

**1 of 3**



**ENVIRONMENTAL HAZARDS ASSESSMENT  
PROGRAM  
ANNUAL REPORT**

**FOR**

**GRANT DE-FG01-92EW50625**

**SUBMITTED TO THE  
U. S. DEPARTMENT OF ENERGY**

**BY THE**

**MEDICAL UNIVERSITY OF SOUTH CAROLINA**

**October, 1993**

**MASTER**

## **Foreword**

In June of 1992, the U. S. Department of Energy (DOE) awarded grant assistance to the Medical University of South Carolina (MUSC) for the Environmental Hazards Assessment Program (EHAP).

In February, 1993, a Status Report outlining progress on the grant in the first six months was published. In that report, we also presented our plans for the next six months and requested changes in the objective class code budgets.

The year one planning effort activities and accomplishments are documented by publishing this Annual Report. Included are copies of all deliverables generated and milestones achieved during this first year.

This report, the EHAP Annual Report, is the second of three reports that document activities under the grant. The first, the Program Implementation Plan, was completed and published in July. It describes the comprehensive plans that will guide execution of this DOE funded research program at MUSC for the remainder of the grant period. This report details progress made during the first year of the grant. The third will be the Second Year Program Plan and will be completed later this month. It details specific project plans for the next year of the grant. Each report has a specific purpose and concentrates on a particular aspect of the work accomplished or planned. However, there is a great deal of carryover and commonality among the reports. So each report can stand alone - without reference to other reports - some descriptions and sections are included in more than one of these reports.

## **DISCLAIMER**

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## 1.0 INTRODUCTION

On June 23, 1992, the U. S. Department of Energy (DOE) signed Assistance Instrument Number DE-FG01-92EW50625 with the Medical University of South Carolina (MUSC) to support the Environmental Hazards Assessment Program (EHAP).

Dr. James B. Edwards, President of the Medical University of South Carolina recently suggested that "Good Health is not the result of 'good doctorin' but the result of a healthy society in a healthy, economic, political and biological environment." In pursuit of that lofty goal he was reminded by Dr. William J. Schull, from the University of Texas Health Science Center of an old quote by Thomas Jefferson.

"I know no safe depository of the ultimate powers of society but the people themselves; and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion."

*- Thomas Jefferson*

It is fitting that a grant of this magnitude turns to the people themselves, at the crossroads, to seek the answers. Inform their discretion. Solve problems. Move ahead.

### 1.1 Grant Objectives

The objectives of the EHAP program stated in the proposal to DOE are to:

1. Develop a holistic, national basis for risk assessment, risk management, and risk communication which recognizes the direct impact of environmental hazards on the health and well-being of all,
2. Develop a pool of talented scientists and experts in cleanup activities, especially in human health aspects, and
3. Identify needs and develop programs addressing the critical shortage of well-educated, highly-skilled technical and scientific personnel to address the health oriented aspects of environmental restoration and waste management.

### 1.2 Initial Task Structure

The specific objective will be to establish an Environmental Hazards Assessment Program through:

1. Assembly of a Program Administration Team and subsequent comprehensive internal and external program governance structure.

2. Completion of a detailed Program Implementation Plan over an initial twelve month period for each of six discrete, but closely interrelated tasks:
  - a. Initiate comprehensive data collection/reformatting to create a risk calculation Database for retrospective reference, study, and interpretation.
  - b. Create the concept of a Living Laboratory in association with appropriate national and/or international sites.
  - c. Establish a holistic Assessment Response Team to address occurring health and risk issues in a timely manner.
  - d. Initiate and maintain a major Education Initiative to produce knowledgeable individuals with combined expertise in health related disciplines as well as in hazardous, radioactive, and mixed waste management.
  - e. Develop and implement a comprehensive National Health and Risk Training for business and government workers in environmental restoration and waste management.
  - f. Develop, design, and implement a Public/Professional Outreach program directed towards the general public and appropriate professional groups.
3. Direct the total program on a nationwide basis through a combination of in-house administration, coordination of appropriate external resources, and brokering the remainder."

These components remain, but are restructured based on lessons learned in the first year to more effectively accomplish the objectives.

### **1.3 About the Program Implementation Plan**

The first year of the grant was devoted to the development of a working program implementation plan. During the developmental process some key objectives were achieved such as developing a Doctor of Philosophy degree program in Environmental Studies at MUSC and conducting the first Crossroads of Humanity Series Round Table Forum. These milestones are detailed in this report. The PIP (Program Implementation Plan) details the objectives, management and budgetary basis for the overall management and control of the grant over the next four years, the yearly program plans provide the monthly and day-to-day programmatic and budgetary control by which the PIP was developed.

## 2.0 DEVELOPING THE PIP

### 2.1 Internal and External

The planning process focused both internally and externally to MUSC. The process, shown in Figure 2.0, began in July of 1992, by initiating a series of meetings and discussions with:

1. people who have been involved in environmental cleanup decisions for some time (e.g., federal, state, and local government agencies; industries; environmental groups; private citizens; elected officials; and labor unions)
2. people within the health care professions, and
3. people within MUSC.

The meetings were dynamic and evolving. As we learned from each interaction, we examined the programs which MUSC could put together to pilot test our ability to implement the approach and accomplish the objectives.

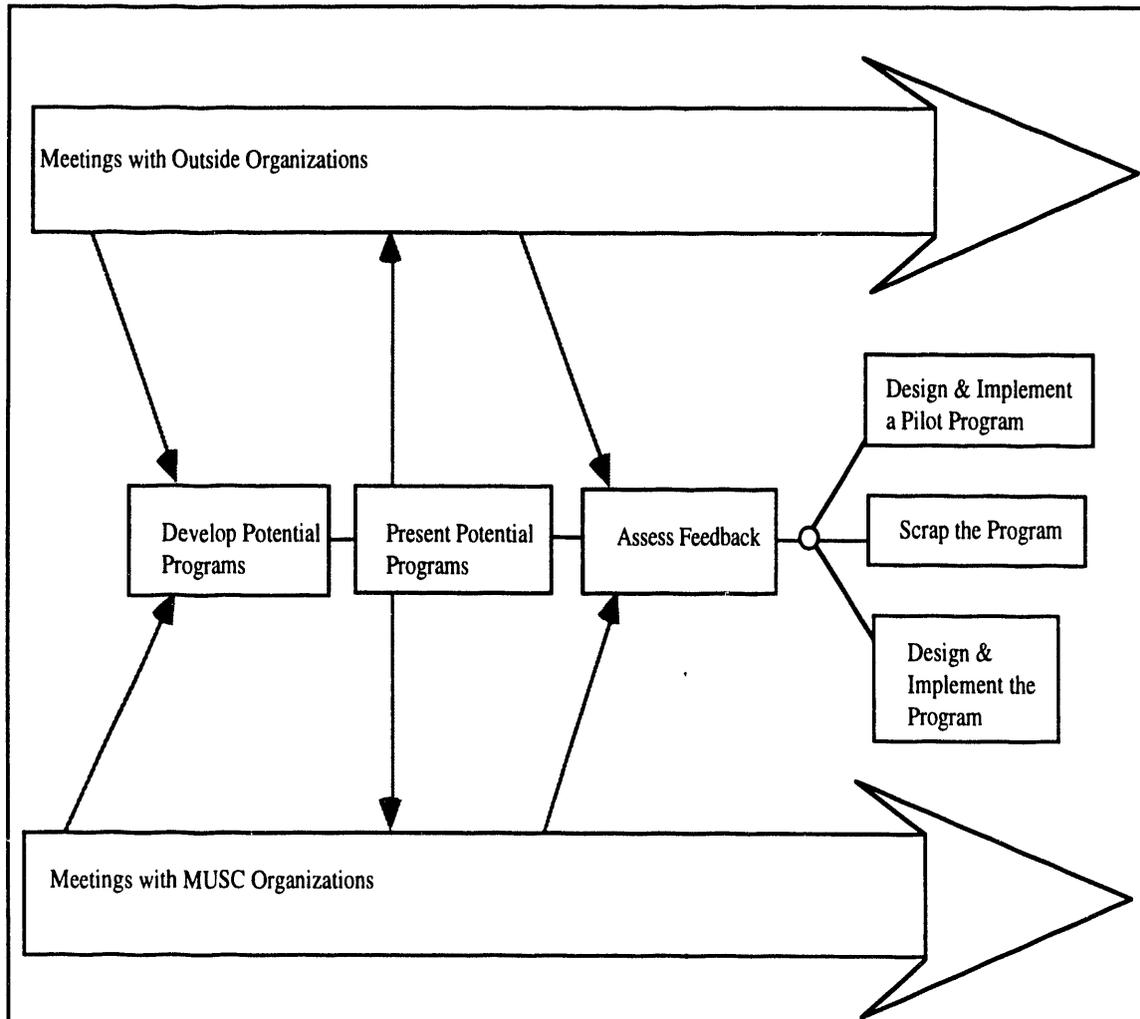


Figure 2.0. The Planning Process

The major question posed was "What should MUSC do to make a positive difference in environmental cleanup?" In posing the question broader than the objective statements of the grant, we were able to stimulate fewer conditioned responses.

