**TREATMENT OF METAL-LADEN HAZARDOUS WASTES
WITH
ADVANCED CLEAN COAL TECHNOLOGY BY-PRODUCTS**

QUARTERLY TECHNICAL PROGRESS REPORT

DECEMBER 30, 1997 - MARCH 30, 1998

**James T. Cobb, Jr.
Ronald D. Neufeld
Jana Agostini**

**School of Engineering
University of Pittsburgh**

May 10, 1999

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The first of these is the fact that the
 system is not a simple one. It is a
 complex one, and it is not possible to
 describe it in a simple way. It is a
 system of many parts, and it is not
 possible to describe it in a simple way.

EXECUTIVE SUMMARY

During the tenth quarter of Phase 2, work continued on conducting scholarly work, preparing for field work, preparing presentations, and making additional outside contacts.

Scholarly Work

The graduate student assigned to this project from the Department of Civil and Environmental Engineering has continued her work on evaluation of the long-term stability of Phase 1 samples.

Preparation for Field Work

MAX Environmental Technologies, Inc., formally rejoined the project team.

Work began on the detailed design of that portion of the new system to handle dusty treatment chemicals. The steps toward installation of this equipment and its initial use in the demonstration were outlined.

Reports and Presentations

An invitation was accepted to give a presentation at the annual FETC conference in July 1998.

Outside Contacts

In a letter to FETC the co-principal investigator described the projects at the University of Pittsburgh on coal combustion by-product utilization.

The principal investigator sent a letter to Burns and Roe Service Company describing the potential assistance of the University of Pittsburgh to the U.S.AID/U.S.DOE Interagency Program with India.

Plans for the Next Quarter

During the quarter from March 30 through June 30, 1998, work will continue on Tasks 4 and 5 of Phase 1. The graduate student assigned to this project will continue her scholarly work during this quarter.

Work on Task 1 of Phase 2 will continue. The principal investigator will maintain contact with MAX Environmental Technologies, Inc., as it plans the installation of equipment at the Mill Service Yukon Plant to conduct Phase 2 of the project.

INTRODUCTION

This fourteenth quarterly report describes work done during the fourteenth three-month period of the University of Pittsburgh's project on the "Treatment of Metal-Laden Hazardous Wastes with Advanced Clean Coal Technology By-Products."

This report describes the activities of the project team during the reporting period. The principal work has focussed upon new laboratory evaluation of samples from Phase I, discussions with MAX Environmental Technologies, Inc., on the field work of Phase 2, preparing presentations, and making and responding to two outside contacts.

LABORATORY AND FIELD WORK

Scholarly Activity

Jana Agostini, the graduate student in the Civil and Environmental Engineering Department, continued her work in the environmental laboratories on the ninth floor of Benedum Engineering Hall. Preliminary results of her work were presented in the previous quarterly report. Further results will be presented in a project report at a later time.

Preparation for Field Work

MAX Environmental Technologies, Inc. (MAX), formally rejoined the project team via a letter of recommitment dated January 22, 1998. This letter is shown in Appendix A.

Work began this quarter by MAX on the detailed design of one portion of the new system at the Mill Service Yukon Plant (MSYP). When fully installed, the new system will allow MSYP to treat dusty wastes with dusty chemicals (including advanced clean coal technology by-products). At the beginning of the quarter it was expected that the entire system would be acquired immediately. However, a major investment at another MAX site required that the installation at MSYP be scaled back to include just the equipment to handle dusty treatment chemicals and to allow these to be used at the SWSS pits.

The steps to engaging this partial installation in the project are:

- detailed design of treatment chemical unloading section, silo, chemical transfer section and dust management system at the SWSS pits
- preparation of the air and solid waste permit applications for construction and operation of the partial system
- review of permit applications and issuance of permits
- construction of the partial system
- preparation of the task plan for Phase 2 of the project

The task plan will describe the acquisition of chemicals and wastes, the treatability and solidification study for each chemical/waste pair, the treatment of 20-30 tons of waste with 2-6 tons of chemicals in each batch in the SWSS pits, and the stabilization/solidification characterization of treated products.

REPORTS AND PRESENTATIONS

On March 19 an invitation was received and accepted to make a presentation describing the project at the annual FETC conference in Morgantown on July 21-22, 1998. The project team plans to provide a comprehensive review of Phase 1 and a summary of the many steps that have been necessary to conduct Phase 2.

OUTSIDE CONTACTS

Suggestions for Other Projects with FETC

On January 19 the co-principal investigator followed up on the discussion at the informal meeting on coal combustion by-product utilization in environmental remediation projects in western Pennsylvania on December 4, 1997 with a letter to FETC describing projects at the University of Pittsburgh involving the innovative use of by-products. This letter is reproduced in Appendix B.

Projects in India

In early February the principal investigator spoke at length with Dr. Radha Krishnan of SAIC about the U.S.AID/U.S.DOE Interagency Program with India. Dr. Krishnan encouraged the University of Pittsburgh to continue its dialog with FEC. about involvement in the program.

At mid-month in February, the principal and co-principal investigators met with Dr. Krishnan and staff from Burns and Roe Service Company at FETC to consider in depth how the University might assist the Interagency Program. A vision for the University's assistance was provided in a letter to Dr. Roger Rao. This letter is reproduced in Appendix C.

ADMINISTRATIVE ASPECTS

This section provides the monthly highlights, and closes by comparing progress with the milestone chart.

Monthly Highlights

Here are the highlights of the tenth three-month period of the second phase of the project.

December 30, 1997 - January 30, 1998

- MAX Environmental Technologies, Inc., officially rejoins the project team.
- Steps are outlined for installation of equipment for and initiation of the demonstration.
- Description of projects at the University on coal combustion by-product utilization is provided to FETC.

January 30 - February 28, 1998

- Discussions are held at FETC on the U.S.AID/U.S.DOE Interagency Program with India.

February 28 - March 30, 1998

- Letter is sent to Burns and Roe Service Company describing potential assistance of the University of Pittsburgh for the U.S.AID/U.S.DOE Interagency Program with India.
- Invitation is accepted to give a presentation on the project at the annual FETC conference in July 1998.

Comparison of Progress with Milestone Chart

The following task for Phase 2 had been scheduled for completion during the first quarter of Phase 2:

- Task 1 - Test Plan for Phase 2

Task 1 still was not completed during the tenth period of this phase. The decision in early April 1996 by METC that an environmental assessment of the Phase 2 project at the Yukon plant of

Mill Service, Inc. (MSI), would have to be conducted and the subsequent withdrawal in late April 1996 by MSI from Phase 2 necessitated a search for a new subcontractor to host and participate in the commercial test of Phase 2. MAX Environmental Technologies, Inc., has rejoined the project team and is designing modifications at the Mill Service Yukon Plant (MSYP) to enable it to enter this business area and carry out the field work on this project. The test plan for Phase 2 will be prepared shortly before the permits are in place for the installation of the equipment at MSYP for carrying out the demonstration.

