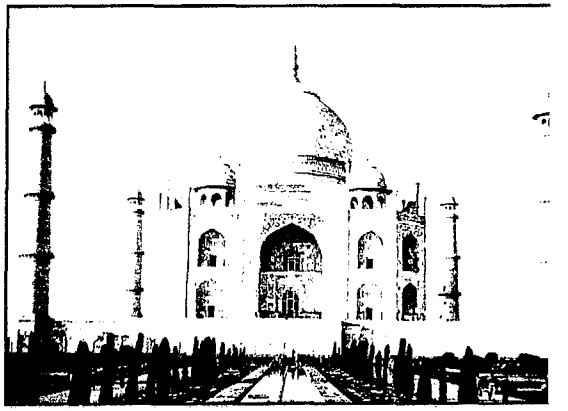


Floatex Density Separator, by Carpco, United States

The Indian Foundry Industry

The Indian foundry industry dates back several thousand years. In Northern India, particularly in the areas surrounding Agra, foundries flourished during t Mughal Period more than four hundred years ago. Si independence in 1947, the Indian foundry industry witnessed impressive growth. Indian foundry produ primarily ferrous metal castings, are used widely in t automobile, machine tool, railway, defense, and consumer products industries.

Foundries are located in major clusters in the areas surrounding Agra, Calcutta and Coimbatore. For example, more than 500 foundries are located in and around the ancient city of Agra, home to the world-renowned Taj Mahal. Agra foundry workers claim a r historical legacy as descendants of the builders of th Taj and artisans to the Mughal court. However, over past decade, the Agra foundries have come under scrutiny and pressure from the Indian government, environmental groups and archaeologists who have pointed to the foundries as one of the sources of air pollution damage to the Taj's pristine white facade.



The Taj Mahal, India, 1995

Prompted by a 1993 lawsuit brought by an Indian environmental activist, the Indian Supreme Court too the unprecedented step of ordering the Agra foundri to install adequate air pollution control equipment o face closure. While most foundries have complied w the order, the problem of affordable and effective air emissions control remains and [redacted]atens the existenc of this historically rich and ec[redacted]cally vital industr

SANDERS
INTERNATIONAL
Environmental Business Development & Consulting

1616 P Street, NW, Suite 410
Washington, DC 20036

Telephone: (202) 939-3480
Telefax: (202) 939-3487

FACSIMILE MESSAGE

To: Preston Clements - Solar Detoxification
Dennis Kostyk - USIA Washington
John Berry - USIS New Delhi
Amitabha Ray -USAID New Delhi
Felipe Manteiga

From: Jeff Hallett

Date: July 3, 1996

Total Pages (including cover):

SUBJECT: Proposed Worldnet Broadcast

MESSAGE:

By way of bringing all parties and players in this initiative up to date on discussions and further thinking, I offer the following "strawman" concept paper for your comments and reactions.

Background: Industrial and municipal wastewater treatment is one of the most serious and growing environmental problems in India. Only a small fraction of India's municipal waste is treated in any way. Uncontrolled dumping of hazardous wastewater from industrial plants onto land and into waterways is causing enormous damage to the health of lakes, rivers, coastal resources, underground water supplies and agricultural land throughout the sub-continent. Access to potable water remains a critical health problem. Access to adequate supplies and quality of industrial process water is a constraint to economic growth in many parts of India.

The high capital and operating costs of conventional wastewater treatment plants, particularly their need for large amounts of electrical power (which is in extremely short supply in many parts of India) are all constraints to building an adequate number of wastewater treatment plants. The Indian environmental industry and government are very interested in exploiting lower-cost and innovative wastewater treatment technologies that can help address this problem if the technologies can be shown to be economically feasible and adapable to Indian conditions and infrastructural constraints.

Through the TEST program's activities over the past three years, we have learned that there is a great deal of interest in emerging solar wastewater treatment technologies. The Solar Detoxification Corporation's treatment process appears to have tremendous potential for India.

Activity: Worldnet Broadcast sometime during first half of September tentatively entitled: "Emerging Environmental Technologies from the Federal Laboratories.

Purpose: 1.) To demonstrate the Worldnet as an effective and cost-efficient way of disseminating information on U.S.-origin environmental technologies that would be appropriate to deal with Indian industrial pollution problems; 2.) To introduce to the Indian environmental business community, regulators and citizens organizations the potential of the Solar Detoxification Corporation's solar wastwater treatment process as a low-cost and appropriate treatment option for industrial wastewater treatment; and to use this broadcast as a means of facilitating a business linkage between Solar Detox and an Indian environmental firm through the TEST program.

Participants: U.S.-side: Worldnet moderator, 1 Solar Detox representative, 1 representative from Sandia National Lab. Indian side: 3-4 panelists drawn from Indian business and pollution control boards, studio audiences in each of the 2-3 participating posts drawn from environmental business community, environmental regulators, research and academic community, citizens environmental groups.

Sanders will provide USIA New Delhi with suggested participants drawn from our data base to augment their own contact base.

Format: Standard Worldnet 60 minute format. Solar Detox would make a 15-20 minute presentation describing the solar wastewater treatment technology with visuals. The balance of the hour would be composed of questions, answers and discussion among the participants and the panelists.

Proposed Pre-Show and Briefing Materials: Working with Solar Detox, Sanders will pull together a packet of information that will be sent to participating posts which can be duplicated and distributed to panelists and key audience members prior to the broadcast to increase understanding about the technology and its potential application in India. All of parts of this packet could also be made available to members of the audience at the time of the broadcast.

Ideally, we hope to have some video footage available that may be shown to the panelists and audience prior to the broadcast. I am not sure that this will be possible, but Solar Detox is checking to see what may be available from the labs. We suggest participating USIA posts in India factor in the possibility of a short video presentation (we will provide copies of the video) prior to the broadcast. A video presentation should enhance the panelists' and audiences' understanding of the technology and provide a clearer mental image which should shorten the learning curve and enhance the quality of the on-air discussion.

ACTION: BTWP-05
INFO: AC-01 IGNE-01 OC-01 BTV-01 BN-01 BTP-04 BTPA-06 BTI-01 BTX-01 BTW-05 XWU-01 MT-01 ANAD-01 ARC-01 NEA-01 SCD-01 DSO-01

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FOR B/TVWPM JOHN APPLETON; NEA FOR THESA

E.O. 12958: N/A
SUBJECT: EVALUATION OF WORLDNET DIALOGUE ON "NEW SOLAR WASTEWATER TREATMENT."

REFERENCE: NEW DELHI

1. SUMMARY: SOLAR DETOXIFICATION CORPORATION OFFICERS C. PRESTON CLEMENTS AND RONALD LEDBETTER PROVIDED A FINE OPENING FOR INDO-AMERICAN COOPERATION WITH SUBJECT WORLDNET ON SOLAR WASTEWATER TREATMENT TECHNOLOGY. POTENTIAL INDIAN PARTNERS IN THE AUDIENCE WARMED TO THE PROSPECT OF PARTICIPATING IN THIS INNOVATIVE APPROACH TO WATER PURIFICATION AND ENGAGED THE AMERICAN EXPERTS IN A WIDE-RANGING EXPLORATION OF ENGINEERING AND CHEMICAL PROCESSES. THE SENIOR ENGINEERS HIGHLIGHTED THE EFFECTIVENESS OF UTILIZING THE SUN'S ENERGY TO DETOXIFY WATERBORNE CHEMICALS AND SOLICITED FACE-TO-FACE FOLLOW-UP ARRANGEMENTS WITH POTENTIAL PARTNERS. THE WORLDNET DREW A E TURNOUT OF ENVIRONMENTALISTS, INDUSTRIALISTS, AND RNMENT OFFICIALS. A SUBSEQUENT QUESTION AND ANSWER RIOD WAS UNUSUALLY TECHNICAL IN CONTENT, BUT HIGHLY PRAISED BY THOSE FAMILIAR WITH SPECIFIC STERILIZATION RANGES AND EFFLUENT CHEMISTRY. END SUMMARY.