## **2.2 Meetings**

### 2.2.1 Meetings with people in the environmental cleanup business

- Meeting in Charleston between key DOE managers and MUSC faculty in August, 1992.
- Workshop in Charleston with over 50 people attending from MUSC, DOE and other agency people (National Labs, EPA, SCDHEC, CCEM, and others) in September, 1992.
- Visit to EPA's Human Health Effects Research Laboratory by MUSC administration and faculty in October, 1992.
- 4 trips to Washington, DC for meetings with managers from DOE's Office of Environmental Restoration and Waste Management and Office of Environmental Health in addition to the 4 visits by individuals or groups of DOE managers to Charleston for meetings (1992-1993).
- Numerous meetings and discussions with people from industries, such as Kaiser Engineers, General Engineering Laboratories, Waste Management, and Phillips Petroleum, involved in risk assessments and environmental databases (1992-1993).
- 4 meetings with the National Laboratory Directors' Environmental/Occupational Health Standards Steering Group (1992-1993).
- Meetings with Pacific Northwest Laboratories, Idaho National Engineering Laboratory, Brookhaven National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratories, and Savannah River Technology Center personnel (1992-1993).
- Numerous meetings with faculty from other universities such as Emory University, Clemson University, and University of Charleston (1992-1993).
- Meetings and discussions with various public interest group representatives (e.g., Natural Resources Defense Council, Energy Research Foundation, and Rocky Flats Monitoring Council) (1992-1993).
- Meetings with various South Carolina state agencies involved in environmental activities such as the Department of Health and Environmental Control and Wildlife and Marine Resources (1992-1993).

### 2.2.2 Meetings with health care professionals

In visits to MUSC, the grant objectives were discussed in great detail with the president of the Association of Academic Health Centers (AAHC) and with the president of the Association of American Medical Colleges (AAMC). Continuing discussions are ongoing to make the grant objectives the environmental health issues primary themes for these organizations in year 1994.

The preliminary Program Implementation Plan was presented at the Annual health care provider meeting in December, 1992, under the sponsorship of AAHC which included representatives of the Federation of Associations of Schools of the Health Professions (FASHP). In attendance were representatives of:

- American Association of Dental Schools
- Association of Academic Health Centers
- Association of American Medical Colleges
- Association of Schools of Allied Health Professions
- Association of Schools of Public Health
- Association of American Veterinary Medical Colleges
- Association of University Programs in Health Administration
- American Association of Colleges of Osteopathic Medicine
- American Association of Colleges of Podiatric Medicine
- American Association of Colleges of Pharmacy
- American Association of Colleges of Nursing

### 2.2.3 Meetings with MUSC organizations

Numerous meetings were held in 1992 and 1993 with researchers and administrators within MUSC including the

- Board of Trustees,
- MUSC Advisory Board,
- Deans of the Colleges of Medicine, Nursing, Dental Medicine, Psychiatry, Pharmacy, Health Professions, and Graduate Studies
- Department Chairpersons, such as Pharmacology, Microbiology and Immunology, and Biometry and Epidemiology, and
- Individual Faculty.

Regular meetings on a bi-weekly basis have been held since January, 1993 to review the preliminary Program Implementation Plan and discuss the various programs and progress as well as obstacles. And to determine the next steps with faculty and staff from the following offices and departments:

- President
- Vice President for Academic Affairs
- Vice President for Finance
- Dean of Graduate Studies
- Center for the Study of Aging/Internal Medicine
- Library Services
- Educational Services
- Biometry and Epidemiology
- Microbiology and Immunology
- Environmental Health Sciences
- Pharmacology

## **2.3 Examples of How the Process Has Worked**

A few examples of actual programs this first year will help demonstrate how the planning process worked.

Early in the grant start-up, a program of basic research in toxicology was proposed as a major program central to accomplishing the grant objectives. When this program was proposed to a number of different outside peer review groups, the overwhelming feedback was negative, so we did not initiate that program.

A program to study beryllium was proposed and received mixed reviews from the external peer review group. The peer review group recommended initiation of a feasibility study to progress the ideas to the point where a more thorough review might be feasible. The feasibility study is not complete. However, early indications are that the focus should be changed from studying the susceptibility of individuals to chronic beryllium disease to using beryllium as a start in examining environmental triggers to genetic effects. When the feasibility study is complete, we will present the results to our external peer review group of experts, outside MUSC, to get feedback on the proposed program's merits. We will either drop the study or initiate the broader study based on the feedback from the reviews.

The idea of bringing experts from a wide-range of backgrounds together to identify and develop cleanup issues leading to a new approach to making these decisions received initial support from our reviews. Therefore, we designed the Crossroads of Humanity Series of workshops and forums. We pilot tested the Series with the first Round Table Forum. The feedback was overwhelmingly positive, so we intend to continue with this series as the flagship task under the grant. Perhaps the most encouraging aspect of the Crossroads is that many issues for future research are identified, health care providers are becoming aware of the consequences of their failure to participate in the debate, the costs of historical medical conservatism is illuminated. The dialogue is now engaged by a bold new vision and direction, a new and noble experiment to reclaim the right to choose has begun.

#### **2.4 Evolving from Planning to Implementation**

The lessons learned from the planning process and the Preliminary Program Implementation Plan became basic premises for the Program Implementation Plan. The fundamental approach of developing program objectives through networking by interacting with groups of people, experts nationally and internationally became a method of operation which links the activities of the grant with reality. To be able to bring together unrelated groups of people whose only common thread is an interest in the environment and who share their lifetime of experience is a reality check often impossible to find and a quality control measure which should continue during the life of the grant. The planning process itself has demonstrated the value to MUSC of this kind of interaction and feedback.

### 3.0 PROGRAM STRUCTURE

#### 3.1 Program Elements

To better accomplish the objectives over the next four years, we have organized the grant efforts into three major elements:

- The Crossroads of Humanity Series,
- Research, Science and Education Programs, and
- Program Management.

The relationship of these elements among each other is shown in Figure 3.0. Each element has a specific programmatic function which is briefly described in the following paragraphs and described in more detail in the following sections. In addition to the function, each element has the responsibility to involve people from outside MUSC faculty, staff, and students. The principal outside participants are also shown in Figure 3.0.

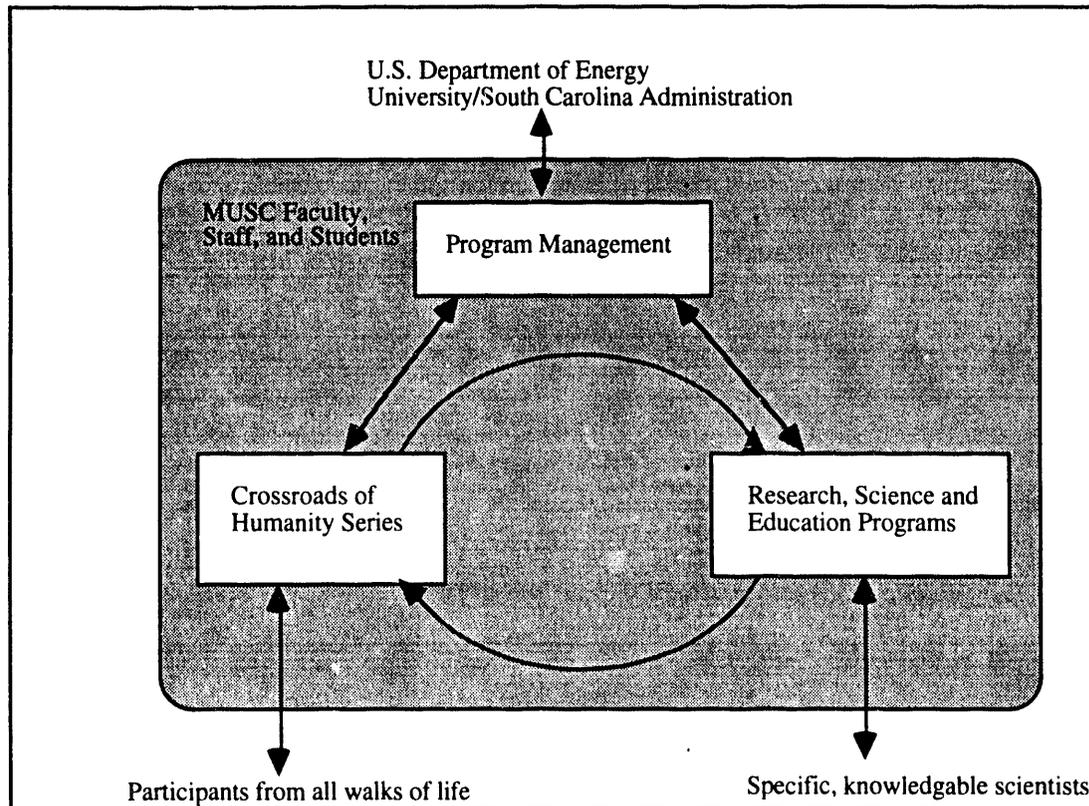


Figure 3.0. The Major Program Elements and Their Relationships.

The Crossroads of Humanity Series with its associated projects, brings talented scientists and experts from all walks of life together to develop a new, holistic basis for risk management, risk assessment, and risk communication. That basis is focused on human health. As such, the Crossroads Series program becomes the driver for the entire grant

efforts, as well as one of the places where research results are presented and used for the public good. It is also through the Crossroads Series that we initially involve health care professionals and generate useful materials for science and education.

The Research, Science and Education Programs provide a foundation to enable health care providers and researchers to explore deeply into environmental health issues. Medical and graduate students learn about environmental health issues through research, lectures, and case studies. Faculty engage in environmental health issues through research and teaching. As research studies are called for in the Crossroads Series, the faculty and students in the science and education programs will conduct this research and present the findings to the participants in the Series. Thus, the science and education programs will evolve throughout the grant from programs focused on science and education objectives alone to programs focused on resolving the problems raised through the Crossroads of Humanity Series by people from all walks of life as problems needing resolution to move to a better basis for making decisions on environmental cleanup.

The Program Management element provides reporting, budgeting and accounting, monitoring, and program direction to the other programs to ensure we accomplish the grant objectives in an effective and efficient manner.

