B-87-192

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

Date: E-20-546

Project Title: Instructional Scientific Equipment Grant

Project No: E-20-546

Project Director: F. G. Pohland

Sponsor: National Science Foundation, Washington, DC

Effective Termination Date: 1/31/81

Clearance of Accounting Charges: 1/31/81

Grant/Contract Closeout Actions Remaining:

_ Final Invoice and Closing Documents
x Final Fiscal ~~Report~~ Accounting
x Final Report of Inventions (if positive)
_ Govt. Property Inventory & Related Certificate
_ Classified Material Certificate
_ Other _____

Assigned to: Civil Engineering (School/~~Laboratory~~)

COPIES TO:

~~Project Director~~
~~Division Chief (EES)~~
~~School/Laboratory Director~~
Dean/Director--EES
Accounting Office
Procurement Office
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~~Reports~~ Coordinator (OCA)
Admin. Coordinator
Library, Technical Reports Section
EES Information Office
Project File (OCA)
Project Code (GTRI)
Other _____

CA-4 (1/79)

E-20-546

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

FINAL PROJECT REPORT
NSF FORM 98A

PLEASE READ INSTRUCTIONS ON REVERSE BEFORE COMPLETING

PART I–PROJECT IDENTIFICATION INFORMATION

1. Institution and Address	2. NSF Program	3. NSF Award Number
Georgia Institute of Technology Atlanta, Georgia 30332	ISEP	SER78-12270
	4. Award Period From 9/8/78 To 1/31/81	5. Cumulative Award Amount $16,200

6. Project Title

Instructional Scientific Equipment Grant

PART II–SUMMARY OF COMPLETED PROJECT *(FOR PUBLIC USE)*

The primary objective of the project was to provide an opportunity to introduce undergraduate students to techniques used in the measurement of environmental quality and impacts of engineering systems on the environment. To achieve this objective, an undergraduate Environmental Monitoring Laboratory was designed and equipped to permit senior-level students to measure parameters used in the analysis of the environmental impacts of selected engineering projects. This laboratory facility was developed in conjunction with existing capabilities within the Environmental Engineering program and was used to accommodate a newly developed course in Environmental Impact Monitoring and Assessment. Selected students from both engineering and science disciplines have participated in the program and evaluated impacts of local engineering projects on the air, water and land environments.

Student response has indicated a developing awareness of the consequences of engineering projects on the environment, the methods used to assess their environmental impact, and the necessity of interdisciplinary involvement in impact analysis. A consciousness of these issues has not only provided the student with a basis for considering environmental issues, but has promoted their use in planning and managing various engineering projects. Therefore, graduating engineers will leave with the capacity to include issues other than technical and economic in justifying projects and determining their overall acceptability.

PART III–TECHNICAL INFORMATION *(FOR PROGRAM MANAGEMENT USES)*

1. ITEM *(Check appropriate blocks)*	NONE	ATTACHED	PREVIOUSLY FURNISHED	TO BE FURNISHED SEPARATELY TO PROGRAM	
				Check (✓)	Approx. Date
a. Abstracts of Theses	X				
b. Publication Citations	X				
c. Data on Scientific Collaborators		X			
d. Information on Inventions	X				
e. Technical Description of Project and Results		X			
f. Other *(specify)*					

2. Principal Investigator/Project Director Name *(Typed)*	3. Principal Investigator/Project Director Signature	4. Date
Dr. Frederick G. Pohland		4/13/81

NSF Form 98A (5-78) Supersedes All Previous Editions

Form Approved OMB No. 99R0013

Part III TECHNICAL INFORMATION

c. Data on Scientific Collaborators (Project Participants)

Project Director: Dr. Frederick G. Pohland, Professor
School of Civil Engineering

Collaborating Civil Engineering Faculty and Staff:

Dr. Edward S. K. Chian, Professor
Dr. Larry J. Forney, Associate Professor
Dr. F. Michael Saunders, Associate Professor
Dr. Joseph P. Gould, Assistant Professor
Dr. Byung R. Kim, Assistant Professor
Dr. Sai H. Lee, Assistant Professor
Dr. Wendall H. Cross, Research Scientist

Participating Students:

Mr. Robert T. Adams
Mr. Kelvin E. Brooks
Mr. Ronald F. Brunson
Mr. Ben Chen
Mr. David A. Chin
Mr. Roger A. Dabalsa
Mr. Randy C. Durham
Ms. Holly A. Elmendorf
Mr. Winston R. Esteves
Mr. James D. Etherton
Mr. Gregory A. Farmers
Mr. Larry E. Fitchhorn
Mr. A. J. Fitzsimons, Jr.
Mr. Sarba Ghosh
Mr. George F. Haines
Mr. Jose Henriques
Mr. Marvin Holmes
Mr. Kurt Kratz
Mr. Rodney G. Kutz
Mr. Gallart J. Medero
Mr. Christopher McGahey
Mr. John P. O'Neil
Mr. Alton A. Ordway
Mr. Willard T. Parker
Mr. Richard J. Posey
Mr. Edwin W. Quillian
Ms. Ruth E. Ramsey
Ms. Diana Rasham
Ms. Elaine L. Ross
Mr. Pedro M. Rosello
Mr. Franklin Rucker
Mr. Jagdish Salgaonkar
Mr. Sunil I. Shah
Ms. Christine A. Shaw
Mr. Laurence H. Smith
Ms. Venessa A. Smith
Mr. Bruce J. Spiller
Mr. Michael W. Wendel
Mr. Carson D. Whitten, III
Mr. John T. Wilkins, Jr.
Mr. Tyrone C. Williams
Mr. Tak Pui Wu
Mr. Gregory L. Yeatman

e. Technical Description of Project and Results

A. Introduction

Prior to the initiation of the ISEP project at Georgia Tech, undergraduate engineering students were not given a formal opportunity to participate in the actual measurement of environmental quality parameters nor in the subsequent use of these data to evaluate the overall environmental impact of an engineering system. Moreover, a limited number of formal courses were available which dealt with and introduced the student to environmental quality and pollution control concepts. Therefore, the undergraduate engineering student did not have an opportunity to investigate in detail the effects of actual engineering systems on environmental quality from the standpoint of environmental impace analysis.

The project focused on this need, first by obtaining the necessary space and supporting facilities to develop an Environmental Monitoring Laboratory, secondly by furnishing it with specialized instrumentation equipment, and supplies, and finally by utilizing the space and equipment to develop formalized courses in Environmental Impact Monitoring and Assessment and in Hazardous Waste Management. Both of these two courses contain a laboratory period and are available to senior level students; the former was stipulated as a desired goal in the project, the latter was developed as a response to the potential for catostrophic impacts of hazardous waste on the environment and was possible only because of the availability of the environmental monitoring laboratory. As such, it was an additional accomplishment derived in part as a consequence of the successful completion of the project. Moreover, this capability and implementation has been recognized by the administration by increased support for continued growth of the overall emphasis on environmental engineering within the School of Civil Engineering at Georgia Tech.

B. Laboratory Development

The Environmental Monitoring Laboratory was developed from a space within the Daniel Laboratory Building on the Georgia Tech campus. The Daniel Laboratory Building houses much of the research and teaching activities of the Environmental Engineering program and the subject laboratory (Room 157) contains 350 square feet of dedicated space. This space was totally renovated including the installation of: three laboratory benches equipped with compressed air, natural gas, and 110 V, 60 Hertz electrical service; two sinks with hot and cold running water; air conditioning; fluorescent lighting; tile floors; and, storage shelves for small equipment and supplies.

The supplies and equipment for the laboratory were derived from NSF funding, institutional matching and donations. Major items of equipment supportive of the project include:

2, GCA/Precision Scientific Air Monitoring Stations
3, Fisher Scientific (Model 610) pH Meters
2, ARF Products Electrolytic Respirometers (Model ER-1 with Datel DPP-7 printers)

3, Millipore Fecal Coliform Field Sampling Kits and Incubator
1, Dohrman-Envirotech Total Carbon Analyzer
1, Ionics Total Oxygen Deman Analyzer
1, Hewlett Packard 5711 Gas Chromatograph with 3380A
Printer-Plotter Integrator
1, Technicon Autoanalyzer II System
1, Romicon, Inc. Model HF ISSS/HF2SSS Ultrafiltration System
1, Culligan Aqua-Clear Series MD Ultrafiltration System

The laboratory facility has been augmented by the purchase of chemicals and other supplies necessary for the operation of the equipment and successful completion of study projects associated with the courses in environmental monitoring and impact analysis and in hazardous waste management. Support for supplies will be continued by the School of Civil Engineering as justified by increasing student participation in the environmental monitoring emphasis.

C. Course Development

To provide a proper setting for the laboratory effort, two new laboratory courses have been developed to address environmental issues. These courses have been made available to senior-level or entering graduate students to provide opportunity for study of environmental quality and impacts from engineering systems. To date, a total of 43 students have participated in these courses since they were first offered under the auspices of this project.

a. Environmental Impact Monitoring and Assessment, 2-3-3

This course was developed to provide an intorduction to techniques for monitoring and assessing the impacts of engineering systems on environmental quality. It provides two hours of lecture and three hours of laboratory effort per week for the ten weeks constituting an academic quarter at Georgia Tech and awards three quarter hours of credit. As indicated in the attached course outline, principles and methods of assessment and impact analysis in the various environmental phases including the air, water, land, and urban and cultural environments are discussed in class with particular emphasis on technical and/or engineering issues. The laboratory periods are devoted to introduction to methods and techniques of environmental quality measurement and evaluation of selected field projects of local concern.