Work continued on two tasks from Phase 1:

- Task 4 - Treatment of Metal-Laden Waste with CCT Solid By-Product
- Task 5 - Data Analysis

Work on Tasks 4 and 5 of Phase 1 will continue into the tenth quarter of Phase 2. The fourth by-product and the final three residues are no longer being actively sought. When the Phase 2 testing program is initiated, consideration will be given to reestablishing this activity.

PLAN FOR THE NEXT QUARTER

During the quarter from March 30 through June 30, 1998, work will continue on Tasks 4 and 5 of Phase 1. The graduate student assigned to this project will continue her scholarly work during this quarter.

Work on Task 1 of Phase 2 will continue. The principal investigator will maintain contact with MAX Environmental Technologies, Inc., as it plans the installation of equipment at the Mill Service Yukon Plant to conduct Phase 2 of the project.

APPENDIX A

LETTER OF RECOMMITMENT TO THE PROJECT BY MAX ENVIRONMENTAL TECHNOLOGIES, INC.

MILL SERVICE, INC.

ALLEGHENY LIQUID SYSTEMS, INC.

FAST DRUM RECYCLE

January 22, 1998

Mr. Michael M. Crouch, Director
Office of Research
University of Pittsburgh
350 Thackeray Hall
Pittsburgh, PA 15260

Dear Mr. Crouch:

This is to confirm that MAX Environmental Technologies, Inc. (formerly known as "Mill Service, Inc."), will resume its participation as a subcontractor in the project on "Treatment of Metal-Laden Hazardous Waste with Advanced Clean Coal Technology By-Products," Contract No. DE-FC21-94-MC31175, which the University of Pittsburgh is conducting for the Federal Energy Technology Center of the U. S. Department of Energy.

As was noted in the letter of April 26, 1996, in which MAX exercised its option to terminate the subcontract agreement, MAX was pleased with the results of phase 1 of the project and with its participation in it. MAX had expected to continue as a subcontractor for phase 2, and was looking forward to doing so; however, we found that we had to terminate the agreement as phase 2 was being planned, due to uncontrollable circumstances.

Those circumstances have recently changed, and MAX is happy to rejoin the project team. In doing so, it accepts all of the terms and conditions of the prior subcontract. It also accepts all currently valid elements of the Continuation Application for the project, dated June 9, 1995, which was submitted by the University to the U. S. Department of Energy prior to MAX's termination of the subcontract agreement on April 26, 1996. It should be noted, however, that certain aspects of the equipment, employees, and procedures used to treat hazardous wastes with advanced clean coal technology by products at the Mill Service Yukon Plant have changed during the intervening period. These changes will be reflected in the "Comprehensive Field-Scale Test Plan for Phase 2 from February 12, 1998 to March 31, 1999," which will be prepared by the project team during the coming 30 days, as well as the need to obtain a permit.

Mr. Michael M. Crouch

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January 21, 1998

We continue to believe that this project is needed to assist in developing appropriate new utilizations for coal combustor by products. In addition, as a good example, this project promotes pollution prevention by using one waste stream in the treatment of a second one. We look forward to a successful conclusion to phase 2.

Sincerely,

Philip R. Costantini
Executive Vice President and
Chief Financial Officer

PRC:mat

✓ c Prof. J. Cobb, University of Pittsburgh
S. Renninger, U S DOE

APPENDIX B

**LETTER TO FETC ON PROJECTS AT
THE UNIVERSITY OF PITTSBURGH
INVOLVING THE USE OF BY-PRODUCTS**

University of Pittsburgh

School of Engineering
Department of Civil & Environmental Engineering

949 Benedum Hall
Pittsburgh, Pennsylvania 15261-2294
412-624-9870 Telephone
412-624-0135 Fax

January 19, 1998

Mr. William W. Aljoe
Environmental Engineer
U.S. DOE
Power & Environmental Systems Division
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

Dear Bill:

This is a follow-up to the DOE "By-Products Utilization" meeting that Jim Cobb and I attended last month. We are pleased to see a consortium forming to further the utilization of by-products, and we are eager to participate in as broad a manner as possible. While research and demonstration is critical in the commercial sector, an "outgrowth" of academic involvement is the contemporaneous training of young engineering professionals who are capable of carrying and implementing the message of energy by-product utilization into the future.

The School of Engineering faculty has a long history of working with DOE in the research and development of environmentally acceptable energy systems. In addition, I would like to bring to your attention a number of current projects within the University of Pittsburgh Department of Civil & Environmental Engineering, and Department of Chemical & Petroleum Engineering involving the innovative use of by-products. For example:

- Scott Renninger is supporting us in an effort to demonstrate use of advanced clean coal technology by-products as treatment chemicals for hazardous waste stabilization. This project, an example of a moderate volume-moderate value use, will move this fall into its commercial demonstration phase (Phase 2) with Max Environmental Technologies, Inc., the reactivated private sector participant.
- An offshoot of this activity with graduate students has raised further questions of (a) long-term aging and stability of previously encapsulated/stabilized heavy metals, (b) potentials for co-disposal of biological sludges with by-products (*noting that anaerobic conversion of sulfates to sulfides is an excellent mechanism for heavy metal precipitation and stabilization*), and (c) development of approaches to minimize the final total volume of the residual waste material-treatment chemical matrix (*a critical issue since the cost of disposal is highly sensitive to the volume/space required*).

- In initial discussions this past week with the Mill Service Yukon Plant of Max Environmental Technologies, Inc., concerning the plan for Phase 2, we learned that the product from the hazardous waste treatment with advanced clean coal technology by-products will be placed as the closure caps for impoundments 5 and 6 at the Yukon Plant. The set strength of the product therefore becomes an important factor. We wish to extend our laboratory work in Phase 2 to include assurance and evaluation of solidification as well as stabilization.
- Recently, severe benthic sediment/sludge pollution (from historical industrial discharges) has been reported in the public press at "The Point", the headwaters of the Ohio River near downtown Pittsburgh. Calcium oxide has been used as treatment chemical in other locations for the stabilization of contaminated river and lake bottom sediments. We believe calcium-oxide containing advanced clean-coal technology by-products could do the same job, and are likely to be an economic and technical choice feed-stock for stabilization of dredged sediments leading to ultimate river-bed decontamination.
- At the December meeting, I provided you with copies of three ASCE Energy Division Journal articles describing our prior EPRI supported work in the area of high-flyash containing Autoclaved Cellular Concrete (ACC), a fairly high-value product. Accomplishments of this work included chemical and physical characterization of the ACC block product, and definition of environmental parameters of metal and organic leaching and radon exhalation: parameters considered necessary to achieve commercial acceptance of this new building material in the market place.
- Since we now have the necessary equipment including a high pressure steam autoclave to fabricate such ACC materials with varying recipes, a number of graduate students and undergraduates have "migrated" to this project. Unsupported work over the past year has included incorporation of polymer fibers for flexural strength enhancement, making of colored block materials, and inquiries into the use of high LOI (and ammonia containing) ash collected from low-NO_x emitting electric utilities as an ACC feedstock. During the past week, for preliminary graduate student experimental evaluation purposes, we received about 450 lbs. of by-product from the Stanton Florida (Boiler #2) electric utility where NO_x control is effected using a combination of low NO_x (lower temperature) combustion with Selective Catalytic Reduction. Personally, I feel that ACC may well be marketed as a high performance building product that incidently is made from high LOI clean-coal technology byproducts as feed stocks, however this needs to be comprehensively demonstrated. Furthermore, we need to examine potentials for incorporation of PM-2½ by-products where many of the particulates may contain metals in levels higher than current flyashes (which may be locked away as a precipitate or complex in the ACC concrete-like matrix), and many of the fine particulates may be the result of ammonium sulfate and ammonium bisulfate condensation.