2. EMPHASIS ON TECHNICAL DETAILS

MUCH OF THE PROGRAM FOCUSED ON THE SPECIFICS OF ORGANIZING, MAINTAINING, AND ADAPTING WASTEWATER TREATMENT PROCESSES WITHIN A GIVEN ENVIRONMENT. ATTENDEES COMMENTED THAT TODAY'S MEGACITIES HAVE NO GREATER PROBLEM THAN THAT OF CLEAN WATER AND WASTEWATER DISPOSAL. WASHINGTON PANELISTS EXPLAINED HOW SOLAR LOW-COST TECHNOLOGY CAN BE ADAPTED TO ACCOMMODATE INDUSTRIAL APPLICATIONS OF VARYING DIMENSIONS. CLEMENTS' AND LEDBETTER'S COMMENT THAT THE SOLAR DETOXIFICATION CORPORATION WAS RECEPTIVE TO TIE-UPS WITH INDIAN COMPANIES ELICITED INTENSE AUDIENCE RESPONSE.

AUDIENCE MEMBERS QUESTIONED HOW THE EFFECT OF RADICAL WEATHER CONDITIONS, INCLUDING MONSOONS, COULD AFFECT COST, PERFORMANCE, AND MATERIALS IN THE SUBCONTINENT. IN ADDITION, THEY DEBATED AT LENGTH PROBLEMS OF REMOVAL OF METALS FROM CATALYSTS, VARIOUS TREATMENT METHODS, EXISTING SEWAGE SYSTEMS, USES FOR RESIDUE, HAZARDOUSWASTE REGULATIONS, AND GOVERNMENTAL POLICIES.

BUSINESS LEADERS RELATED ANECDOTAL WASTE WATERDISPOSAL EXPERIENCES AND EXPRESSED INTEREST IN DGRADING PERFORMANCE AND/OR REDUCING PROCESSINGCOSTS. NEW DELHI'S ...IST DR. P.S. RANA, DIRECTOR, HOUSING AND URBAN ...ELOPMENT CORPORATION, UNDERSCORED THE IMPORTANCE OF ...LIC EDUCATION, AS DID THE WASHINGTON ENGINEERS, UNDERLINING THE NEEDS OF FUTURE GENERATIONS AND PEOPLE "DOWNSTREAM." ATTENDEES CONCLUDED THAT INDIVIDUAL TREATMENT PLANTS WILL HAVE DIFFERING REQUIREMENTS FOR LEVELS OF WATER PURITY AND THEREFORE NEED TO BE EXAMINED ON A CASE-BY-CASE BASIS.

3. POST COMMENT

THIS WORLDNET BROUGHT TOGETHER A CROSS SECTION OF GOVERNMENT, BUSINESS, AND ENVIRONMENTAL LEADERS SEEKING SOLUTIONS TO INDIA'S WASTEWATER TREATMENT PROBLEMS CAUSED BY INDUSTRIALIZATION AND POPULATION. SOME MEMBERS OF THE BUSINESS COMMUNITY REPORTED THAT THEY ARE BEGINNING TO WORK DIRECTLY WITH THE GOVERNMENT ON POLLUTION REGULATIONS. THIS PROGRAM HAS AN EXCELLENT EXAMPLE OF THE CLOSE COOPERATION BETWEEN USAID, USIS, AND THE MULTINATIONAL PRIVATE SECTOR. THE PROGRAM SIMULTANEOUSLY PROMOTED AMERICAN EXPORTS, CONTRIBUTED TOWARDS CLEANING THE WORLD'S DWINDLING WATER SUPPLY, AND ADDRESSED SOLAR DETOX USAGE PARAMETERS. COUNTRY PLAN THEME IV: ENVIRONMENTAL ISSUES AND CONCERNS WAS WELL COVERED. OUR THANKS TO B/TVWPM AND SANDERS INTERNATIONAL FOR SELECTING THESE ARTICULATE AND TALENTED EXPERTS. WILLS
BT
#1350

FROM: JEFF HALLETT
SANDERS INT'L

TO: NANCY HARDY

ONE PAGE

2.4.1

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

Funded by the
United States Agency
for International Development

Implemented by the
Industrial Credit & Investment Corporation
of India Limited

Technical assistance provided by
Sanders International, Washington, D.C.

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Why TEST in India?

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

THE ENVIRONMENTAL SCENARIO IN INDIA

India is one of the world's top ten industrial producers. Its rapid industrialization and urbanization have created major air, water and soil pollution problems throughout the country. The World Health Organization ranks India's largest urban centers of Bombay, Delhi and Calcutta among the world's ten most polluted cities. India's four year old economic reform program has brought renewed efforts by the Indian government, business community and people to address its serious environmental problems. More than ever before, India is committed to achieving a cleaner environment through government action and through the deployment of cleaner and more efficient technologies throughout India's rapidly modernizing economy. However, appropriate and affordable environmental technologies, environmental management expertise and environmentally-focussed financial resources are all in short supply.

India has enacted environmental laws and regulations governing air, water, soil pollution and hazardous waste management. These laws are administered and enforced by India's 25 state governments. While enforcement standards vary widely across the country, environmental regulations are an important and growing factor in business planning and decision-making. Environmental impact assessments are now required for all new production sites.

OPPORTUNITIES FOR U.S. FIRMS

India's economic reform program is creating unprecedented opportunities in the Indian market for U.S. firms with environmental services and technologies, particularly in the areas of low-cost and energy efficient air and wastewater treatment, environmental instrumentation, hazardous waste management and resource recovery. India is unique in the industrializing world for its tremendous pool of technical and engineering talent, willing and able to work with U.S. firms for the development of environmental markets in India.

India is Open for Business

- India has implemented a wide-ranging program of policy and regulatory reforms including: import tariff reductions, automatic investment approvals, no restrictions on profit remittance, currency convertibility (on the current account), easing of restrictions on foreign ownership, and an enhanced commitment to patent and intellectual property protection.
- India's growth rate was about 4 percent in both 1992 and 1993, up from 1.8 percent in 1991.
- U.S. exports to India have doubled since 1987.
- U.S. investment in India is on the rise: the Indian government approved $1.1 billion in U.S. investment in 1993, up from $500 million in 1992 and $20 million in 1990.
- India is the largest democracy in the world.
- India is the largest market in South Asia. By the year 2000, India is projected to have a population of one billion people, with a middle class of about 200-300 million people.

The **TEST** program has been created and implemented by the U.S. Agency for International Development (USAID) to respond to the commitment by the people of India to environmental protection and to India's new economic environment of market-driven initiative and incentive.

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OBJECTIVE

One of the TEST program's objectives is to establish a permanent information system, ultimately to be managed by the Industrial Credit & Investment Corporation of India, Ltd. (ICICI), to provide access to information essential in the overall effort to increase environmental protection and Indian industrial efficiency via linkages with U.S. firms.