### **3.2 Expenditures - Year 1**

Personnel	1,289,773.78
Contractual Services	370,422.75
Supplies	156,006.64
Fixed	23,263.20
Equipment	370,806.31
Travel	103,628.29
Traineeships	83,250.00
Subcontracts	65,082.03
Indirect Costs	<u>824,186.00</u>
	3,286,419.00

## 4.0 PROGRAM MANAGEMENT

The Environmental Hazards Assessment Program Office (Program Office) was established by the MUSC administration to ensure the management of grant efforts to meet the program goals and objectives. These goals include the development of joint venture funding of environmental programs.

The Program Office reports to the office of the Vice President for Academic Affairs and Provost.

The mission of the Program Office and the projected efforts of the Program Office faculty and staff over the next five years are illustrated in Figure 4.0. In addition to administrative and reporting functions, the Program Office will coordinate the development of private sector support for "spin-offs" of the environmental programs at MUSC. To support this mission, MUSC has made non-federal funds available to the Director.

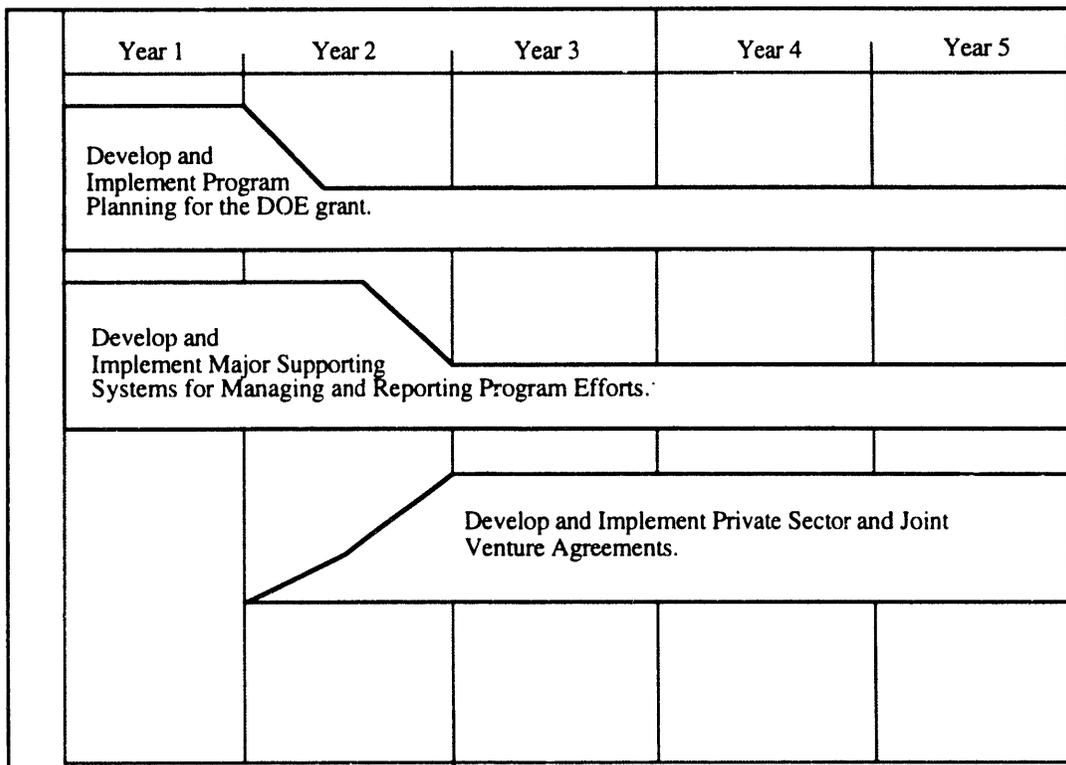


Figure 4.0 The EHAP Program Office Major Efforts

The first-year efforts of the Program Office were focused on the development and implementation of the planning process. The products of this effort are this program implementation plan and the support systems required to manage and report on program progress. The support system includes:

- Design and staffing of the Program Office organization,
- Acquisition of physical support such as office space, telephones, furniture and computers and networking capabilities,
- Development of operational procedures,
- Training of Program Office faculty and staff,

- Development and implementation of financial management systems linked with MUSC accounting systems, and
- Development of program reporting systems.

In June of 1993, the Program Office began to explore potential private sector "spin-offs" of the programs under this grant as well as other programs in place at MUSC. One of the early considerations was to encourage technology transfer and private sector institutionalization of the grant activities.

Three areas show particular promise:

- The information systems
- The statewide family practice resident training initiative
- The workshops of the Crossroads of Humanity Series.

We have begun to explore with private sector companies and state and federal agencies the possibilities of enhancing the database and adding to network activities in order to provide a needed service to a variety of individuals and organizations.

We are also exploring with industry the possibility of establishing a cooperative industrial and government council for expanding the products of the Crossroads of Humanity Series after the International Symposium scheduled for March, 1995. As a demonstration of the importance of joint-venture efforts, using non-federal funds, EHAP is cosponsoring an international symposium as part of the Kids and the Environment Project. The symposium, entitled "Preventing Child Exposures to Environmental Hazards: Research and Policy Issues", will be held in March, 1994. EHAP is cosponsoring the symposium with the National Institute of Environmental Health Sciences, the U. S. Environmental Protection Agency, the Centers for Disease Control and the Agency for Toxic Substances and Disease Registry.

#### **4.1 EHAP Organization**

The EHAP Program Office structure is shown in Figure 4..1.

Director:	R. Martin Jones, Ph.D.
Ass't. to Director for Operations:	Jack Davis, M.S.
Ass't to Director for Univ. Programs:	Allen Smith, DR., P.H.
Ass't. to the Director for External Programs:	Robert Draughn, D.SC.
Director for Crossroads:	Glenn Fleming, Ed.D.
Administrative Assistant:	Susan Harris
Administrative Specialist:	Mimi Gainey
Administrative Specialist:	Anita Noisette
Business Manager	Gail Brubaker

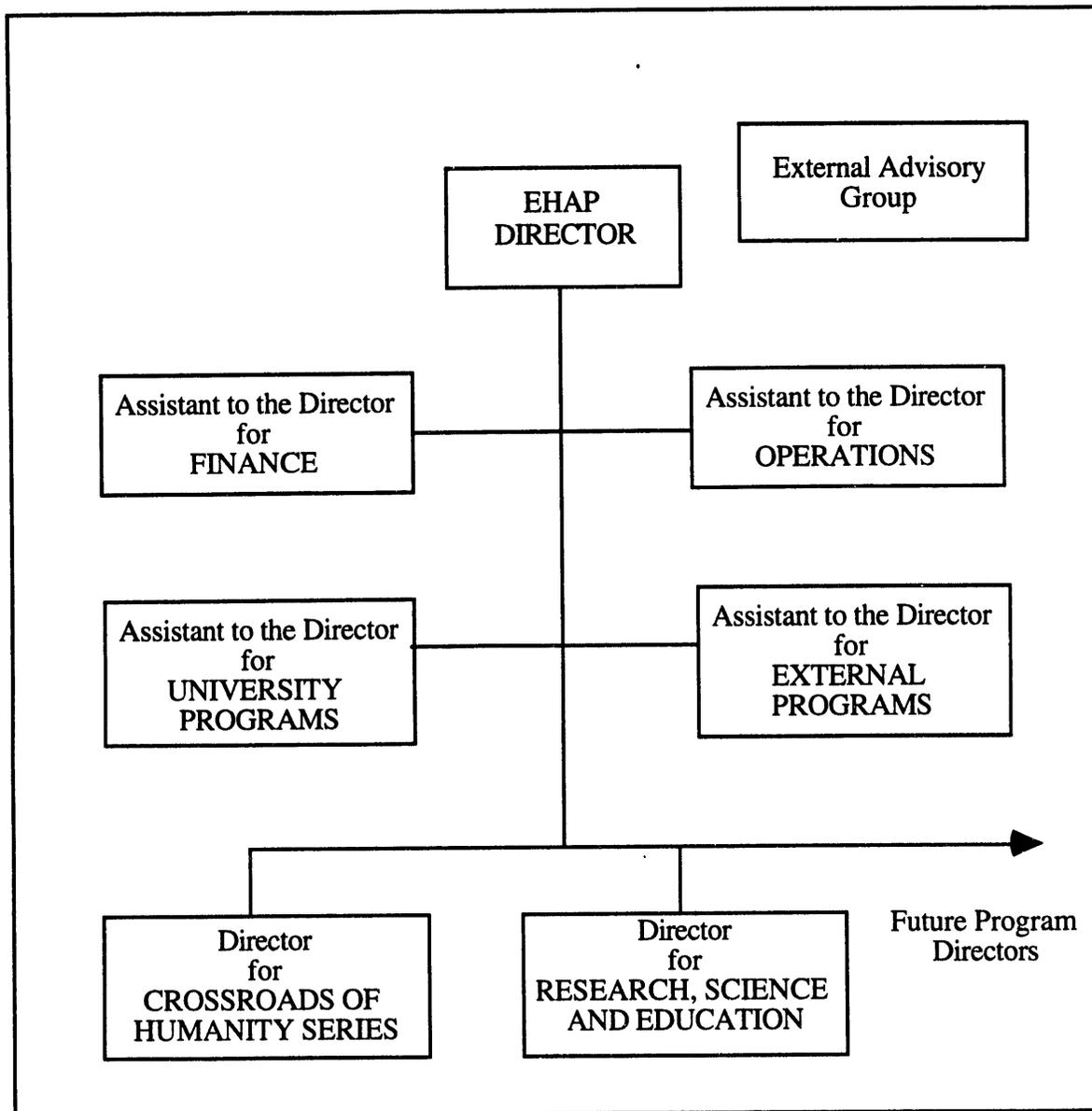


Figure 4.1. The EHAP Program Office Organization

The EHAP Director's job is to fulfill the EHAP mission in both development and management. A significant portion of the Director's time is devoted to the networking of people and programs. It is the Director's intent to identify and develop opportunities for MUSC to work with others in the environmental arena. The Director has primary responsibility for reviewing and approving program plans and budgets of existing programs.