- The geotechnical faculty of the Department of Civil & Environmental Engineering has long term interests in flowable fills. Use of FGD and other sludges for such applications was demonstrated to the group during our December meeting at the St. Vincent College. Further research linking both physical and environmental properties of these and similar materials and applications should be undertaken before they can become accepted products for extended commercial use.
- On the international front, Dr. Cobb and I have been interacting with Gary Stats who, with AID funding, supported the visit of Dr. Shiv Dube from the Center for Power Efficiency and Environmental Protection of the National Thermal Power Corporation Ltd., India visit to FETC and Pitt. Dr. Dube is now back in India, and we are currently exploring possibilities of involving the University of Pittsburgh in furthering incorporation of American technology in the utilization of Indian by-products by creating a project involving some graduate students at IIT Delhi and others coming to the University of Pittsburgh.

The above are current areas of faculty activity and interest. We are keenly desirous of conducting further research at both the academic and field levels.

I look forward to an opportunity to again meet with you, and to develop an implementation plan and proposal for further research!

Best personal regards;

Sincerely,

Ronald D. Neufeld, Ph.D., P.E., DEE
Professor of Civil & Environmental Engineering
Environmental Engineering Program

cc: James T. Cobb Jr., P.E.-Department of Chemical & Petroleum Engineering

APPENDIX C

**LETTER TO BURNS AND ROE SERVICE CORPORATION
ON A POTENTIAL ROLE FOR THE UNIVERSITY OF PITTSBURGH
IN THE U.S.AID/U.S.DOE INTERAGENCY PROGRAM WITH INDIA**

University of Pittsburgh

SCHOOL OF ENGINEERING
Chemical and Petroleum Engineering Department

March 2, 1998

Dr. Roger Rao
Burns and Roe Service Corporation
P. O. Box 18288
Pittsburgh, PA 15236

Dear Dr. Rao:

Professor Ronald Neufeld and I greatly appreciated meeting with you and Dr. Radha Krishnan on February 13, 1998 to hear your thoughts about the U.S.AID/U.S.DOE interagency agreement for assistance to the electric utility sector of India. In this letter we offer ideas and suggestions for a new element of the program, which will deepen and enrich the exchanges that are already taking place.

We understand that the interagency agreement has the vision that ultimately throughout India there will exist a set of efficient, clean, reliable electric power stations, producing fully utilized by-products. We further understand that an important goal of the agreement is the comprehensive, collegial transfer to Indian utilities of concepts, designs and procedures that have been developed and demonstrated in the United States. The University of Pittsburgh suggests that an important and useful new strategy to reach this goal is to bring together academics and industrialists from India and the United States for a scholarly examination of policies, systems, technologies and practices.

Professor Neufeld and I therefore propose that we take action to establish a "U.S./India University/Industry Collaborative Program for Electric Utility Progress" within the framework of the interagency agreement. We currently envision that elements of this collaborative program might be:

- Bilateral seminars in India, first on broad technical topics, such as advanced power systems, power efficiency, sustainable energy, environmental protection, greenhouse gas reduction, and by-product utilization, and eventually on power generation and distribution policies.
- Consultations in India by U.S. academics and industrialists on specific technical topics, such as by-product utilization, advanced power systems, environmental controls, transportation, natural gas production and utilization, and analytical laboratory equipment selection.

Letter to Roger Rao

March 2, 1998

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- The latter topic is of immediate importance. CENPEEP wishes to establish a comprehensive set of coal analyses in one of the research laboratories of NTPC to eliminate the costly, time-consuming shipment of samples to laboratories at Indian universities and overseas. A project on this topic within the collaborative program would assist in preparing equipment specifications and identifying vendors.
- Another topic of great interest is the control of water pollution from ash piles and ponds.
- A third topic is the siting of cooling towers and design of switchyards, such that the water droplet-laden plumes from the cooling towers do not adversely impact switchyards downwind.
- Study, research and teaching visits by faculty and key industrial staff to exchange general information, collaborate on research projects, and share insights on power generation and environmental protection.
- Graduate education for Indian students in the United States and U.S. students in India, and training for utility staff by U.S. experts in India.

Key participants in the "U.S./India University/Industry Collaborative Program for Electric Utility Progress" might be:

- Engineering Center for Environment and Energy (ECEE), School of Engineering, University of Pittsburgh, which would organize and direct the program. The ECEE, described in Attachment I, is a tenure stream-faculty driven coordinating body whose mission is to facilitate and promote multidisciplinary joint activities across departments on the School of Engineering. The coordinating committee of the center has recently prepared an inventory of the School's activities in environment and energy. Attachment II summarizes the projects that are being conducted by the School's faculty.
- University Center for International Studies (UCIS), University of Pittsburgh, which will provide the ECEE with a university-wide support system for enriching and advising the "U.S./India University/Industry Collaborative Program for Electric Utility Progress." The India Studies Program, directed by the Asian Studies Program — a major element of UCIS, provides students at the University with training in languages of India and in area studies through a variety of courses and seminars. Attachment III describes the India Studies Program and two of its special elements — (1) a lecture series on "Fifty Years after Independence: Reflections on India Today" and (2) "Pitt in India," a 10-week summer study abroad program, whose first offering will take place this year in Hyderabad.