The TEST Information System is being designed by Sanders International to provide a two-way information flow and an environmental technology and services network matching Indian needs for environmental information and technology with the U.S. environmental industry's capability to meet those needs.

DESCRIPTION

Sanders International developed the Information System to specifically meet the objectives and requirements of the TEST program. Sanders International selected, evaluated and integrated the most essential and cost-effective resources and information technologies into a manageable and user-friendly information system. The system comprises three components as further illustrated by the graph on page 6. The three components are:

Information Resource Center (IRC). The IRC is posed of the most commercially relevant and cost-effective environment-related electronic and hardcopy information resources, as well as files on environmental firms (e.g. company brochures, annual reports, technical papers, and other). The IRC also includes files on new, innovative, low-cost or commercially relevant environmental technologies and processes. The IRC's filing system follows a detailed technology coding scheme, first developed by the US-Asia Environmental Partnership (US-AEP) program and later adapted by Sanders International to permit quicker and more systematic information searches.

Of the many resources that Sanders International evaluated, only a selected few proved consistently valuable in facilitating business linkages between U.S. and Indian firms. Sanders International has highlighted these resources in the chart on pages 2-4. Many other resources have also proven their usefulness, but to a lesser degree. These resources are listed and further described in a TEST Resource Guide, also compiled by Sanders International.

The Contact Management System. This is a user-friendly networked database which Sanders International employs to track client contacts for TEST. It is comprised of a growing list of over 1,000 U.S. and international companies, consultants, officials, and professional organizations involved in environmental business and technology development. The database has great versatility, providing an option for detailed notetaking with each contact record and for conducting keyword and phrase searches.

The Communications Outreach System. Sanders International developed the outreach system to facilitate timely and cost-effective communication links to targeted companies, program participants, multiplier groups (e.g. trade associations, chambers of commerce and environmental technology interest groups), either to inform them of new projects, keep them up-to-date on TEST developments, or to request specific information. Using computer-mounted faxboards linked to commercial databases and the TEST contact management system, companies can be sorted by name, technology, SIC code, geographic location or any other search criteria and automatically receive targeted fax messages. Sanders International is also making use of e-mail and Internet to further enhance and facilitate communications between TEST program managers.

Sanders International has furthermore developed a conference tracking mechanism for TEST to identify all major and most significant environmental and energy conferences, courses and events in the U.S. and abroad. Sanders International is planning TEST participation at several major U.S. Environmental Trade Shows in 1995 to publicize its services to U.S. companies.

Sanders International is continuously evaluating new information resources for TEST. In particular, Sanders is exploring the use of Internet's World Wide Web (WWW), which provides users with much more accessible and intuitive methods for searching the Internet's many layers and for accessing and manipulating the available information. Sanders International is also exploring the Internet's "talk" or "chat" feature to facilitate communication among program participants, as well as the WWW "homepage" feature in order to actually place TEST on the Internet.

ENVIRONMENTAL S

RESOURCE	DESCRIPTION	EVALUATION	COST
CD-ROM Products			
Environment Abstracts	Comprises over 200,000 records providing abstracts from all major environmental and energy journals, conferences, paper and articles, from 1975 to the present. Updated quarterly.	Valuable research tool, particularly for identifying new technologies and what environmental research is being done worldwide.	$1,295/yr.
McGraw Hill-Encyclopedia of Science and Technology (EST)	A comprehensive multimedia reference set, containing the 20 volume McGraw-Hill Encyclopedia of Science and Technology as well as the entire McGraw-Hill Science and Technology Dictionary. The disc is a state-of-the art multimedia technology with graphics, sound and animation. Periodically updated.	Valuable research tool, particularly for providing general science and engineering information.	$1,300/yr.
Thomas Register	Provides company/ product information on over 194,000 U.S. and Canadian companies, both public and private. Each record includes complete contact information, a brief company description, and a list of products and services with SIC codes and Tradenames. Most records also show asset ratings or annual sales, number of employees, exporter status, and names of parents/subsidiaries. Updated bi-annually.	Extremely user-friendly and cost-effective; allows for detailed menu or command driven searches; offers easy downloading or printing and report making. Has proven invaluable in identifying vendors, suppliers or manufacturers of environmental technologies and services.	$1,500/yr.
Commercial On-line Services			
Compuserve	One of the largest commercial networks of PC users, with more than 500,000 members worldwide and over 1,200 online offerings. Offers an extensive range of services, including special interest groups and clubs, computing support, financial and stock information, and a broad range of reference databases. Its electronic mail has links to MCI mail, fax, telec and the Internet.	Compuserve is particularly useful for exploring the capabilities of networks, forums, and electronic mail. Compuserve can also be used to access a range of information databases, such as IQuest, Books in Print, CENDATA/The Census Bureau Service, and the National Technical Information Service.	• $8.95/month, incl. unlimited connect time to basic services. • online charges vary from $4.80 - $9.60/hr. based on the user's modem speed.
Dialog Information Service	The largest online bibliographic company in the U.S. with over 200 million items available for searching in 370 databases. Databases can be searched using keywords, phrases and boolean connectors.	Dialogue is an invaluable resource, but it can be extremely expensive. Some particularly useful databases are the Dun & Bradstreet files, TRW, ABI/Inform, Enviroline, Predicast, and NTIS. Cost-effective searching can be done using Dialindex (file 411) and Dialog Finder (files 413, 414, 416).	• minimal start-up fee. • online charges up to $90.00/hr. • charges for downloading or printing vary from $.20 - $100.00/ record.

RESOURCE	DESCRIPTION	EVALUATION	COST
Commercial On-line Services *(continued)*			
Dun & Bradstreet Information Service	Provides business information services which range from detailed country reviews and global market information to corporate financial, payments and business profiles.	D&B is one of the most prominent resources for financial information on a company. Reports can be obtained over the phone through D&B report services, called "DunsDial"; by subscribing to D&B on-line services directly; or indirectly through other on-line services such as Dialog or Compuserve.	• prices depend upon services selected. • reports can cost up to $107.00.
EPA Bulletin Boards and Databases			
Alternative Treatment Technology Information Center (ATTIC)	A bulletin board that serves as a retrieval system from a collection of hazardous waste databases. Most notably contains Emerging Technology and Engineering Bulletins.	Very user friendly. Includes highly technical and some cost information on treatment technologies, but limited to Superfund/hazardous waste related topics.	Free, except for phone connect time.
Bioremediation in Field Search System (BFSS)	A PC-based software application retrievable from ATTIC (see above) which provides access to a database of information on over 150 U.S. bioremediation sites, including location, media and contaminants, and the type, status and cost of technologies being used.	Very user friendly. Allows for customized searches to identify technologies or vendors of specific projects.	Free, except for initial download time.
Vendor Information System for Innovative Treatment Technologies (VISITT)	An electronic database of 171 companies offering 277 innovative treatment technologies for the cleanup of soil and groundwater contaminated by hazardous waste. Contains detailed information on in-situ and ex-situ technologies in 37 areas such as bioremediation, bioventing, electrical separation, thermal desorption or vitrification. Captures information on the availability, performance, and cost of technologies provided by vendor, suppliers and manufacturers.	Very user friendly. Allows for customized searches to identify specific technologies or vendors.	Free.
Government Resources			
Federal Laboratory Consortium (FLC)	Comprises all major (over 500) laboratories and centers representing 17 different U.S. departments and agencies. Promotes and facilitates the transfer of R&D results from federal laboratories into applications in the private and public sectors and serves as a kind of coordinating body and locator. Also publishes a directory of federal intermediaries which provide access to the federal research programs.	Very responsive to search requests. Results generally lead to a list of top experts at appropriate federal labs. Delivery time varies on difficulty of search and current demand. Useful directory for contact information.	Services free of charge. $25.00 for directory.