The External Advisory Group (EAG) will provide guidance to the Director as required. The EAG will be made up of people from all walks of life, depending on the nature of the programmatic advice needed. Beginning in January of 1994, a minimum of two meetings will be held each year. The purpose of the group will be to review programs and provide input on the potential privatization of spin-off initiatives.

The Assistant to the Director for Finance (Finance Manager) supports the Director by developing and maintaining the financial management systems necessary to ensure proper expenditures of funds, to providing accurate financial information for managing the programs, and developing budgets for current and proposed projects. The Finance Manager has a support staff of several people to support the processing of financial information and transactions.

The Assistant to the Director for Operations (Operations Manager) supports the Director by managing day-to-day operations of the Program Office including logistics, clerical, and physical support, and by providing the support for the preparation of proposals and grant reporting documents. The Operations Manager is supported by a small direct staff as well as the MUSC Research Office.

The Assistant to the Director for University Programs (University Programs Manager) and the Assistant to the Director for External Programs (External Programs Manager) support the Director in both the development and management missions.

The primary focus of the University Programs Manager is on understanding and developing the capabilities of investigators and university organizational units, both on the MUSC campus and on other university campuses, to fit with funded and potentially funded programs.

The External Programs Manager focuses on developing relationships with other institutions, agencies and industries which are beneficial to EHAP and MUSC. For example, the External Programs Manager has developed a Memorandum of Understanding (MOU) with the Idaho National Engineering Laboratory (INEL). The External Programs Manager's job is to understand in what areas INEL and EHAP/MUSC can collaborate.

The Director for the Crossroads of Humanity Series and the Director for Research, Science and Education are directors of grant-funded programs. Their jobs are to develop and to manage the resources necessary to accomplish the objectives of the DOE grant.

As new grants are developed, more directors may be added to accomplish the programmatic objectives of the new grants.

In the following sections there are project descriptions for all of the EHAP grant-funded work. It is organized by project. For each project there is a project description, list of milestones, and list of deliverables. Milestones are indicated and deliverables are indicated by a ♦

## 5.0 CROSSROADS OF HUMANITY SERIES

Director: Glenn Fleming, Ed.D.  
Research Director: Catherine Musham, Ph.D.  
Publications Designer and Editor: Cathi Bare  
Administrative Assistant: Percilla Coaxum  
Research Associate: Dylan Holmes  
Public Information: Richard Jablonski  
Events Coordinator: Sylvia Rivers

The primary objective of the Crossroads of Humanity Series is to develop a holistic, national basis for risk assessment, risk management and risk communication focused on human health. By creating, designing, executing and videotaping a series of workshops and forums, we will advance in three areas:

- Development of a pool of talented scientists and experts in cleanup activities;
- Production of videotaped dialogues and seminars suitable for use in environment-related curricula;
- Creation of a model scenario useful to government and citizens, particularly at the local level, when they face environmental-cleanup situations.

The Crossroads Series can not and should not exist in a vacuum. It must incorporate elements of research, public information, communication, expert recruitment and support of EHAP activities in areas of Program Management, Science and Education. To accomplish these ends, Crossroads Series personnel devoted Year One efforts to:

- Recruiting staff to formulate and implement Crossroads projects;
- Research projects and surveys related to risk perception and risk communication;
- Design and publication of a newsletter and information updates;
- Design and production of such education-related materials as Ph.D. and Masters program brochures;
- Development of a public information plan;
- Design and development of a streamlined database including 250 experts in cleanup-related activities; and
- Identification and recruitment of those experts.

### 5.1 Research and Evaluation

1. Conducted literature review and compiled a bibliography of risk communication research (6/93)
2. Initiated and completed study of the needs of South Carolina family residency programs for environmental medicine education. Study will be used in design of an environmental medicine curriculum for the Department of Family Medicine at MUSC (completed 12/92).
  - ◆ Results of the Environmental Health Activities and Needs Assessment of the South Carolina Statewide Family Practice System for the Environmental Hazards Assessment Program (Musham, Hainer)
  - ◆ Concept paper for presentation at Society of Risk Analysis Convention, 12/93
3. Planned surveys of patients at six family practice residency sites in order to understand more about patients' perceptions of environmental risks (study completed during summer, 1993; results available 10/93).

- ◆ Concept paper for presentation at Society of Risk Analysis Convention, 12/93
4. Initiated study of medical educators and their belief that environmental medicine should be incorporated into curriculum. Planned surveys of deans of academic affairs at medical schools, program directors of family practice residency programs and deans of nursing schools (ongoing).
  5. Collaborated with Department of Biometry and Epidemiology on telephone survey of residents of Savannah River Site to test hypothesis that public concern about environmental hazards is a function of proximity of residence to the site (ongoing).
  6. Initiated mail survey of pharmacists to assess the extent to which they are asked environmental risk questions by clients and their needs for environmental medicine education (ongoing).
    - ◆ Concept paper for presentation at Society of Risk Analysis Convention, 12/93
  7. Planned two telephone surveys measuring environmental risk perceptions. One will focus on Charleston area. The other will be a statewide survey (to be initiated late, 1993, and early, 1994).
  8. Developed survey instruments for Crossroads of Humanity Series workshop evaluations (6/93).
  9. Initiated a qualitative study of language used by lay people in discussing environmental issues for the purpose of developing easily understood information materials for the general public (6/93).

## **5.2 Workshops and Forums**

1. Inaugurated Crossroads of Humanity Series with Socratic dialogue on risk, focusing on the mythical, environmentally damaged city of Purity. Fifteen panelists participated in the 2-hour Round Table Forum. Approximately 270 concerned citizens attended the dialogue, which was videotaped by South Carolina Educational Television for future broadcast and use in environment-related curricula (6/93).
  - ◆ Round Table Forum script
  - ◆ Round Table Forum transcript
  - ◆ Round Table Forum Audience response

The impact of the Socratic dialogue on those who have participated, watched, evaluated, planned the activity has been startling. Groups within communities who stereotype one another, eventually refusing to even communicate, find themselves participating and working mutually to resolve conflict. The peer review group also endorsed the notion of setting up other workshops or round tables in other communities, perhaps collocated near DOE field offices, or wherever the need was greatest. These workshops could be planned and implemented upon request and available funding.
2. Planned Crossroads Series Workshops. During first four workshops (7/93-10/93) participants will complete review of the first Round Table Forum and plan for the November, 1993, Round Table. Beginning in January, 1994, workshops will focus

on specific topics and areas of concern generated by the first six Crossroads Series events.

3. In anticipation of the International Symposium, it was recommended by the peer review process that the suggestion for an international Round Table, perhaps focusing on the former Soviet Union would create both contrast and fundamental truths when confronted in a Socratic setting with a script having no right or wrong answers. Targeted time frame for this type of workshop/round table is April, 1994.

### **5.3 Publications/Information**

1. With assistance of South Carolina Educational Television and Socratic Seminars, produced and edited the first Round Table Forum into cohesive, thought-provoking, "In Search of Purity" a 58-minute tape, suitable for broadcast in late 1993 (6/93).
  - ◆ 2-hour unedited and 1-hour edited videotapes of dialogue
2. Designed, edited and published needs assessment report for masters-level educational program in Environmental Science (5/93).
  - ◆ Needs Assessment for the Proposed Masters Degree Program in Environmental Science (Hoomani)
3. Designed and published print materials related to June, 1993, Round Table Forum, including 20-page forum program, expanded and updated on monthly basis for Crossroads Series events (5/93-6/93).
  - ◆ Round Table Program
4. Designed first edition of *Crossroads of Humanity Round Table Forum & Workshop Update*, a two-page follow-up mailer describing Series events (6/93).
5. Designed *EHAP News & Information*, a four-page bimonthly newsletter to inform readers of the Environmental Hazards Assessment Programs existence, plans, goals and accomplishments. Mail circulation: approximately 1,200. Publication to commence July-August, 1993 (6/93).
6. Negotiated agreement with Medical University of South Carolina Public Relations staff to identify and inform public sectors of Environmental Hazards Assessment Program's existence, purpose, plans and achievements (6/93).
7. Designed and edited brochures for the Medical University of South Carolina's doctoral-level program in Risk Assessment and masters-level program in Environmental Sciences (5/93-6/93).

### **5.4 Expert Support**

1. Developed the Crossroads of Humanity database, adding experts as they are identified/recruited and modifying the reports and screens as needed (6/93).
2. Assigned task of identifying/recruiting environment-related journals, organizations and associations to MUSC Public Relations Department. PR group will provide contacts for expansion of expert pool and overall database.
  - ◆ Expert listing with organizational affiliation.

## 6.0 RESEARCH, SCIENCE AND EDUCATION

Director: Rosalie Crouch, Ph.D.

Administrative Assistant: Joy Sharkey

The third objective of the grant is to identify needs and develop programs addressing the critical shortage of well-educated, highly-skilled technical and scientific personnel to address the health oriented aspects of environmental restoration and waste management. The research, science and education programs are designed to be the principle program element to accomplish this objective.