Letter to Roger Rao

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- Centre for Power Efficiency and Environmental Protection (CENPEEP), National Thermal Power Corporation, Ltd., which is coordinating Indian participation in the activities of the interagency agreement. Dr. Shiv K. Dube, Manager of CENPEEP, has just completed a six-month visit at the University of Pittsburgh, where he was a Research Associate in the Chemical and Petroleum Engineering Department, assigned principally to the by-product utilization project being conducted by GAI Consultants, Inc. While he was here, I worked closely with Dr. Dube to introduce him to various professional groups and to counsel with him on his vision for CENPEEP.
- Indian Institute of Technology Delhi, with whom the School of Engineering is developing a formal relationship. We are in the midst of the second exchange of letters with Prof. V. S. Raju, Director of IIT Delhi, expressing mutual interest in a partnership and providing details of capabilities.

Professor Neufeld and I suggest that the team eventually include specialists from a number of U.S. universities, initially including ours, CMU, WVU, Penn State, Lehigh, U. Ky, and SIUC; U.S. utilities, such as AEP, APS, Southern Companies and TVA; and Indian organizations, such as CENPEEP, NTPC, CSIR, IIT Delhi and Jian University in Delhi. Funds for its operation would come initially through the interagency agreement, but other sources may be tapped as well. Our relation with IIT Delhi in all aspects of electric power and environmental protection would be the key one, although our connection with Jian University on policy matters would be very important. But we would also want to involve other universities in India that have existing or logical connections to power stations across the country, as well as certain of the 1600 NGOs that have spring up recently all across the subcontinent.

The first step toward formal creation of the collaborative program to be headquartered in our School is the submission of this brief white paper describing our vision and capabilities. I understand that over the next few weeks you and Dr. Krishnan will share this paper with appropriate individuals in India. If all agree that the collaborative program should be formed, a formal proposal can be developed.

Upon initial funding, Professor Neufeld and I might spend several weeks, principally in Delhi, to organize the Indian portion of the team and to identify the first topics for seminars and consultations. Upon our return to the United States, we would begin drawing together the experts needed for instruction and consultations. The first topics would be expected to include climate change, analytical equipment for coal, proposal development and project management for highly-educated technical staff members of the Indian utilities, and improvements in water quality of the runoff from coal ash piles. NTPC is particularly interested in knowing what it takes to become a "green" utility. Parallel to the development of seminars and consultations would be creating a research and education program jointly with IIT Delhi. The faculty who would be

Letter to Roger Rao
March 2, 1998
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involved in this program would be asked particularly to broadly examine the situation and challenges facing Indian electric utilities and to offer generic solutions.

We are very excited by the opportunities which the "U.S./India University/Industry Collaborative Program for Electric Utility Progress" offers to the University of Pittsburgh to enhance its activities related to India. We appreciate your sharing the ideas embodied in this letter with your colleagues within the framework of the U.S.AID/U.S.DOE interagency agreement. And we look forward to working with you to develop the concept of the collaborative program to fruition.

Sincerely,

James T. Cobb, Jr., P.E.

Associate Professor

Co-Director for Service, Engineering Center for Environment and Energy

- cc. Ronald Neufeld, Professor, Department of Civil and Environmental Engineering
Alan Russell, Chair, Department of Chemical and Petroleum Engineering
Rafael Quimpo, Chair, Department of Civil and Environmental Engineering
Gerald Holder, Dean, School of Engineering
Patricia Stranahan, Director, Asian Studies Program
Frederick Pohland, Weidlein Professor of Environmental Engineering and Director,
Engineering Center for Environment and Energy

- ♦ Electron Microscope Laboratory
- ♦ Image/Pattern Recognition Laboratory

Participating Faculty

ATAAI, Mohammad M.; Bioprocess engineering, immobilized enzymes
 BECKMAN, Eric J.; Environmentally-benign processes, supercritical fluids
 BIRKS, Neil; Hot corrosion/erosion; atmosphere control
 BLACHERE, Jean R.; Ceramics, refractories, hot corrosion
 BULLEN, A. Graham, R.; GIS, transportation systems
 CASSON, Leonard W.; Adsorption, fate and transport of particles and pathogens
 CHAPARO, Luis F.; Signal/image processing
 CHIANG, Shiao-Hung; Solid-liquid separation, coal cleaning
 CHIU, Chao-Lin; Hydraulics and hydrology
 COBB, James T., Jr.; MSW combustion, energy resources
 COLCLASER, R.G.; Power Engineering transient analysis
 d'ITRI, Julie L.; Environmental catalysis, surface chemistry, reaction kinetics
 FALK, Joel; Optical methods, laser technology
 GOODWIN, James G.; Catalysis, chemisorption
 HOLDER, Gerald D.; Phase behavior, gas hydrates
 HUNG, Tin-Kan; Fluid dynamics, bioengineering
 HWANG, Charles C.; Multiphase heat transfer, coal combustion

KLINZING, George E.; Particulate systems, solid transport
 KOLAR, Michael; Nuclear energy, electric power generation
 LI, C.C.; Image analysis and pattern recognition
 MAZUMDAR, Mainak; Power system reliability analysis
 MEIER, Gerald H.; Alloy oxidation, hot corrosion
 MORSI, Badie I.; Enhanced oil recovery, coal cleaning, reactor and process engineering
 NEUFELD, Ronald D.; Solid and hazardous waste management, industrial waste, biological processes
 PETTIT, Frederick S.; Hot corrosion, high temperature materials
 POHLAND, Frederick G.; Solid and hazardous waste management, environmental impact assessment and remediation
 QUIMPO, Rafael, G.; Groundwater hydrology, water distribution systems
 RAJAGOPAL, K.; Fluid dynamics, multiphase systems
 RUSSELL, Alan J.; Applied enzymology, biotechnology and protein engineering
 TIERNEY, John W.; Process modeling/control, coal liquefaction
 VALLEJO, Luis E.; Geotechnical engineering, geomembranes, fracture mechanics
 VIDIC, Radisav D.; Physical/chemical processes, adsorption, flue gas clean up
 WENDER, Irving; Catalysis, coal science, coal conversion

ENGINEERING CENTER FOR ENVIRONMENT AND ENERGY

Attachment I

Dr. Frederick G. Pohland, Director
 1140 Benedum Hall
 School of Engineering
 University of Pittsburgh
 Pittsburgh, PA 15261

(412) 624-1880
 fax (412) 624-0135

Introduction

The School of Engineering has a long history and tradition of quality education and research in environment and energy areas ever since the first degrees of "Engineer" were conferred in 1846. The School offers accredited engineering programs in six departments: chemical and petroleum, civil and environmental, electrical, industrial, and mechanical engineering. The School has more than 100 full-time faculty members, many of whom have had industrial experience and continue to participate in industrial, educational and government consulting and service activities.

The Engineering Center for Environment and Energy was established within the School of Engineering to mobilize the unique resources of the School. The Center coordinates the extensive expertise and experience of the faculty in multidisciplinary teams for resolving critical issues in environmental and energy related areas. Collaboration with industrial partners, government agencies and public entities is a key component of Center activities.