.ATION RESOURCES

RESOURCE	DESCRIPTION	EVALUATION	COST
Government Resources *(continued)*			
Fedworld/ NTIS	Comprehensive bulletin board which serves as an information outlet for the National Technical Information Service (NTIS), which is the distributor of most government publications. It also serves as an electronic mail system and as a gateway to over 135 government bulletin boards.	Provides easy access to government information in all fields. Access to technical information is most easily obtained through NTIS. A rapidly evolving information source.	Free, except for phone connect time.
National Trade Databank (NTDB)	Comprehensive source of international trade and economic information compiled from 17 federal agencies. Includes basic export information, industry-specific information, market research reports, and other. Released on CD-ROM and updated monthly.	User-friendly database. Good for obtaining industry and trade-related information.	$35 for a single issue or $360/yr.
Na[illegible]nal Technology T[illegible]er Center (N[illegible]TC)	Serves as a national clearinghouse for federal technology transfer linking U.S. firms and industry with federal agencies and laboratories, much like the Federal Laboratory Consortium (see above). Also available on-line, offering access to federal lab directories, Small Business Innovative Research (SBIR) solicitations, news, publications, e-mail, and calendar of events.	Very responsive to search requests. Results generally lead to a list of top experts at the appropriate laboratories. Delivery time varies on difficulty of search and current demand.	Free services. Free bulletin board access, except for phone connect time.
Publications			
BNA Environment Reporter	News service on major domestic environmental policy and regulatory developments.	Provides comprehensive weekly news information. Has proven essential in tracking domestic environmental policy and technology developments.	$1,170.00/yr.
Resource Guides			
Environmental Management Sourcebook	Published by Environment Today. Annual guide to company products, systems, services, R&D facilities and professional, scientific and industry resources.	Functions as the "environmental yellow pages" to products and services. One of the more comprehensive guides to environmental information sources.	Free with one year subscription to Environment Today ($66.00).

PROVIDING TECHNICAL ASSISTANCE

Providing effective TEST technical assistance means forging viable long-term business linkages between U.S. and Indian firms to solve India's industrial pollution problems. In addition to the Information System, Sanders International has developed a search procedure which outlines how best to make use of the system in order to facilitate this task. The search procedure draws both on the Information System and, if a higher level of effort is necessary (which the procedure helps to determine), on TEST subcontractors.

Using this procedure, Sanders International has the capabilities to quickly and cost-effectively research and evaluate appropriate environmental technologies or solutions, identify and contact U.S. companies with selected services or technologies, and assess the technical and financial qualifications of selected companies. The procedure can be summarized as follows:

TEST Company/Technology Search Procedure

PHASE 1

First Level Effort

- ❑ In-house search (textbooks, reference books, newsfiles, technology files, contact management system scans, CD-ROMS, etc.).
- ❑ Free database keyword and fulltext searches (via U.S. government databases, e.g. ATTIC, PIES, VISITT, FEDWORLD, EPA OLS, NTIS, etc.).
- ❑ Selected telephone calls to close contacts.
- ❑ Pulse public sources of information (National Technology Transfer Center, National Technical Information Service, US-AEP help desk, professional organizations, etc.).
- ❑ Outside library search (Resource for the Future, Environmental Protection Agency, universities).

Second Level Effort

- ❑ Telephone calls to leads obtained from first level search results.
- ❑ Preliminary assessment of search results.
- ❑ Post requests for information and leads on electronic bulletin boards, check for and follow up on useful responses.

Third Level Effort

- ❑ Assess second level search results. Follow up calls. Request for written information.
- ❑ Commercial databases (Dialog, Compuserve) for key word searches, full text searches, company information searches.

Fourth Level Effort

- ❑ Evaluation of initial search results, preparation of initial report.

PHASE 2

Verification of Phase 1 findings (telephone industry contacts, government agencies, trade associations, technical experts). New directions, new contacts (repeat Phase 1 as necessary).

Decision Point: Preparation of final report or tasking of subcontractors to fill in gaps.

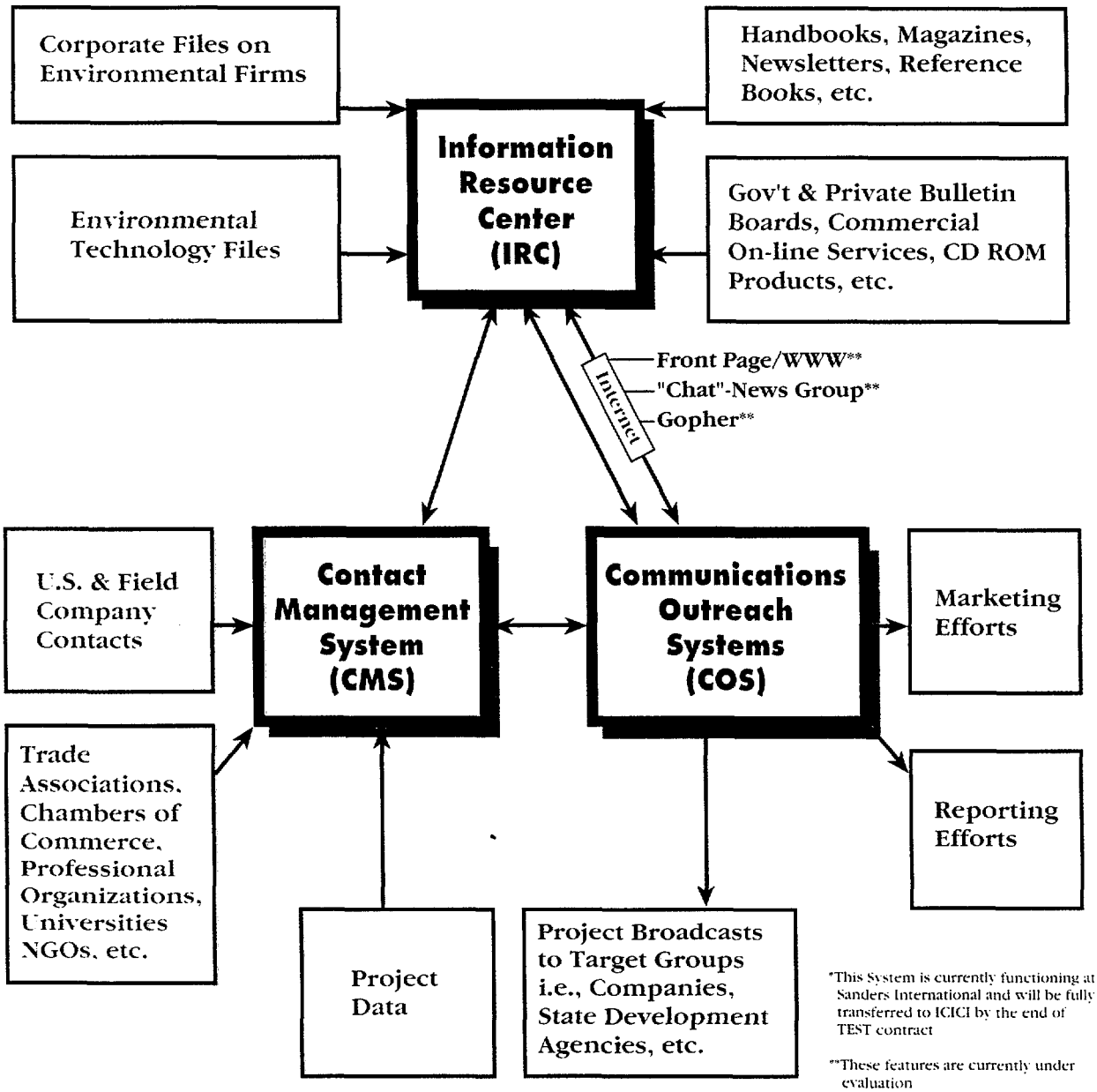
PHASE 3

Subcontractor tasked: Search and analysis requirements defined, supporting materials provided, along with estimated level of effort required (maximum 2 weeks).