Our strategy is to devote the first two years of the grant efforts

- to establishing a base capability in the basic sciences and education surrounding risk assessment,
- to establishing a base capability in information systems support for research and education, and
- to establishing the involvement of health care professionals through the development of research and education programs.

The approach is to engage both the institution and the faculty and students by providing opportunities in research programs and education programs. The driving force for MUSC as an institution is teaching health care professionals, e.g., doctors, nurses, dentists, and psychiatrists, through the clinical sciences efforts. Basic sciences efforts support the clinical sciences by providing faculty with expert knowledge to teach health care professionals what they need to know about the basic sciences and by providing the capability to conduct basic research on medical problems. The quality of the basic sciences faculty is maintained through active programs of basic sciences research. It is therefore important to establish a basis in the institution for basic sciences research and courseware in environmental health sciences areas.

At the end of the second year, the basic sciences research and education programs will be well established and providing the foundation enabling us to move more aggressively into the clinical sciences programs. The driver for the clinical sciences programs will be the questions and problems from the Crossroads of Humanity Series. We have initiated some educational programs in the clinical sciences areas in the first year and will continue to promote new programs in the second year.

Also by the end of the second year, many of the basic research, science and education programs initiated under the grant will either be self-sufficient, such as the training and education programs funded by tuition fees, or funded by grants from other sources. The grant funds are being used to design and test courses and curricula which can then be exported to other academic health institutions. The implementation of these programs will be accomplished using other funds.

By the end of the third year, the majority of the funding for both clinical and basic science and education will be to support the resolution of problems raised in the Crossroads of Humanity Series.

### 6.0.1 Linking and Directing Science

An underlying question posed throughout is "What do we need to know to resolve these issues?" The answers to this question become drivers for faculty, student, and staff

research. In some cases, we will need to conduct focus group workshops bringing together the experts who have studied these problems. In other cases, we will need to do some survey research to bring understanding to light. In yet other cases, specific research projects will be identified which need to be conducted to provide the needed knowledge to help resolve the issues.

The issues to be researched are born out of the study of the community decision process and the results bear on the ability of the community to make better decisions. It is the community, the public, who is directing the research and it is the community, the public, who is deriving benefit from the research results in a more direct fashion. By linking the research with the series of workshops and forums focused on community decision making, we are embarking on a grand experiment on new ways to direct research.

## 6.1 Research and Science

One of the greatest environmental issues facing industrial societies is the increasing volume of waste and the public concern over the potential environmental and health consequences. The public believes that hazardous wastes are a serious health problem although many scientists and regulators do not hold this view. The one thing that most everyone DOEs agree on is that the knowledge of exposures and health effects associated with hazardous-waste sites is lacking <sup>1,2</sup>.

Congress is passing the Superfund legislation (CERCLA) requiring the establishment of a systematic inventory of hazardous-waste sites and the establishment of priorities among the sites based on relative danger. Also response action is taken to assure protection of the public health and the environment in a cost-effective manner. The approach of health based risk assessment for cost-benefit strategies of clean-up has also been echoed by the National Research Council's DOE nuclear weapons complex oversight committee <sup>3</sup>. Specifically the committee felt that

"the evaluation of clean-up actions should be guided by the consideration of risk-that is, the likelihood that contamination will present a threat to human health or the environment".

The appropriate EHAP research program for MUSC should therefore center on health risk assessment with respect to toxic waste and exposures associated with clean-up. Also, research in the area of public perception and attitudes concerning environmental health risks would also be appropriate.

In establishing a research program it is best to categorize the science areas of health risk assessment and toxic waste. The main division is between exposures and health effects. The question of what is present in waste is generally a chemistry and engineering issue. But whether people are actually exposed is a biomedical issue. Traditionally, environmental scientists will sample, model and estimate environmental levels of toxicants. The problem then is to determine actual human exposures. To answer this difficult issue the best prospect is through the development of and utilization of human biomarkers of exposure <sup>6,7</sup>. These methods have the potential of providing data on an individual's actual exposure thus avoiding the need to make questionable estimates of exposure from measured environmental levels of the toxicant of interest. The development of selective markers using biological fluids is an area for which MUSC has an appropriate science base. We plan to study those chemicals which are of particular health concern in toxic waste clean-up. Further the choice of model chemicals must be

both scientifically interesting and tractable. The tools then will be available for human monitoring of both environmental exposures and exposures to workers in waste clean-up.

The health effects component of risk assessment has several basic areas which are both of scientific interest and of relevance to waste management. First, the traditional method for determining health risk is to use toxicological data and extrapolate these data to man. The health endpoints which are under regulatory health control have typically been carcinogenesis and teratogenesis. Gradually other adverse health effects are being studied and recognized as important environmental health issues<sup>1</sup> (e.g. immunotoxicity, neurotoxicity, etc.). The problem is further complicated by the need to extrapolate this information from animals and laboratory experimental systems to man in both a qualitative and quantitative manner.

Several important areas of research exist. First, radioactivity and adverse health outcomes have been estimated by modeling actual human data through epidemiological studies. These studies unfortunately are generally only for acute exposures of ionizing radiation while what is of particular interest is continual low-level exposures. It is believed that cancer risks are much smaller for the case of continuous exposures<sup>4</sup>. It is important to know whether or not this is correct since it would impact costs in toxic waste strategies as well as radiation standards. The modeling of existing animal data can provide answers to this issue. A second area of study involves the re-examination of health risk estimates for a few specific but critical chemicals. In some cases, toxicological data may be inadequate or inappropriate interpretations may have been made from the scientific literature. Using outside experts, workshops could address risk estimates for several of the more important chemicals in toxic waste management. The scientific outcome may include suggested novel research to better understand and determine the estimated health risks for these chemicals. A third area of scientific importance in risk assessment involves the relationship between exposure and dose. The use of pharmacokinetic models, especially those which are physiologically based have been important to the understanding of both dose-response and species scaling at the biological target site. MUSC research in this area should focus on a few relevant compounds. Methods should especially include both considerations of chemical interactions and also the impact of parameter errors and model variability's.

The issue of adverse health effects other than carcinogenesis and reproductive outcomes will be of great future environmental concern. Coupled with this is the general problem of genetic susceptibility to toxicants. Again the field of human biomarker research is moving in this direction<sup>5</sup>. The Medical University of South Carolina is ideally suited to begin investigations in these areas through immunology. An appropriate initial or model compound would be a small molecule such as beryllium for which its effects are known to be under genetic control. Once the mechanism of toxicity is understood for this type of molecule realistic risk estimates can be developed.

Finally, the concerns of individuals near toxic waste sites need to be better understood. This can be accomplished through the use of existing environmental questionnaires. Further, environmental health information, which is the most convincing to the public, involves the establishment and analysis of disease registries. Lastly, the program should encourage the identification of environmental health problems through the use of 'alert practitioners' and the administration of questionnaires to practicing physicians.

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### 6.1.1 Environmental Risk Perception in Defined Populations

Science Task Leader: David Hoel, Ph.D.

Project Leaders: Daniel T. Lackland, DR., P.H.

John Dunbar, P.H.

The goal of this subproject is the development and implementation of a comprehensive environmental risk perception assessment center, capable of rapid ascertainment, evaluation, and analyses of populations. The program is designed to be a major resource for Department of Energy sites as well as other groups involved in the decision process for environmental remediation and restoration. Furthermore, the project will provide timely feedback of community and population based findings for the Crossroads program. Specifically, the objectives of this project focus on measuring knowledge, awareness and attitudes with regards to environmental risks, quantifying these measures so as to create a "perceived risk index," and estimating levels of acceptable risk in the population. To accomplish these ends, Year 01 was devoted to several components including research, expert panels, and education. Specific efforts included:

- Inventory of existing perceived risk assessment programs.
- Assessment of methodologies used to incorporate risk perception in decision making.
- Comprehensive review of literature on risk perception.
- Development of population pilot project.
- Development of an advisory committee.

### Research

1. An inventory of existing risk perception assessment programs was completed with detailed review of the programs at:
  - a. Environmental Protection Agency.
  - b. University of Cincinnati.

- c. Centers for Disease Control.
- d. National Cancer Institute.
- e. Oak Ridge National Laboratory.
- f. Agency for Toxic Substance and Disease Registry (ATSDR).
- g. Institut für Strahlenhygiene (Munich, Germany).

Furthermore, the mechanisms for incorporating risk perception into the risk model were reviewed with representatives of the above agencies as well as those of the Department of Energy, American College of Surgeons, National Council on Radiation Protection, and Argonne National Laboratory.

2. A population pilot project to measure risk perception and knowledge in the region of the Savannah River Site was planned with protocol finalized as follows:
  - a. Instrument was developed with assistance from EHAP personnel as well as ATSDR, CDC, EPA, and others. The instrument was pre-tested.
    - ◆ Perceived Risks and Knowledge Assessment Survey
    - ◆ Protocol was developed and finalized with consideration of a random-digit dial telephone survey. (Specifics and details are available.) The survey was to be completed by the Survey Research Center at MUSC. The results will test the hypothesis that risk perception, attitudes and knowledge vary by geographic proximity to the Savannah River Site (SRS). Four geographic areas were selected for study:
      - 50 mile radius of SRS,
      - 50 - 100 mile radius of SRS,
      - Northeast South Carolina,
      - Southwest Georgia.
  - Eight hundred interviews will be completed.
3. An established relationship with the Savannah River Region Health Information System (SRRHIS) was finalized. This program will provide accurate morbidity and mortality data for assessing accuracy in knowledge as well as explaining attitudes and perceptions. SRRHIS will also be a resource in determining "real risks" and in working with the community.
4. A relationship with the S.C. Department of Health and Environmental Control was also established. They are developing a state-wide cancer registry in collaboration with SRRHIS.