Mission

Coordinate the intellectual and physical resources of the School of Engineering with federal, state and local agencies, and with industries and the public to resolve technical, economic, and social challenges associated with environmental and energy resources management, use and preservation.

Goals

- ♦ To promote research that leads to a greater understanding of environmental and energy resources.
- ♦ To encourage and promote engineering education of the highest quality in the environment and energy.
- ♦ To enhance an intellectual atmosphere which encourages synergism and a global perspective as these relate to the Mission.
- ♦ To improve the environment through the development and transfer of information and new technologies to the local, national and international communities.

Organization

Representative Activities

- ♦ Environmental Engineering and Petroleum Engineering Programs
- ♦ Interdisciplinary Environmental Engineering Minor/Certificate Program
- ♦ Center for Energy Research
- ♦ Distance Learning Program

- ♦ Pittsburgh Coal Conference
- ♦ National Conference on Environmental Engineering
- ♦ Environmental Colloquium and Poster Fair
- ♦ Ground-Water Remediation Technologies Analysis Center
- ♦ Program in Environmentally Conscious Processing
- ♦ PA DEP Institute for Environmental Studies
- ♦ Institute for Fly Ash Research
- ♦ Alternative Fuel Vehicles

Facilities

In addition to modern teaching facilities with state of the art instructional equipment, the following facilities are available for environment and energy research at the School of Engineering:

- ♦ Environmental Microbiology and Chemistry Laboratory
- ♦ Unit Operations and Processes Laboratory
- ♦ Solid Waste Laboratory
- ♦ Physical/Chemical Processes Laboratory
- ♦ Environmental Trace Substance Analytical Laboratory
- ♦ Reactor Engineering Laboratory
- ♦ GIS Facility
- ♦ Catalysis Laboratory
- ♦ Supercritical Fluids Laboratory
- ♦ Surface Science Laboratory
- ♦ Advanced Coal Processing Laboratory
- ♦ Coal Conversion Laboratory
- ♦ Solids Transport Laboratory
- ♦ Gas Hydrate Research Laboratory

Attachment II

ENGINEERING CENTER FOR ENVIRONMENT AND ENERGY (ECEE) Thrust Research Areas

Although the environment and energy activities at our neighboring institutions, as briefly summarized in Table 1, cover a wide spectrum of topic areas, ranging from policy analysis, management and training pertaining to science and technology of fossil fuels and environmental issues, the technology and process aspects, particularly those pertaining to industrial applications have received little emphasis.

Table 1: Environment and Energy Activities at Our Neighboring Institutions

Institution	Activities
Carnegie Mellon University	Green Design Initiative, Brownfields Revitalization, and Environmental and Energy Policy Studies.
Pennsylvania State University	Emissions Reduction Research, Bioremediation and Detoxification, Energy and Fuels Research, Coal and Organic Petrology, BioDiversity Research, Artificial Intelligence in Water Quality Control Processes, Gas Turbines and Power Research.
West Virginia University	Longwall Mining and Ground Control Research, Appalachian Oil and Natural Gas Research Consortium, National Research Center for Coal and Energy (with an emphasis on Coal Conversion and Alternative Fuels).
Duquesne University	Education program in Environmental Science and Management through the Bayer School of Natural and Environmental Sciences.

The thrust of the ECEE is in the development of integrated innovative technologies and processes for the protection of the environment and for the efficient use of energy resources. The mission of the ECEE includes emphasis on:

- Total System Integration (from Upstream to Downstream)
- Industrial Applications (Close Collaboration with Industries)
- Community Services (to Local, State and National Constituencies)
- Technology Transfer (through Education Training Programs)
- International Technology Export (with focus on Developing Nations)

Some of the current research activities in environment and energy being conducted by School of Engineering faculty involved with the ECEE are summarized in Table 2. The research activities can be classified into categories covering basic science, CO₂ technologies, environmental technologies, biocatalyst use in environmental applications, industrial process development and control, outreach activities, and international research activities and cooperation. The anticipated outcomes and the benefits to potential sponsors are greatly dependent on the nature of the project. In general, technology transfer is being conducted in conjunction with each research activity. Activities

involving conferences, publications and continuing educations are also summarized.

**Table 2: Current Research Activities of the ECEE Faculty
1995 -Present**

1. Basic Science:

d'Itri	Hydrodechlorination of 1,2,3, - Trichloropropane	\$ 29,750	Dow Chemical
d'Itri	Active Sites for Selective Catalytic Reduction of Nitrogen Oxides	15,000	Exxon
d'Itri	Environmentally Benign Chemical Processing: A Theme for the Future of Chemical Engineering	60,000	NSF
Pettit/Meier	Hot Corrosion Testing and Evaluation of Aluminide Coatings	44,893	Howmet Corp.
d'Itri/Hall	Fundamental Aspects of Selective Reduction of NO _x and Low Temperature Methane Activation Catalyzed by metal-containing Zeolites	133,000	DOE

2. CO₂ Technologies:

Chiang	An Integrated CO ₂ -Based Process for Fluid/Solid Separation	\$50,000	Westinghouse/DOE
Enick	Mixing, Characterization and Flow Studies for the Carbon-Dioxide-Based Microsorption of Recyclable Polyolefins	7,700	Normex Inc.
Enick	Formation Of Macromolecular Structures in Dense Carbon Dioxide	25,000	Am. Chem. Society
Russell/Beckman	Biocatalytic Polymer Synthesis in and from Carbon Dioxide for Pollution Prevention	180,000	EPA
Enick/Beckman	Isolation of Metals Using Carbon Dioxide	63,100	Normex Inc.
Beckman	Reverse Micelles in Carbon Dioxide	18,210	NSF/Oakridge Univ.
Beckman	Supercritical CO ₂ -Mediated Reactions on Polyvinyl Acetate	42,000	Air Products
Beckman	Extraction and Purification of Proteins from Cell Broth Using CO ₂ -Phylic Surfactant/CO ₂ Mixtures	65,000	Genencor Inc.
Beckman/Russell	Design And Synthesis Of Co-Soluble Affinity Ligands and Surfactants for Use in Carbon Dioxide Extractions	50,000	NSF
Beckman	Generation of Highly CO ₂ -Soluble Chelating Agents for the Extraction of Mercury from Mixed Waste	65,028	DOE - Sandia

3. Biocatalyst in Environmental Applications:

Ataai	Optimization of IMAC by Fine-Tuning Protein Metal Interactions and Mathematical Modeling	\$191,541	NSF
Ataai	New Strategies for Designing Inexpensive but Selective Bioadsorbents for Environmental Pollutants	92,297	Texas Univ./DOE