Mid-course correction.

Final report.

TEST INFORMATION SYSTEM*



*This System is currently functioning at Sanders International and will be fully transferred to ICICI by the end of TEST contract

**These features are currently under evaluation

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CASTONE INTERNATIONAL

SNAPSHOT

U.S. Firm: Castone International
Type of Venture: Licensing, distributorship
Type of Technology: Fly ash conversion
Industry: Coal-fired plants
Environmental Benefit: Fly ash management and waste utilization

The Project

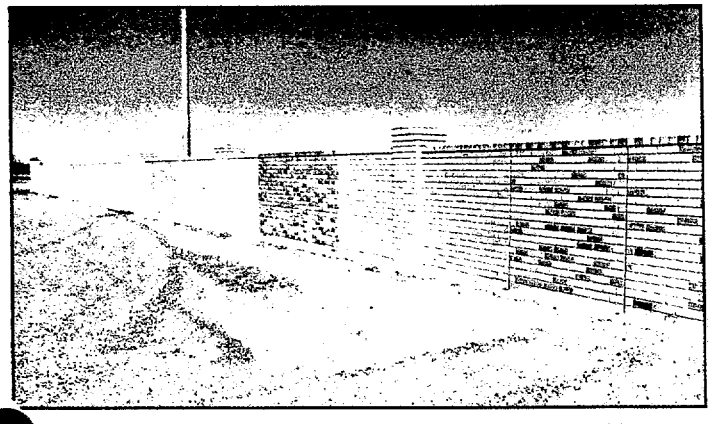
Castone International, a Tennessee based firm, has developed a practical, energy-efficient process to make consistent, high quality bricks using the ashes or waste products from coal-fired electric plants. Castone is in negotiations with a leading Indian firm involved in fly ash and other industrial waste utilization.

The Technology

Castone's brick-making process employs an innovative "continuous mix process". The company uses basic raw materials for the brick including fly ash, bottom-ash, cement and water. The bricks may be sized and colored to fit local customs and preferences. This technology is of special importance to India, where the fly ash released from coal-fired power plants is an enormous environmental problem.

TEST Collaboration

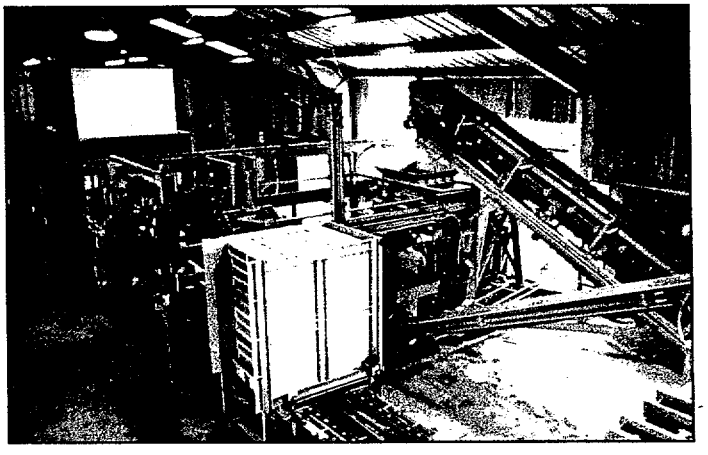
An Indian business association approached the U.S.-Asia Environmental Partnership (US-AEP) program to provide partial funding for a U.S. trip in June, 1994. The purpose of this trip was to evaluate appropriate environmental technologies for India's heavy industrial sector. The group had expressed a particular interest in locating fly ash conversion technologies. USAID-New Delhi instructed Sanders International to recruit qualified and interested firms to meet with the delegation and to identify appropriate environmental technologies. Sanders provided a comprehensive itinerary for the delegation which included a trip to Houston to visit Castone's brick making facility. The delegation was extremely impressed by Castone's technology and the quality of its bricks.



Entrance wall to Castone Brick Plant in Houston, Texas, depicting the various size and color bricks produced by Castone.

Current Status

While in Houston, Castone and one of the business delegates agreed to explore possible collaboration. Over the next few months, Castone sent the Indian delegate a chemical analysis of the U.S.-origin fly ash. Further analysis showed that the Castone technology could be suitably applied to convert Indian fly ash into high quality construction bricks. Negotiations are ongoing between the two firms regarding a potential licensing or distribution agreement.



Sideview of the Castone prototype machine showing the pallet magazine in the foreground, the mold unit, and the heat shrink unit with raised hood.

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Donaldson Corporation and Munradtech Services Private Ltd.

Snapshot

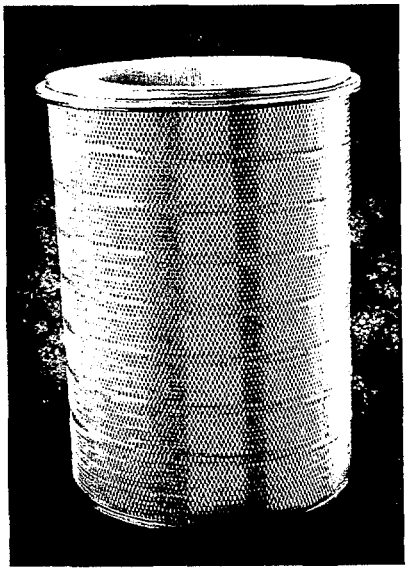
U.S. Firm: Donaldson Corporation
Indian Firm: Munradtech Services Private Limited
Type of Venture: Joint venture
Type of Technology: Air filters for gas turbines
Indian Beneficiary: "DI Filtration Systems"
Industry: Power, oil and gas
Environmental Benefit: Improved turbine efficiency with resulting lower emissions
Project Cost: $1 million

The Project

Donaldson Corporation has entered into a joint venture agreement with Munradtech Services Private Limited to manufacture industrial air filters for gas turbines. Donaldson, a Minneapolis-based company, is a world leader in a broad range of air intake systems for industrial gas turbines. As a result of this agreement, a new company called DI Filtration Systems Private Ltd. has been formed which will manufacture industrial air filters in India.

The Technology

Gas turbines are literally the driving force for power generation in India. Air filtration systems play a vital role in enhancing the efficiency and extending the lives of gas turbines by removing particles and other impurities from the air intake streams. Gas turbines consume enormous quantities of air and may ingest hundreds of pounds of solid and liquid foreign matter each year, which, if not removed, will cause damaging corrosion and fouling. Clean intake air, free from abrasive particles, permits the turbines to run longer and more efficiently which also permits a larger amount of electrical power to be generated with a correspondingly lower percentage of emissions per unit of input fuel.