### Expert Panels

Experts from around the world were identified to participate on an advisory committee recommending methodologies and procedures for risk assessment in an effort to develop a state-of-the-art program. While individual meetings were completed in Year 04, the first forum is planned for Year 02 with at least annual meetings planned thereafter.

- ◆ Radiation Dosimetry and Risk Assessment Agenda

### 6.1.2 Development Of A Biotreatment System For Destruction Of Multi-Component Waste

Science Task Leader: David Hoel, Ph.D.  
 Project Leader: Michael Schmidt, Ph.D.

Biodegradation of organic waste has been shown to be a cost-effective technology option for the destruction or detoxification of organic waste. However, while the biological

transformation or mineralization of selected halogenated solvents has been reported in the scientific literature, the costs and technology associated with the treatment of large volumes of air or water containing low levels of pollutants are important considerations. A cost effective technology which results in the effective concentration of pollutants could have a significant impact on the utility of biological solutions to our nation's ongoing pollution problems. The waste targeted in this particular project, vapor phase, volatile organic carbons (VOCs), lends itself to biotreatment but required the development on new technology to deliver the VOC to the bioreactor. The multiyear, interdisciplinary approach to this problem involves a no-cost partnership between Envirogen Incorporated and the laboratories of Dr. Michael G. Schmidt at the Medical University of South Carolina and Dr. Charles H. Gooding of Clemson University. The goal of the partnership is to design a biotreatment system to degrade *vapor phase* VOCs. Recent developments in the field of membrane technology offer promising potential opportunities for segregating organic waste and permitting microorganisms to destroy appropriate fractions from multi-component waste streams. The research program presently is evaluating one such membrane technology and plans to characterize the capabilities of one or more additional membrane developments in conjunction with a phased program that will characterize the microbial treatability of the components of the waste mixture. To date the project has been successful in achieving its major milestone, *Proof of Concept and Treatability*. Dr. Schmidt's laboratory has been primarily responsible for execution of the feasibility/treatability studies while Envirogen Inc. has provided expertise on the designing, testing and scale up requirements for the Integrated Membrane Bioreactor will be constructed and demonstrated. Dr. Gooding of Clemson University has been an invaluable contributor to the project by providing the necessary expertise in the area of membrane technology. The hope of all parties when they entered into the cooperative research program was that the collaboration would result in an acceleration of the development of biotreatment systems for the destruction of vapor phase VOCs. To this end the team has realized its goal.

This project has been jointly funded by EHAP and SCUREF. Accomplishments in the first year include:

- **Proof of Concept and Treatability was achieved** for TCE and methylene chloride as waste streams.
- **Execution of a CRADA between MUSC, Envirogen and SCUREF.** Envirogen has an exclusive right to commercialize the technology developed within this program. The net result is the technology developed will not be a laboratory curiosity. Phase II of the program is scale up of the technology and demonstration at either a DOE or private sector location. Phase III will be commercialization of the technology.
- **Invention Disclosure has been made to the principal investigator's institution.** The Intellectual Properties Committee of the Medical University of South Carolina of 12 January 1993 has evaluated the disclosure and concluded the following:
  1. MUSC has rights.
  2. Federal funds were involved in developing the invention.
  3. The inventor pursue the patent issue with DOE.

In the second year of the project it is important to get the technology protected to insure that the DOE will have a royalty free license to use the technology.

- **CRADA development between MUSC, Hoechst Celanese and SCUREF.** Dr. Schmidt has entered into discussions with **Hoechst Celanese**, the developer of the membrane separation technology presently employed in the project. The greatest limitation to full scale implementation of the technology is cost. By entering into a CRADA with the developer and manufacturer of the most critical component of the technology it may be possible to greatly reduce the cost. This is critical if the technology is to be successful in competing with existing non-biological solutions.
- **CRADA development between MUSC, Industrial Partner and SCUREF.** The Co- investigator, Dr. Gooding of Clemson University has entered into discussions with a developer of an alternative membrane separation technology. In year two the team plans on a competition between the technology it developed and the alternative technology identified by Dr. Gooding. Presently, the budget required for this task depends on whether or not it will be possible to execute a CRADA between the private sector and us. Failure to execute a CRADA will require additional capital for the purchase/lease of the equipment required for the competition.

### 6.1.3 Immunological Consequences of Beryllium Exposure

Principal Investigator: Jean-Michel Goust, MD.

Co-Investigators: Philippe Arnoud, MD., Ph.D.,  
Gillian M.P. Galbraith, MD.  
Janardan Pandey, Ph.D.

It is frequently alleged that the exposure of a worker or community to a particular agent compromises their immune system and could predispose the individual to allergies, immunodeficiencies and associated infections, and/or cancer. Several relevant law suits have occurred in South Carolina in relation to hazardous waste. Since there is little or no relevant information on this, it will be vital to obtain information concerning immune function of individuals at risk, particularly at DOE facilities at which exposure to suspected agents is unusually high or in question.

The possible health effects of beryllium are of emerging concern, particularly under circumstances where exposure may be intermittently or continually high. Beryllium is used in the nuclear and the lighting industries. It is responsible for a chronic respiratory disease progressing to respiratory insufficiency in a small percentage of individuals exposed to it by inhalation. Beryllium-induced disease reflects the predominantly pulmonary nature of human exposure, through inhalation of dust, salts or fumes. Two apparently distinct patterns of pulmonary disease may be observed. Acute pneumonitis is thought to reflect a rapid and perhaps self-limited chemical response to high concentrations of beryllium. In contrast, chronic interstitial beryllium disease follows lower levels of exposure over a more prolonged period, and may represent a hypersensitivity reaction. Unfortunately, in neither case has the precise level of exposure necessary for development of disease been established, nor has the role of possible co-factors such as smoking and other pulmonary diseases e.g. tuberculosis and pneumoconiosis been established.

The mechanisms underlying **Chronic Beryllium Disease (CBD )** are poorly understood but the lung pathologies of **CBD** and **Sarcoidosis** are very similar. Both are characterized by the existence of a chronic lung granuloma formed by activated T cells surrounding giant cells derived from alveolar macrophages. Several potentially serious clinical associations have been described, and recent work has indicated that one major mechanism involves an immunological delayed hypersensitivity reaction. These studies

have just begun (4/1/93) and the interdisciplinary group is in the process of planning an international conference on Genetic Markers of Human Diseases. Purely human diseases with no known environmental trigger as well as those known or suspected to have an environmental trigger will be discussed. Dr. Jay Pandey, the genetics task leader on the Be project is well placed in the genetic community and it is anticipated that the conference will generate a monograph on the subject. This topic not only meets the EHAP mission but is also critical to the mission of molecular medicine that is now part of the strategic plan of the College of Medicine of the Medical University of South Carolina. This is but one conference that is planned. Two additional conferences are in the concept development phase. Although DOE grant funds are used to sponsor, in part, this research, no DOE funds are or will be used to sponsor the international conference planned.

#### 6.1.4 Diatoms As Sentinels For Aquatic Environmental Risks

Director: Donald R. DiBona, Ph. D.

Research Associates:

Robert A. Ashcraft

Leslie Schwarz

Jack T. Walker

Student Assistant:

Rachel H. Levine (Wesleyan University)

The Savannah River Site (SRS) was established in 1950 for the production of tritium, plutonium, and other nuclear materials used primarily by the US Government for purposes of national defense. A major consequence of SRS operations has been repeated atmospheric and liquid releases of the radionuclides  $^3\text{H}$  (tritium),  $^{137}\text{Cs}$ ,  $^{90}\text{Sr}$ ,  $^{14}\text{C}$ ,  $^{129}\text{I}$ ,  $^{238}\text{Pu}$  and  $^{239}\text{Pu}$ , as well as non-radiological contaminants like heavy metals and a broad range of organics. The Savannah River drainage basin has been the primary receptacle for liquid contamination and the principal operators of the SRS (The Department of Energy and the Dupont and Westinghouse Corporations) have supported long-term monitoring programs to assure that the radiation dose received by the public due to onsite activities remained well below applicable regulatory standards. As a result, an apparently large body of data exists for surface water, sediments, and biota of the Savannah River. In many respects, however, the data collected have been insufficient to accurately characterize the overall status of this large geographic area and to assess the specific nature of potential risks to human and ecological health. Practical considerations have restricted the major efforts at environmental evaluation to 300 sq. miles that comprise the SRS itself. Monitoring of downstream river biota, for example, has been restricted to the collection of fish and shellfish at irregular intervals; little is known regarding the water and sediment quality conditions in which micro-organisms and lower trophic level invertebrates flourish and where complexities in the important, web-like, food chain originate and are modified by environmental stresses. Examination of the densely populated, lower reaches of the river and of the coastal ocean have been minimal. Health in the resident populations of Savannah, Ga., Beaufort and Hilton Head, S.C. and of the upstream river bed has not been compromised in any obvious way so that anxiety over the long-term consequences of contaminated drinking water and seafood has been only episodic and otherwise minimal. It is, nonetheless, the case that the very long term effects of low-dose exposure to potentially harmful agents requires careful examination if we are to appreciate fully the degree to which the aquatic environment represents risks for human health.