4. Environmental Technologies:

Pohland	Landfill Disposal of Creosote and Pentachlorophenol Treated Wood Poles	\$ 20,036	EPRI
Pohland	Develop the INSIT Model for Soil and Groundwater	25,000	Gas Research
Neufeld	Belt Filter Sludge Processing System	83,000	BFTC
Klinzing	Assessment of Environmental Technologies	10,000	BFTC
Beckman	Environmental Impact Of Polymer Processes	100,000	NSF
Beckman	Environmentally Conscious Manufacturing: Waste Minimization In Chemical Processes	575,000	NSF
Chiang	Oily Wastewater Treatment	200,000	DOE
Casson	HIV in Wastewater: Presence and Viability	16,363	NSF
Vidic/Beckman	Development of Novel Activated Carbon-Based Adsorbents for the Control of Mercury Emissions from Coal-Fired Power Plants	71,607	DOE
Cobb/Geiger	Wood/Coal Co-Firing in Industrial Stokers in Pittsburgh	30,000	USDA Forest Serv.
Neufeld	Mechanical and Environmental Properties of Fly Ash	40,000	EPRI

5. Industrial Process Development and Control:

Goodwin	Attrition Resistant Fe Catalysts for Slurry-Phase Fischer-Tropsch Synthesis	\$125,000	DOE
Morsi	Characterization of Mass Transfer In Cyclohexane Oxidation Process	75,000	DuPont
Morsi	Mass Transfer in Slurry Bubble Columns with High Catalyst Loading	25,000	Exxon
Billo/Bidanda	A Computer Aided Rapid Diagnostic System for Blow Molding	77,516	BFTC
Mazumdar	Stochastic Models for Electric Power Production Costing	200,680	NSF
Kim	Manufacturing Technologies for III-V Refractory Semiconductors	31,100	BFTC
Needy/Bidanda	Development of a Smart Inventory Management System	57,000	BFTC
Norman	Hot Rolling Process Control	60,000	BFTC
Beck	Reduced Modeling in the Control and Optimization of Dynamic Systems	10,000	Alcoa Foundation

6. Outreach Activities:

Pohland	Institute for Environmental Studies	\$131,885	PA Dept. of Environmental Protection
Pohland	Ground-Water Remediation Technologies Analysis Center (GWRTAC)	750,000	NETAC/Univ. of Pittsburgh/EPA-TIO
Wender/Tierney	Cooperative Research Program In Coal Liquefaction	267,347	University of Kentucky
Eror	Cryoprocessing Institute for Advanced Materials	96,278	Argonne Labs
Cobb	Natural Gas Vehicles Technical Assistance Project	296,000	USFHWA/Penn DOT/SPRPC
Ataai	Research Experience for Undergraduates	67,328	NSF

7. International Research Activities and Cooperation:

Goodwin	Comprehensive Chinese Program for Engineering	\$298,606	NSEP
Russell	Biotechnology Versus Chemical Weapons: Implementation of Enzyme Technology into Existing Decontamination Techniques	45,352	German Ministry
Morsi	Mass Transfer in Toluene Oxidation Process	30,000	Equimed, Switzerland
Morsi	Modeling and Optimization of Toluene Oxidation Process	27,000	LABO-Huiles, France
Morsi	Design and Scaleup on slurry Bubble Column Reactors	60,000	Sasol, South Africa
Chiu	Hydrologic, Hydraulic and Sediment Studies for Reservoir Sedimentation in Taiwan	141,800	MOEA Taiwan
Cobb	Ash Utilization in India	22,000	USAID/U.S.-DOE/GAI Consultants Inc.
Chiu	Development and Application of an Efficient Method of Discharge Measurements in Rivers and Streams in Taiwan	18,800	Ntl.-Chung-Hsing Univ.

8. Conferences and Colloquia:

1. The Annual International Pittsburgh Coal Conference (The 14th Conference was held in Taiyuan, China along with DOE workshop on September 23-28, 1997).
2. Annual Developments on Innovative Groundwater Remediation Technologies. The GWRTAC (Ground-Water Remediation Technologies Analysis Center) has been sponsoring an annual one-day conference since 1997.
3. National Conference on Innovative Technologies for Site Remediation and Hazardous Waste

Management. The Conference was sponsored by Environmental Engineering Division of the ASCE, co-sponsored by the Canadian Society of Civil Engineering in cooperation with the a number of national and local organizations, and hosted by the University of Pittsburgh. The proceedings were edited by R. D. Vidic and F. G. Pohland (7/23-26, 1995).

4. The University of Pittsburgh Environment and Energy Colloquium and Poster Fair. The 4th Environment and Energy Colloquium and Poster Fair, sponsored by the University of Pittsburgh-School of Engineering, was organized by the ECEE and held on October 29, 1997.

9. Books and Publications:

1. Emerging Technologies in Hazardous Waste Management VI, Amer. Acad. Of Envir. Engrs. (edited by D. W. Tedder and F. G. Pohland), 1996.

2. Emerging Technologies in Hazardous Waste Management V, ACS Symposium Series No. 607 (edited by D. W. Tedder and F. G. Pohland), 1995.

3. Emerging Technologies in Hazardous Waste Management as a result of 1994 Symposium of the I and EC division of the ACS Symposium Series No. 554 (edited by D. W. Tedder and F. G. Pohland), 1994.

4. WASTECH Monograph Series (Phases I) on Innovative Site Remediation Technology: Process Description and Limitations. (F. G. Pohland, Chair, Steering Committee), 1994.

5. WASTECH Monograph Series (Phases II) on Innovative Site Remediation Technology: Design and Application. (F. G. Pohland: Chair, Steering Committee), 1997-98.

6. Hazardous and Industrial Wastes: Proceedings of the Twenty-Third Mid-Atlantic Industrial Waste Conference, (edited by R. D. Neufeld and L. W. Casson, 1991)

7. Coal-Energy and the Environment: Proceedings of the Annual International Pittsburgh Coal Conference, Volumes 1-14, University of Pittsburgh, 1984-1997 (Volumes 10-14 edited by S.-H. Chiang).

10. Continuing Education:

1. Soil and Ground Water Contamination/Remediation (Dr. F. G. Pohland, Department of Civil and Environmental Engineering. University of Pittsburgh).

2. Conventional Drinking Water Treatment (Dr. L. W. Casson, Department of Civil and Environmental Engineering. University of Pittsburgh).

3. Physical/Chemical Processes in Environmental Systems (Dr. R. D. Vidic, Department of Civil and Environmental Engineering. University of Pittsburgh).

ASIAN STUDIES PROGRAM

The Asian Studies Program (ASP) is part of the University Center for International Studies (UCIS), which is the framework for the international scholarly work of faculty and students at the University of Pittsburgh. ASP was established in 1969 to promote broader knowledge and a new understanding of the nations of South, Southeast, and East Asia. In 1982 there were eight students enrolled in Asian Studies certificate programs; today there are more than 300 graduate and undergraduate students making a major commitment to the study of Asian languages and cultures. ASP is committed to the basic goals of enriching the international dimension of education for all students at Pitt, providing opportunities for students through the University to attain proficiency in an Asian language and familiarity with Asian cultures and societies.