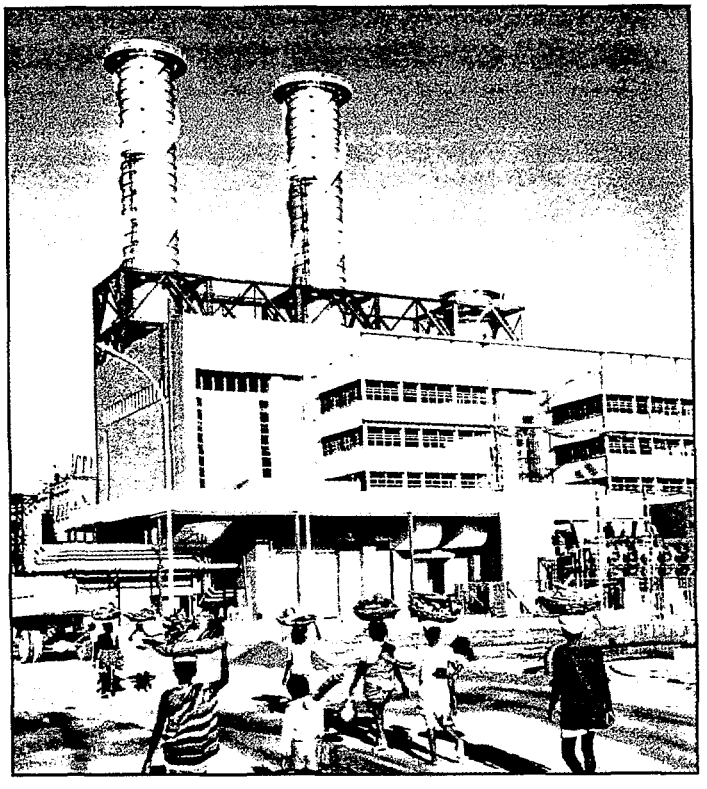
Donaldson filter element for gas turbine

TEST Collaboration

TEST approached Donaldson in December, 1993, with an offer to provide technical and financial assistance for the joint venture. At the time, Donaldson was in the preliminary stages of concluding its joint venture agreement with Munradtech to produce the air filter systems. They were, however, having difficulty in obtaining financing for their venture. Both Sanders and ICICI reviewed the project and found it suitable for funding under the TEST program. In September 1994, ICICI approved a loan of $500,000 for DI Filtrations Systems, the new joint venture.

Current Status

The new plant to produce air filters is expected to be completed by March, 1995. Total project costs amount to $1,000,000, and Donaldson anticipates first year revenues from sales in India to be over $4,000,000. Donaldson plans to introduce other filtration products into the Indian market such as dust and fume collectors for the workplace and filters for diesel engines.



Donaldson inlet filter system on NTPC Gandhar gas turbine power plant in Gujarat.

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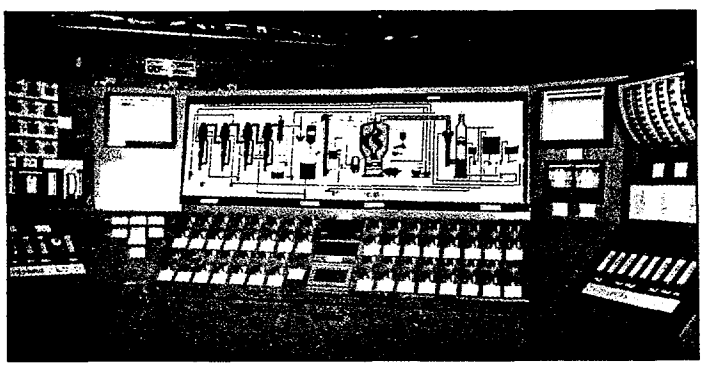
Enders Process Equipment Corporation and Agro Pulping Machinery Ltd.

Snapshot

U.S. Firm: Enders Process Equipment Corp.
Indian Firm: Agro Pulping Machinery, Ltd.
Type of Venture: Technology licensing
Type of Technology: Fluidized bed incineration systems
Indian Beneficiary: Shreyans Paper Mills
Industry: Pulp and paper
Environmental Benefit: Power savings, resource recovery, clean water
Project Cost: $4.1 million

The Project

Enders Process Equipment, an Illinois company, has entered into collaboration with Agro Pulping Machinery, Ltd. of Madras to manufacture and supply a "fluidized bed incineration system" for chemical recovery from spent pulping liquors from the pulp and paper industry. This project will provide small-and medium-sized paper mills an affordable system to treat effluents from their units and recover valuable chemicals for recycling. Under this project, Enders will provide the engineering designs for the systems, and Agro Pulping Machinery will manufacture and install systems in Indian paper mills. Enders and Agro Pulping have signed an agreement with Shreyans Paper Mills, Ltd. of Punjab, India, to install its first fluidized bed chemical recovery system.



Graphic flow sheet of the Enders fluidized bed incineration system.

The Technology

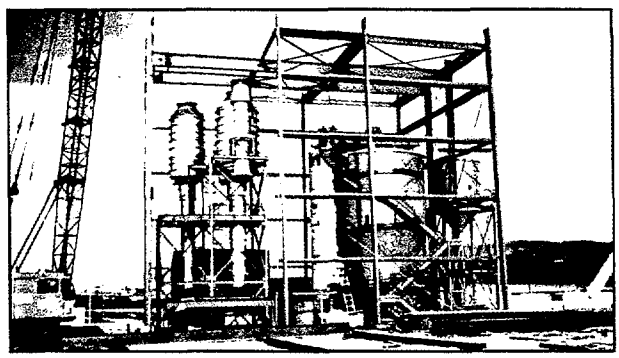
The fluidized bed incineration system provides for the treatment of spent pulping liquors in a fluidized bed reactor to recover the pulping chemicals and simultaneously destroy the unwanted organic pulping chemicals which ordinarily seep into and pollute nearby lakes and rivers. This technology is of prime importance to India where out of approximately 300 paper mills, only 90 have effective systems to treat effluents and recover chemicals for recycling. The remaining 210 mills empty their spent effluent pulping liquors directly into fields and rivers. Most paper mills in India have been reluctant to install effluent treatment systems due to their high costs. The Enders system is attractive to these mills because it costs half as much as the conventional systems currently used in India. Future plans are to adapt the Enders system for effluent treatment in sugar refineries, steel making units, and petrochemical refineries.

TEST Collaboration

In September, 1993, Sanders International approached Enders Process Equipment believing its innovative and low-cost technology was ideally suited for Indian conditions and directly applicable to one of India's top environmental "priority industries": pulp and paper. In cooperation with the U.S.-Asia Environmental Partnership (US-AEP), Sanders organized a marketing visit to India for an Enders representative which resulted in an agreement with Shreyans for a pilot installation of Enders fluidized bed incineration technology. In October 1994, the Industrial Credit and Investment Corporation of India (ICICI) approved a conditional grant under the TEST program of $600,000 for the project.

Current Status

Currently, the engineering designs for the new plant have been completed and submitted to Shreyans Industries. Moreover, 60 percent of the plant has been completed, and the new technology is expected to be operational by the end of 1995.



Construction phase of the Enders system before construction of new plant. From left to right half of the evaporator, venturi & secondary scrubber, reactor and product storage silo are shown.