Example projects used by students in the past have included studies of the impacts of waste discharges on receiving streams including measurements of organic loadings and biological stresses; the impacts of urban transportation systems on air quality including measurements of particulates, organics and inorganic emissions; and the contamination of groundwaters by land disposal practices including analyses of leachate for organic and inorganic constituents. In addition, each student is required to present a term report of these analyses and to supplement it with an executive summary of an existing environmental impact statement of an engineering project of the student's choice.

b. Hazardous Waste Management, 2-3-3

Although not included as a goal within the project, the availability of the environmental monitoring laboratory has helped to catalyze the development of a companion course on Hazardous Waste Management. This course also awards three

quarter hours of credit, meets twice a week (one hour each) for lecture, and once a week (three hours) for laboratory. The thrust of the course is to provide an introduction to hazardous waste management with special emphasis on sources and characteristics, transportation, treatment and disposal. These topics are integrated with the laboratory exercises which include techniques for measuring and monitoring potential environmental impacts within the current regulatory perspective.

In addition to the preparation of a report on the laboratory effort, the student is required to develop a term paper focusing on a current hazardous waste management problem. Example laboratory projects have included the determination of impacts of co-disposal of municipal and industrial solid wastes on leachate quality, the toxicity of metal plating wastes, and the presence of priority pollutants in waste discharges.

Topics specifically addressed during the course have included:

- Sources and Characteristics of Hazardous Materials

    Classification and Chemistry of Hazardous Materials
    Health Hazards-Toxicology of Hazardous Materials
    Radioactive Materials
    Industrial Sources of Hazardous Materials

- Handling and Transport of Hazardous Materials

    Inventory Systems
    Personal Safety and Protective Equipment
    Shipping Containers and Vehicle Requirements
    Regulations

- Hazardous Materials Spills

    Prevention
    Clean-up and Treatment
    Emergency Response Assistance Systems

- Monitoring and Model Evaluation Systems

    Instrumentation and Analytical Procedures
    Environmental Models, Use and Evaluation: Air, Water, Land
    Standards and Compliance Requirements

- Disposal of Hazardous Wastes

    Source Reduction and Process Modification
    Methods and Applications: Incineration, Burial, Chemical Neutralization, Co-disposal, Recycling, Exchanges
    Advantages and Limitations
    Cost and Risk Analysis
    Site Selection and Maintenance
    Liability and Responsibility
    New Techniques
    Case Histories

- Federal and State Laws and Regulations

    Resource Conservation and Recovery Act (RCRA)
    Toxic Substances Control Act (TSCA)
    Hazardous Materials Transportation Act (HMTA)
    Other Laws and Regulations
    Federal/State Responsibilities
    Hazardous Waste Management Responsibilities and Liabilities

Both of the courses discussed herein are presently undergoing internal review for final authorization as routine catalogue offerings.

CE 4803

ENVIRONMENTAL IMPACT MONITORING AND ASSESSMENT

Course Outline

Lecture No.		Assignments*
1-2.	Introduction and Course Rationale a. Selection and Assignment of Term Papers b. Background; Introduction to Environmental Quality and its Protection c. The National Environmental Policy Act (NEPA) d. Related Environmental Legislation e. State Programs	Chapter 1
3-4.	Principles of Environmental Assessment and Impact Analysis a. The Environmental Assessment Process b. Impact Prediction and Analysis Procedures c. Format for Environmental Impact Statements	Chapters 2 and 10
5-7.	Description of the Environmental Setting a. Purpose and Rationale b. Environmental Factors c. Sources of Information	Chapter 3
8-9.	Prediction and Assessment of Impacts on the Air Environment a. Basic Concepts of Air Pollution b. Sources of Information c. Prediction and Assessment	Chapter 4
10-12.	Prediction and Assessment of Impacts on the Water Environment a. Basic Concepts of Water Pollution b. Sources of Information c. Prediction and Assessment	Chapter 5
13.	Mid-Term Examination	
14-17.	Prediction and Assessment of Impacts on the Land and Urban Environments a. Basic Concepts of Ecology b. Basic Concepts of Noise Pollution c. Sources of Information d. Prediction and Assessment	Chapters 6 and 7
18-19.	Cultural and Socioeconomic Issues a. Cultural Resource Identification b. Socioeconomic Factors c. Sources of Information d. Prediction and Assessment	Chapters 8 and 9
20.	Course Summary and Evaluation	

Laboratory No.

1.	General Laboratory Procedures, Laboratory Safety and Introduction to Laboratory Equipment and its Use
2.	Methods of Sampling and Storage of Environmental Samples
3-4.	Instrumental Methods for Analysis of Samples from the Air, Water and Land Environments
5.	Selection and Assignment of Field Monitoring Projects
6-8.	Collection and Analysis of Environmental Samples
9.	Data Evaluation and Environmental Impact Assessment
10.	Presentation of Results

* Text: Environmental Impact Assessment, L. W. Canter, McGraw-Hill Book Company, New York, 1977.