- 3) One course (three credits) on Asia in the major department. If the major department does not have options for an "India" focus (e.g., chemistry, English), the student must take an additional India-related course in a third department.

GRADUATE REQUIREMENTS for the India Studies concentration ASP certificate include:

- 1) Three years (six terms) of a vernacular Indian language at the college level, or equivalent proficiency. If the Sanskrit language is chosen, two years (four terms) are required to fulfill the graduate certificate requirements.
- 2) Five upper-level courses or graduate seminars dealing with India in at least two departments.
- 3) A research paper: either a seminar paper or thesis. The paper can be used to complete departmental requirements for a graduate degree as well as the certificate, but must include research using the student's knowledge of an Indian language.

To enroll in one of the certificate programs, or for more information about any of the activities of the India Studies Program, please call or visit the Asian Studies Program: 412/648-7367, 4E-35 Forbes Quadrangle, University of Pittsburgh, Pittsburgh, PA 15260.

FACULTY

FRED W. CLOTHEY
Professor of Religious Studies
EDWIN D. FLOYD
Associate Professor of Classics
ROBERT HAYDEN
Associate Professor of Anthropology
RENÉ LYSLOFF
Assistant Professor of Music
ROBERT NORMAN
Associate Professor of Public & International Affairs
MARSHALL SINGER
Professor of Public & International Affairs

ADJUNCT FACULTY

JOSEPH S. ALTER
Visiting Assistant Professor of Anthropology
MADHU BAZAZ WANGU
Instructor in Art History & Religious Studies

INDIA

STUDIES

ASIAN STUDIES PROGRAM

UNIVERSITY OF PITTSBURGH

INDIA STUDIES

The INDIA STUDIES PROGRAM at the University of Pittsburgh (Pitt) is dedicated to promoting knowledge about the history, society, and culture of India, one of the world's most dynamic and influential nations. To that end it provides training in some of the languages of India and in area studies through a variety of courses. The India Studies Program encourages multi-disciplinary and interdisciplinary research, and facilitates the exchange of ideas and information through seminars, conferences, and outreach activities for members of both the academic and local communities. These activities are directed by the Asian Studies Program (ASP) at Pitt, part of the University Center for International Studies.

One of the most valuable resources to the continued growth of India Studies at Pitt is the Pittsburgh Indian community. The Pittsburgh area is home to the ninth-largest Indian population in the United States. The western PA region has five temples to serve this community: the Jain-Hindu Temple; the Sri Venkateshwara Temple; the Sikh Gurudwara; the Sri Sai Baba Temple; and the Iskcon (Hari Krishna) Commune. There are also two South Asian Moslem centers in the area.

In addition, two local foundations are active in supporting India Studies in the area: the Kodenkandeth Foundation, which is dedicated to enhancing sensitivity to cultural pluralism; and the Indian Heritage Research Foundation.

Pitt has been a member of the American Institute of Indian Studies since 1979. Pitt is also home to the *Center for the Performing Arts of India* which sponsors many classical music and dance-drama events throughout each year. The University has also supported the *Encyclopedia of Hinduism Project*.

Beginning in 1996 India Studies at Pitt will sponsor a SUMMER INSTITUTE IN INDIAN STUDIES. The Institute will offer four classes: *Music in South India; Religion & Civilization in South Asia;*

Art of India; and Cultures & Societies of India. All of the classes may be taken during a twelve week period.

COURSES

The India Studies Program offers a selection of courses from several departments in the College of Arts and Sciences. Students may pursue more advanced course work in India Studies by enrolling in Independent Studies courses with specific faculty members.

ANTHROPOLOGY

1764 Cultures & Societies of India

CLASSICS

1710 Sanskrit 1
1720 Sanskrit 2
1730 Sanskrit 3
1740 Sanskrit 4
1790 Topics in Sanskrit

FINE ARTS

0700 Special Topics: India
0101 Art of India
0720 Hindu Art (x-listed w/RELGST 0517)
1700 Special Topics: India

HISTORY

1757 Religion in India I (x-listed w/RELGST 1500)
1758 Religion in India II (x-listed w/RELGST 1510)

MUSIC

1358 Music in South Asia

RELIGIOUS STUDIES

0515 Religion & Civilization in South Asia
1500 Religion in India I (x-listed w/HIST 1757)
1510 Religion in India II (x-listed w/HIST 1758)
1516 Temple, Icon, & Deity in India

UNCOMMONLY TAUGHT LANGUAGES

The Department of Linguistics, through the Language Acquisition Institute (LAI), offers opportunities for the study of languages not otherwise available in the University curriculum. The Institute will undertake the development of a course of study for any modern languages for which adequate instructional materials exist, except for those which are taught in the regular foreign language departments of the University.

Languages of India that have been offered in the recent past by the LAI include Hindi and Urdu.

CERTIFICATE PROGRAMS

Students enrolled in any BA, MA, or PhD degree program in any department or professional school at Pitt may earn a Certificate in Asian Studies with a concentration on India. The certificate may be earned by American and international students and is especially helpful for those who want to focus their academic major on India.

The certificate is designed for students who wish to intensify their study of India--either because they intend to use their knowledge of that critical part of the world in their careers after graduation, or because they realize the importance of an understanding of Indian history, language and culture as part of their liberal arts education. Upon graduation, both the academic degree and CERTIFICATE IN ASIAN STUDIES are posted on the student's transcript.

Enrolling in the India Studies-focus certificate program allows students to earn another academic credential at no extra tuition cost and without additional investment in time or work.

UNDERGRADUATE REQUIREMENTS for the India Studies concentration ASP certificate include :

- 1) Two years (four terms) of a vernacular Indian language at the college level, or equivalent proficiency. If the Sanskrit language is chosen, only three terms are required to fulfill certificate requirements.
- 2) Four courses (12 credits) on India in at least two departments outside the major.

**Fifty Years After Independence: Reflections on
India Today
Lecture Series**

sponsored by
The Pitcairn-Crabbe Foundation
The University of Pittsburgh's Department of Religious Studies and
Asian Studies Program

Wednesday February 25, 1998

Gandhi's Fasts: Ethereal Politics and Communal Violence

Dr. Joseph Alter
Assistant Professor of Anthropology
University of Pittsburgh
2M56 Forbes Quadrangle
4:30 p.m.

Thursday March 19, 1998

Fifty Years After Independence: The Role of Dalits (ex-Untouchables) and Ambedkar

Dr. Eleanor Zelliot
Emeritus Professor of History
Carlton College, Northfield Minnesota
2K56 Forbes Quadrangle
4:30 p.m.