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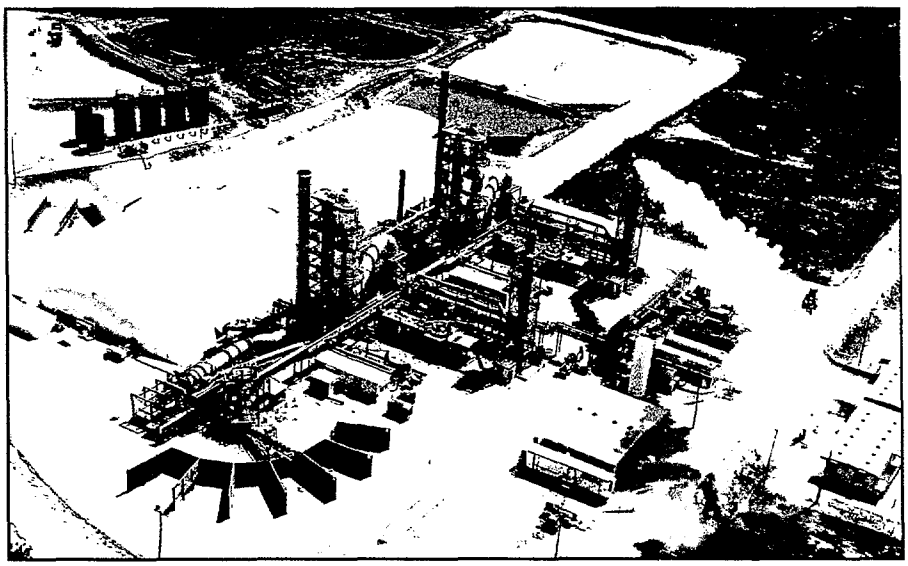
INTERNATIONAL TECHNOLOGY CORPORATION

SNAPSHOT

U.S. Firm: International Technology Corporation
Type of Venture: Technology licensing/engineering services
Type of Technology: Rotary kiln incinerator
Industry: Chemical industry and other hazardous waste generators
Environmental Benefit: Safe disposal of hazardous solid and liquid waste

The Project

The Indian promoters of this project wish to construct a 200,000 metric tons/annum rotary kiln hazardous waste incinerator to service the chemical and petrochemical industries in Madras. Currently, the majority of these solid and liquid wastes are being disposed of improperly. Engineering design, supervision and commissioning services are to be provided by the International Technology Corporation of Knoxville, Tennesee (IT Corp.). Most fabrication work will be executed in India by a leading Indo-U.S. joint venture company that is active in manufacturing equipment for the cement industry.



IT Corp.'s Transportable Hybrid Thermal Treatment System® (HTTS®) Units at the Motco Hazardous Waste Site.

The Technology

The project developers decided that a rotary kiln incinerator was the most appropriate technology for the waste profile of the Madras-area industries. A rotary kiln is a refractory-lined cylinder used as the primary combustion chamber for liquids, solids and sludges. This design facilitates tumbling and turnover for sludges, combustible solids and organically contaminated noncombustible solids. The combustion products and/or volatilized organics pass into a secondary combustion chamber to complete the gas phase oxidation. The secondary combustion chamber is generally operated at a temperature much higher than the kiln itself. The primary advantage of the rotary kiln system lies in its ability to process both solids and sludges. The IT design also calls for thermal energy to be drawn from the incinerator to generate approximately 1 megawatt of electricity.

TEST Collaboration

The TEST program facilitated initial introductions and information exchanges between IT Corp. and the Indian promoter. In cooperation with the U.S.-Asia Environmental Partnership (US-AEP), TEST also organized multiple visits by IT Corp. to India and by personnel from the Indian promoter firm to the U.S. The visits played an important role in moving the two sides to commit to development of this project. In addition, the Indian firm was able to visit IT Corp. in Knoxville, tour two of their incinerator installations, and talk to competing U.S. firms about alternative technologies. TEST program staff from ICICI and Sanders International have worked extensively with both sides to further develop the project concept, review financing alternatives and trouble shoot problems.

Current Status

A full-cost engineering study has been completed. A preliminary financing proposal has been submitted to the TEST Group at ICICI, and a series of technical and financial questions have been posed to the Indian project developers. Efforts are underway to secure necessary commitments from waste generators, as well as to secure a power purchase agreement from state electricity officials. Project approval is slated for late 1995.

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MTCI/Thermochem and Esvin Advanced Technologies Ltd.

Snapshot

U.S. Firm: MTCI/Thermochem
Indian Firm: Esvin Advanced Technologies Ltd.
Indian Beneficiary: Delta Paper Mills
Type of Venture: Technology licensing
Type of Technology: Indirect gasification
Industry: Pulp and paper
Environmental Benefit: Energy recovery, clean water

The Project

Manufacturing and Technology Conversion International, Inc. (MTCI), a Maryland-based company, has developed an indirect gasification technology to eliminate water pollution from mini paper mills. Thermochem, Inc., a California firm, is the marketing arm for the technology. MTCI/-Thermochem have licensed this technology to Esvin Advanced Technologies Limited (Esvin Tech) - Madras for manufacturing and marketing in India.

The Technology

The indirect gasification technology is used to treat waste from paper mills and recover valuable chemical by-products and energy. This unique process recovers all common spent liquors including kraft, sulphite, and non-wood derived liquors. It also recovers sodium sulphite, which is dissolved to form green liquor and is recycled for use in the pulping process. The technology recovers clean, hydrogen-rich fuel gas which can be used to drive gas turbines for electrical generation. In addition, the MTCI/Thermochem process shows great promise in treating effluents from small and medium-sized distilleries.

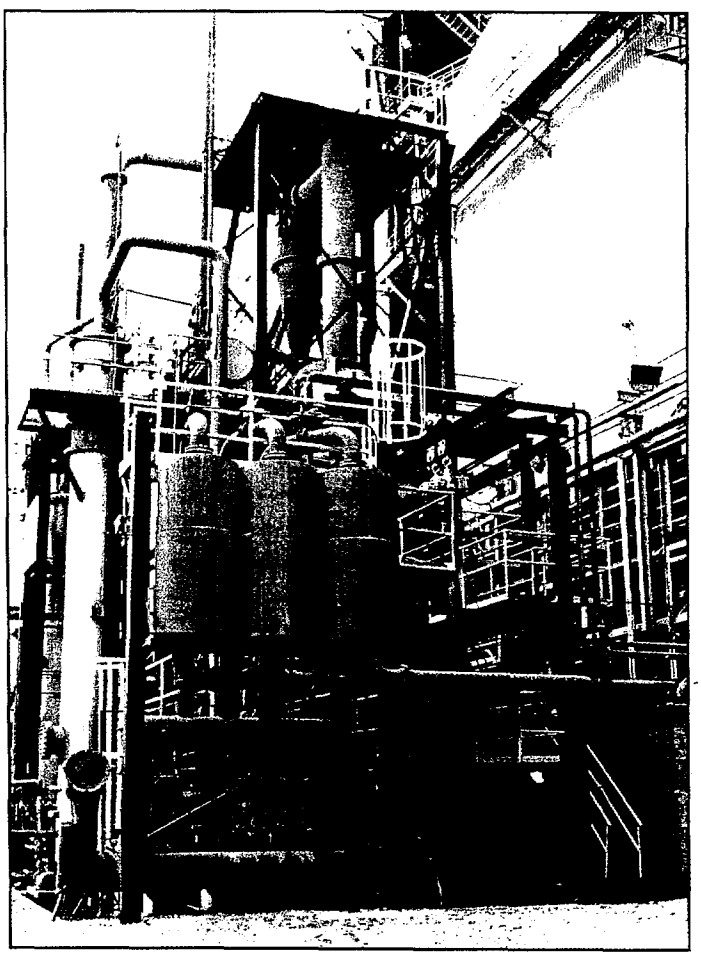
TEST Collaboration

MTCI/Thermochem and Esvin Tech began their collaboration and efforts to develop the gasification technology under an earlier USAID project called the Program for Advancement of Commercial Technology (PACT), which is also implemented in India by the Industrial Credit and Investment Corporation of India (ICICI). Their cooperation was ultimately successful and Delta Paper Mills expressed interest in being the first commercial installation of the new effluent treatment technology.