The study proposed has concentrated on the Savannah River Drainage Basin from the location of the SRS to within the offshore, marine environment that is effected by the effluence of this major waterway. Biological and geochemical surveys have been designed to take place in parallel to increase efficiency in selection of sampling sites and to facilitate the identification of natural sinks or "hot spots" that will be of particular interest. Studying the biology, chemistry and geology of this region will exploit the laboratory-like situation that has been provided by the inadvertent labelling of the river's chemistry and biochemistry with radionuclides, heavy metals and organic chemicals. This constitutes a uniquely advantageous situation for examination of the transport and fate of anthropogenic chemicals in a rich and complex aquatic environment. The resulting assessment of potential risks to human health in this important watershed is intrinsically important and valuable since there are few comparable opportunities to examine the very long term effects of very low level exposure to radioactivity. With accurate evaluation of the Savannah River basin as a model environment, this study should make a positive contribution to the development of rationally-based, predictive models for the evaluation and formulation of environmental policy and legislation in the future.

The wide-ranging approach described above is provided for the sake of context. The shortened agenda for project execution has yielded results in two discrete categories.

1. Establishment of diatom/sediment assay:

First samples of river, estuary and coastal sediment cores have been collected and diatom frustules will be isolated, cleaned and classified from each. Milestone 1 will require development of routine procedures and the acquisition of quantitative results. Samples will be described in terms of major ambient species, relative densities, heavy metal content and radioactivity (tritium levels and those of any gamma-emitters that may be detectable.)

- ◆ EHAP summer intern report - August, '93. (Complete as supported by year 01 funds and enclosed)

2. Profile of Tritium Content in Savannah River Sediment

The major emphasis of the biological survey throughout the first year will be on the use of sediment diatoms for the establishment of the spatial/temporal history of tritium releases from the SRS. Other radionuclides will be monitored as well and detected high levels will be targeted for further follow-up should they occur. The pattern of association between tritium and other contaminants will be recorded throughout. It will be of interest to note whether organic pollutants are retained with diatom frustules since these algae are the only primary producers that use lipid as their stored carbon reserve material; consequently they may bioaccumulate organic chemicals of interest. Samples from collected sediments will also be subjected to electron probe microanalysis (through an arrangement with Dr. Ann LeFurgey at Duke) so that we might establish which of the several species found are the principal accumulators of the various heavy metals and organic chemicals. This information will be of particular value in the future when we attempt reconstruction of the trophic transfer pathways (food chains).

- Preliminary evidence for detection limits (Tritium and Cesium)-established with random sampling that sediment sampling 150 miles downstream of the SRS can effectively detect tritium and cesium content at a level of ten times the detection limit; quantitative description of this finding is in progress.

## **6.2 Information Support**

Director: Tom Basler, Ph.D.  
Systems Analysis: Richard Gadsden, CCIT  
Assistant to the Director for Operations,  
Manager/Coordinator: Jack Davis  
Biomolecular Computing: Starr Hazard  
Word Processing Specialist: Carol Savage

There are three main thrusts of the Information Support Project and one operational responsibility:

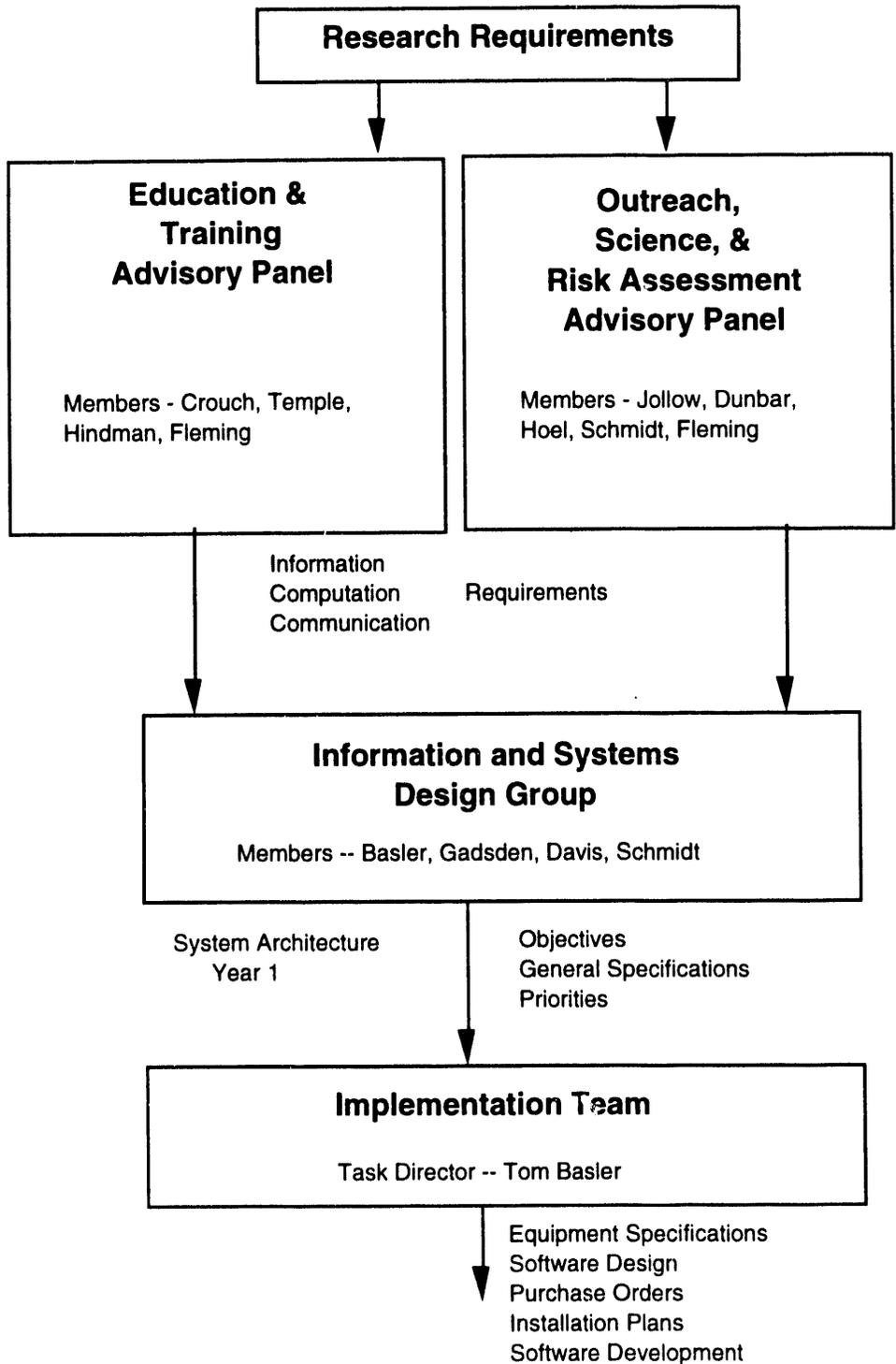
- build and maintain the basic computer and network structure for information handling,
- support of the Education Initiative,
- support of the Seminars, Science, & Risk Assessment, and
- operational support of EHAP overall internal computing & communications.

The following project description addresses project execution through its support of the other education, science, and Crossroads projects.

### **6.2.1 Project Goals, Objectives and Strategies**

The objective of this project is to support the information, communication, and computational needs of the outreach, education, and research tasks encompassed by EHAP. The basic strategy involves two primary components. First, the Information Systems Design Group built the specifications and architecture for computer systems that are capable, generally, of the computation and communication necessary to achieve EHAP goals. During Year 1 of the program, core equipment, based on the design architecture has been purchased. Installation of this equipment will continue into Year 2. Since specific requirements for information and other support are not available, the system we've designed and begun to install is based on general requirements. Specific hardware and software will be added as detailed requirements are identified and documented. Second, we're establishing advisory panels to work with the Information team. Representatives from other projects will serve on these panels. As their needs for information and support are better defined, the panels will generate more specific requirements. This process, which will continue throughout the remainder of the program, is illustrated in the following diagram.

# Information Support Development Process



## 6.2.2 Milestones and Deliverables

1. A university computer systems architecture design was completed in January. The architecture identifies the new hardware needed to build an EHAP research and education support system.
2. Computer hardware necessary to support the Science and Education initiatives was ordered in January - March and the equipment was received in May - June. Installation has started and will be completed during the first quarter of the second grant year.
3. The EHAP offices and staff have been equipped with the necessary computing and communications equipment. An EHAP network has been installed and connected to the main university communications network. Completed in June 1993.

## **6.3 Education**

### 6.3.1 Clinical Education

Environmental Medicine & Risk Communication: Curriculum and a Professional Support Network - Department of Family Medicine

Director:	Stanley H. Schuman, M.D., Dr. P.H.
Project Administrator:	Samuel T. Caldwell, M.A.
Ed./Research Associate:	Larry H. Spell, M.S.
Ed./Research Associate:	Jan A. Lay, M.S.
Administrative Assistant:	JoAnn Retter

**NOTE:** This EHAP project was initiated on April 1, 1993, thus this report is for the April 1 - June 30, 1993 period of Year 1.

The objectives of this project are to:

1. develop environmental medicine curriculum for the SC Statewide Family Practice Residency System (SCSFPRS), and
2. develop a consultative/support network in environmental medicine for the faculty and residents of the SCSFPRS.

The success of this project is dependent upon the development of an Environmental Medicine Curriculum Committee (EMCC) composed of at least one faculty member from the seven SCSFPRS sites (Anderson, Charleston, Columbia, Florence, Greenville, Greenwood, and Spartanburg, South Carolina). The success of the committee will be dependent on a team approach among the members and on the EMCC having access to an academic based resource to develop curriculum for their sites and to be on call to their residents and faculty for environmental medicine consultations.