Thursday April 2, 1998

Hindu Nationalism and Independent Indians: 1947-1997

Dr. Walter Andersen
Division Chief
The Office of Analysis for Near East and Southeast Asia
U.S. State Department
2K56 Forbes Quadrangle
4:30 p.m.

All lectures are free to the public. For more information, please contact:
Michele Ferrier 648-7414 or e-mail ferrier+@pitt.edu

Students will need to budget for airfare, meals not covered in program fee, books, health insurance, and personal expenses. An estimated budget for these expenses is shown below. Because students' spending habits vary depending on living and travel preferences, this should only be a rough approximation.

Airfare	\$1,500
Personal expenses	\$400
Books	\$50
Application fee	\$50
Visa	\$75

FINANCIAL AID & SCHOLARSHIPS

All state and federal financial aid (with the exception of work-study grants) and most Pitt scholarships which you would normally receive if you were studying on campus are applicable to this program. Students who wish to apply for financial aid should do so as early as possible to the Financial Aid Office, 2nd Floor Bruce Hall. In addition to financial aid, these scholarships are applicable to the PITT IN INDIA program:

- ♦ Study Abroad Scholarships
- ♦ Provost's Scholarships for Study Abroad
- ♦ Nationality Rooms Scholarships

For more information on the PITT IN INDIA program, contact:

Albena A. Balouris
Advisor, Study Abroad Office
University of Pittsburgh
802 William Pitt Union
Pittsburgh, PA 15260
412-648-2299 (phone) 412-383-7166 (fax)
athenab+@pitt.edu

Dr. Fred Clobbey
Chair and Professor, Department of Religious Studies
University of Pittsburgh
2616 Cathedral
Pittsburgh, PA 15260
412-624-5977 (phone) 412-624-5994 (fax)
clobbey+@pitt.edu

ADMISSIONS & PROGRAM REQUIREMENTS:

- ♦ Applicants must have a 2.75 GPA (for students who are below this requirement, possible exceptions could be made to the dean of your school or college).
- ♦ Students must take all 12 credits offered.

APPLICATION PROCEDURES:

- ♦ Applications are available and should be returned to the Study Abroad Office.

DEADLINE: FEBRUARY 15, 1998

- ♦ A \$500.00 non-refundable deposit is due 2 weeks after acceptance to confirm participation in the program.

- ♦ Students will be required to attend at least one orientation session on the Pitt campus. For possible exceptions, contact Albena Balouris in the Study Abroad Office.

STUDY
ABROAD
OFFICE

Pitt around the planet...

PITT IN INDIA

HYDERABAD, SUMMER 1998

Join the University of Pittsburgh in Hyderabad, India for Summer 1998!

The University of Pittsburgh is pleased to offer a 10-week summer study abroad program which introduces students to the fascinating country of India. The program will be held at the University of Hyderabad, a culturally rich city and university environment.

HYDERABAD—THE CITY

The city of Hyderabad is the fifth largest city in India with history dating from the 14th century. From the 17th through the 19th centuries it was one of the most opulent cities in Asia. Today it is pluralistic, using four languages locally (Telugu, Hindi, Urdu, and English) and is a microcosm of Indian religious and ethnic diversity. The city has a moderate climate and is home to five major universities and several research and cultural institutes.

HYDERABAD—THE UNIVERSITY

The University of Hyderabad is a nationally funded university founded in 1974. It is a strong research and teaching university with a computerized library and an internationally connected faculty. It is situated on a large campus outside Hyderabad.

ACADEMIC PROGRAM

The program will be coordinated by Dr. Aparna Rayaprolu, PhD, Sociology, University of Pittsburgh. In addition, Fred Clothey (Religious Studies), will accompany students as program facilitator. An additional 20 faculty from the University of Hyderabad are available for the program.

COURSE DESCRIPTIONS:

The PITT IN INDIA PROGRAM spans 10 weeks and consists of 3 components, worth a total of 12 credits:

- 1. INTRODUCTION TO CENTRAL INDIA
- 2. ETHNOGRAPHY AND THE INDIAN LANDSCAPE
- 3. DIRECTED STUDY PROJECT

STUDENTS MUST TAKE ALL OF THE 3 COURSES OFFERED FOR A TOTAL OF 12 CREDITS:

ANTHROPOLOGY 1764: INTRODUCTION TO CENTRAL INDIA

(Weeks 1-10: June 22-August 28) 3 CREDITS

The program begins with this course providing students with a general introduction to India with a multi-disciplinary approach, an intensive survey of the region, and how it reflects the history, culture, and geography of the subcontinent. Learning is largely through field trips and hands-on observation. Topics include:

- ◆ geographical and cultural history
- ◆ politics, literature, and artistic heritage
- ◆ linguistics and rudiments of language
- ◆ religious and social landscape
- ◆ economic patterns
- ◆ effects of globalization, ethnicity, and urban and national policies
- ◆ contemporary culture including artists, writers, directors, and ritual life
- ◆ future directions of India

SOCIOLOGY 1414: ETHNOGRAPHY AND THE INDIAN LANDSCAPE

(Weeks 1-4: June 22-July 17) 3 CREDITS

This course focuses on developing skills in observing and interpreting the contemporary Indian landscape and providing an avenue to meaningful interaction with contemporary India. Topics include:

- ◆ gender issues
- ◆ human rights
- ◆ minority issues
- ◆ development projects
- ◆ religious pluralism

DIRECTED STUDY PROJECT

(Weeks 1-10: June 22-August 28) 6 CREDITS

Students have 2 options from which to choose:

- (1) The student may work closely with a faculty advisor to engage in a reading and research program on a topic of the student's interest. Topics may be preselected or may emerge from the introductory courses. Options may range widely from the anthropology of food to the impact of

Telugu culture, aspects of Islamic Studies, the role of women in Indian life, and so on. (3-6 CREDITS)

- (2) The student will choose from one of the courses listed in the University's Study India Program (available only if a minimum of 3 students register per class). These courses include Intensive Hindi, Intensive Telugu, Indian religion, cinema, literature, dance, etc. (3-6 CREDITS)

HOUSING/MEALS

- ◆ (1) University guest houses are available for all students. Students will be housed in double rooms which have a private bath. Indian style food and hygienic water will be provided.
- ◆ (2) Students can also choose homestays with Indian families, the details of which will be negotiated ahead of time. Indian style food and hygienic water will be provided.

PROGRAM FEE

\$2,200	For Pitt-students
\$2,500	For non-Pitt students

1800

Fee includes:

- ◆ Tuition and fees for 12 credits
- ◆ Housing and meals
- ◆ Field trips to various sites of cultural importance
- ◆ Students will also have access to bicycles at no charge

1998 PROGRAM DATES

Arrival date	Saturday, June 20
Classes starts	Monday, June 22
Classes end	Friday, August 28
Departure date	Sunday, August 30