TEST agreed to support the project because the MTCI/Thermochem effluent gasification technology is specifically designed for small- and medium-scale paper mills, a priority environmental sector in India. In 1994, TEST and the U.S.-Asia Environmental Partnership (US-AEP) program funded a visit by Esvin Tech engineers to the U.S. and a return visit to India by an MTCI/Thermochem representative to iron out remaining technical problems and to finalize details for the project installation.

Current Status

Delta Paper Mills has applied for TEST project financing to support installation of the MTCI/Thermochem treatment technology. The proposal is currently under consideration and is expected to be approved in 1995.



MTCI/Thermochem indirect gasification system at the Weyerhaeuser Paper Mill in New Barn, North Carolina.

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TEST
TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

Business Ventures

TEST
TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

COMPLETED PROJECTS

- Through the Industrial Credit and Investment Corporation (ICICI), the TEST program has financed a licensing agreement between **Davy-McKee** of San Francisco, California, and **TTG Industries** of Madras, India, to transfer production know-how for the manufacture of water-jacketed gas collection hoods.
  Project cost: $.5 million.

- Through ICICI, the TEST program has financed a multi-million dollar joint venture between **Snyder General** of Dallas, Texas, and **Kirloskar Industries** of Pune, India, for the production of a variety of air pollution control equipment.
  Project Cost: $3 million.

- ICICI has approved a conditional grant to **Shreyans Industries** of New Delhi for a demonstration project to install an innovative U.S. technology to recover caustic soda from an existing pulp and paper mill's waste stream. Specialized equipment, engineering design and know-how will be supplied by **Enders Process Equipment** of Glen Ellyn, Illinois.
  Project Cost: $4.1 million.

- Through ICICI, the TEST Program has financed the transfer of flow modelling technology for gas collection equipment from **Research Cottrell**, Somerville, New Jersey, to **Associated Cement Companies**, New Delhi, India.
  Project Cost: $.6 million.

- Through ICICI, the TEST Program has financed a joint venture between **Munradtech** of New Delhi, India, and **Donaldson** of Minneapolis, Minnesota, to produce gas turbine air filters.
  Project Cost: $1 million.

- Through ICICI, the TEST Program has financed and provided technical assistance for the licensing of a fluidized bed boiler technology from **Tampella**, Atlanta, Georgia, to **Ignifluid Boilers India, Ltd.**, Madras, India.
  Project Cost: $1.5 million.

PENDING VENTURES

- ICICI is evaluating a proposal for a hazardous waste incinerator to be erected in Madras. This will be the first facility of its type and size in India. Design, supervision and specialized equipment is to be provided by the **International Technology Corporation** of Knoxville, Tennesee.

- Under TEST sponsorship, **Pneumaphil** of Charlotte, North Carolina, a major U.S. manufacturer of industrial air filters, has signed a 5 year technical collaboration agreement with **Inalsa** of New Delhi for the production of gas turbine filters. ICICI is currently evaluating a proposal to finance this collaboration.

- **Thermochem** of Columbia, Maryland, and Madras-based **Esvin Tech** are seeking TEST project support to finance their first sale of an innovative gasification technology to a large Indian paper mill.

- In June 1994, **Premier Ziba**, a Delhi-based manufacturer, signed a distribution agreement with U.S. Bio-tech, a New Jersey-based environmental firm to import its bio-treatment products into India. A multi-phased project is planned to use the U.S. firm's products in India to deal with the serious pollution problems caused by small scale distillery and pulp and paper effluents. ICICI is evaluating a proposal to finance this collaboration.

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Business Ventures

Other Business Collaborations

OTHER BUSINESS COLLABORATIONS

- **A** small Virginia manufacturer of auto emission control devices travelled to India in November 1993 under joint TEST and U.S.-Asia Environmental Partnership (US-AEP)/World Environment Center (WEC) sponsorship. The trip resulted in a memorandum of understanding with the **Automotive Research Association of India** to test and adapt its product for the Indian market. A joint venture with a major Indian auto components manufacturer is under active negotiation.

- **A**s the result of a TEST-sponsored contact, **Smith & Loveless** of Lenexa, Kansas, a large waste water treatment equipment manufacturer, signed a distributorship agreement with **PureTech Engineering**, a Madras-based engineering firm, to represent the company's full product line in Southern India.

- **A**s a result of a TEST/US-AEP-sponsored contact and business exchange, **Modular Environmental Technologies** of The Woodlands, Texas, signed a distribution agreement with **Ion Exchange India** -Bombay to market their low-cost water purification products primarily to markets in Central and South America.

- **A**s a result of a TEST/US-AEP-sponsored contact and business exchange, **Yankee Environmental Systems, Inc.** and its associated manufacturer, **Pacific Fluid Systems**, both of Seattle, Washington, are negotiating with the **Indian Navy and Coast Guard** for the sale of their oil-spill recovery systems.

- **A**s a result of a TEST/US-AEP-sponsored exchange, **Koch Membrane Systems**, a Wilmington, Massachusetts-based manufacturer of thin membranes and modules for wastewater treatment, has developed and signed a distributorship agreement with **Ion Exchange - India** to market thin membrane technology for pulp and paper waste water treatment.

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Case Profile

TRADE IN ENVIRONMENTAL SERVICES AND TECHNOLOGIES

Business Ventures

Other Business Collaborations

Illustrative Areas of Involvement

TECHNOLOGY SEARCHES

CNG conversion kits for autos
Distillery waste treatment
High BOD removal systems
Chromium removal in tannery effluents
Reverse osmosis technologies
Reactor/clarifier technologies
Anaerobic digestor technologies
Treatment of cyanide bearing wastes
Treatment of caustic chlorine wastes
Coke oven effluents
Cyclones
Catalytic converters for autos
Electrostatic precipitators
Wet ESPs

TECHNICAL ASSISTANCE

Hydrocarbon soil remediation
Solvent recovery technologies
Modular wastewater bio-treatment
Agriculture waste conversion technologies
Upgradation of distillery waste treatment
Integrated waste treatment for industrial estate
Rice husk utilization
Electronic control for auto emissions
Instrument calibration center
Package desalination plants
Color removal for textile industry wastes
Laser welding for polymer filters
Floating roof digestors
Foundry air emission control

DEALS IN PROGRESS

azardous waste incinerator
.per mill effluent gasification
o-augmentation of waste lagoons
ash conversion technologies
ustrial air filter technology transfer
aption of batteries for vehicles

FINANCED DEALS

Industrial air filters
Gas recovery hoods
Air pollution control equipment
Fluidized bed boiler technology
Caustic soda recovery for paper mills
Air flow modeling testing facility

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