Project personnel devoted the last three months of the project year to:

- the restructuring existing MUSC Department of Family Medicine staff and office operations to accomplish the above objectives;

- a survey of the seven residency directors of the SCSFPRS for their perceptions on environmental medicine curriculum needs;
  - organizing at least one faculty member from each of the seven SCSFPRS sites into the EMCC which will advise the project staff and participate in the development of general and site specific environmental medicine curriculum;
  - begin curriculum development based upon the recommendations of the SCSFPRS department chairs, and
  - begin restructuring the existing Department of Family Medicine consultative data base (previously limited to agricultural medicine) into a resource for environmental and occupational medicine.
- Milestones and Deliverables (bullets) for the Period

### Curriculum

1. Initiated and completed a survey of the seven family practice residency directors. This survey identified self-study curriculum formats preferred for faculty and residents and a rank order of specific topics for curriculum development (5/93).
  - ◆ Report - Environmental Medicine Curriculum FAX Survey
2. The director and project administrator attended a meeting of the directors of the SCSFPRS to present and discuss the goals of this project. The directors voted to approve the objectives of the EMCC and appointed faculty representative for each site (5/28/93).
3. July site visits were scheduled with each of the designated EMCC faculty representatives (6/93).
4. An Occupational and Environmental Medicine Committee was formed in the MUSC Department of Family Medicine. Members, which include MUSC faculty and specialists in private practice, will advise the department on curriculum strategies and longer term academic terms. The organizational meeting was held June 9.
5. Produced a slide lecture on low-dose chemical exposure (6/93).
  - ◆ Multiple Chemical Sensitivity - a package consisting of teaching slides and script. This lecture was presented to over 100 family medicine physicians on June 16. It is currently being updated for distribution to the EMCC members.
6. Staff members initiated literature reviews on the top six ranked curriculum topics identified in the Environmental Medicine Curriculum FAX Survey in preparation for curriculum development (ongoing).

### Consultative and Support Network

1. Staff members updated risk communication skills by participating in a US Navy Environmental Risk Communication workshop on May 25-27.
2. Monthly environmental medicine literature reviews were initiated for the retrieval of pertinent environmental medicine articles for inclusion in the project's computerized data base (ongoing).

3. Staff members consulted on 74 occupational and environmental cases during the period.

### 6.3.2 Basic Education

#### 6.3.2.1 Graduate Education

Director: Rosalie Crouch, Ph.D.

Task Leader: Eberhard Voit, Ph.D.

Task Leader: Michael Schmidt, Ph.D.

Administrative Assistant: Joy Sharkey

An essential part of the program in environmental risk assessment is the educational component. This task is concerned with establishing strong academic graduate programs at the masters and doctoral levels which both address the needs of governmental agencies and private industry and respond to public concerns. These programs will address the void of graduates who have the combination of some understanding of science, risk analysis and the policy process. Graduates at the doctoral level will have, in addition, considerable expertise in a defined area which they have selected for their dissertation. Attention will be given in future years of the project to undergraduate environmental studies and introduction of these topics at the primary and secondary school levels.

**Goal:** To develop outstanding academic programs at the masters and doctoral levels which educate the student in the fundamentals of environmental risk, policy and science with a specialization in one of these areas.

#### Milestones - Year 1

1. Six students have been enrolled in the doctoral program in risk assessment. They are:
  - a. Julie Recknor, Michael Pisarcik, Paul Berg, Len Balthis, Jean Cantey, and Paul Nietert
  - ◆ *Selected Topics in Risk Analysis* - book edited by Dr. Eberhard Voit and his students enrolled in the Special Topics Course
  - ◆ Proposal for Master of Science in environmental studies.(5/93)  
Needs assessment of MS degree in Environmental Studies. (4/93)
2. Proposal for Master of Science degree in environmental studies prepared, approved by the Commission for Higher Education for the State of South Carolina for consideration for the offering of a new degree program.
  - ◆ Description of academic programs and research projects (including any abstracts and/or manuscripts) of doctoral students. (7/93)
3. Searches in progress for position of Assistant Professor in Health Policy and Director of Environmental Health Science initiated. Search Committee members for the Health Policy faculty position were: Drs. James A. Johnson, Walter Jones, Andy Felts, Jeff Hoomani, and Mr. Mike Reed Applicants interviewed for this position were: Drs. Arthur Rubens, and David Graber.  
Search Committee members for the Director of Environmental Health Science position were: Drs. James A. Johnson, Maralynne Mitchum, Alan Junkins, John Dunbar, Mr. Mike Reed, and Mr. Jim Graves. Applicants interviewed for this

position were: Drs. Denis Bourcier, Leslie Alexander, Nurtan Esmen, and Paul Mushak.

- ◆ Description of search process: search committees, applicants, candidates invited for visits , interview schedules. (7/93)

4. Courses in environmental studies developed and approval obtained for internal committees. Courses are:

Epidemiology of Cardiovascular Disease  
Environmental Health Risk Assessment  
Environmental Biology  
Pollution Microbiology  
Environmental Microbiology  
Toxicology

- ◆ Course description of proposed courses. (7/93)

5. Summer undergraduate research program in environmental studies initiated with enrollment of seventeen students. Students are:

SaraJane Carlson - University of Michigan  
Kimberly Frampton - Presbyterian College  
Jill Huntington - State University of N. Y. - Buffalo  
Lisa Johnson - Long Island University - Southampton  
Rachel Levine - Wesleyan University  
Katherine Maze - Georgetown College  
R. Blaine McClesky - College of Charleston  
Matthew Mitchell - Cedarville College  
B. Charlotte Smith - College of Charleston  
Amy Weaver - College of Charleston  
Tim Dulaney - College of Charleston  
Jenie Taylor - College of Charleston  
Natasha Simpkins - College of Charleston  
David Ross - College of Charleston  
Chris Taylor - College of Charleston  
JoNita Mann - College of Charleston

Final report is a deliverable for Year 2

- ◆ Description of summer research program (recruitment process, Applicants, Students enrolled, projects selected, lecture series, abstracts of projects). (8/93)

### 6.3.3 Professional Training

#### 6.3.3 1. Department of Environmental Health Sciences (DEHS) Education and Training Initiative

Project Director:	Janet Z. Temple, Ph.D.	
Assistant Director	Mike Reed	
Faculty	William Hotle	(April, 1993)
Faculty	Nancy Kierstead	(April, 1993)
Administrative Specialist C	Gerri Hollis	(April, 1993)
Accounting Tech II	Paula Butler	
Administrative Specialist B	Jeannette Scott	

The primary objective is to address worker and management training needs in a rapidly changing DOE environment. One of the Department of Energy's missions is to ensure that resources are available to assure the current and future workforce has the skills, knowledge and abilities to carry out its mission today and in the future; and to ensure that all groups within our society participate in the successful cleanup activities of DOE sites. As DOE transitions from production to decontamination, decommissioning, and environmental restoration, the identification of workforce training needs is necessary. Adequate training to address the risks to the public, the workers, and the environment is essential for those workers and managers who will be involved with environmental cleanup and restoration issues within DOE as well as DoD, government, business, and industry.

Emphasis during year one was placed on understanding and applying risk assessment in environmental management decisions, identifying competencies needed for effective environmental managers, initiating the concept of a professional development series concerning issues in risk, convening an advisory committee, and developing compliance training relative to air, water, and waste management.

The first six to eight months were used to familiarize MUSC staff with DOE operations and to better assess past and present projected DOE workforce needs. Site visits were conducted and workshops attended networking with Headquarters, GOCO's, field personnel, and trainers.

A needs assessment instrument is under development to secure profiles of mid and upper level environmental managers and their training needs relating to risk. An initial survey instrument has been developed to support this endeavor and was administered May 13 and 14 at a TRADE - EM Special Interest Group (SIG) meeting. Literature searches are also underway to support this task. Activation of an advisory committee June 3, 1993 in Charleston allowed for representation of viewpoints of DOE, DOD, unions, regulators, educators, public interest groups and the healthcare community. Their function is to render guidance to the project task.

Decisions were made regarding topics for the Professional Development seminars to be designed and developed during year 2. The 2-3 day programs will include an introduction to risk assessment methods for mid and upper level managers, with follow-up seminars focusing on the use of risk assessment in the decision making process (risk management) and public participation/risk communication.

Academic support for graduate education performed by the Department of Environmental Health Sciences is included in this summary. These initiatives were given no monetary support, however.

#### Planning/Administration

1. Staff and faculty were secured to support the Professional Education and Training initiative.
2. Site visits were conducted and workshops attended networking with Headquarters, GOCO's, field personnel, and trainers. Travel to support Professional Education and Training is noted.
3. Numerous presentations were made by Jan Temple and Mike Reed regarding the direction and proposed agenda for Education and Training. These presentations

were addressed to EHAP, DOE, MUSC Faculty, MUSC Board of Visitors, as well as recognized leaders in the health risk field. These presentations and meetings occurred throughout the year.

4. Faculty within the Department of Environmental Health Sciences developed a reference list March 17, 1993 for purchases through the library to support Education and Training. Items were approved and are currently on order with library funds. A second list was submitted May 26, 1993 with additional references for the library.
  - ◆ Library upgraded environmental and occupational health risk assessment information due to the literature searches and suggestions of DEHS.
5. We requested an automated version of the Federal Register be purchased. In March 1993, faculty reviewed the Federal Register on CD ROM as well as Internet and suggested Internet version be purchased. The request was approved and is currently on order with library funds.
1. A needs assessment is underway to identify what is currently available for risk training for environmental managers as well as what is perceived to be needed in the eyes of the trainers and educators. An initial survey was developed and distributed at two workshops. May 13 & 14 Dr. Temple distributed the survey to the TRADE EM SIG at an Augusta,GA meeting and May 26, 27, 28 the survey was distributed again to the DOE Educational Outreach group in Denver, CO. Non-attending SIG group members and educators will receive the survey via the mail in June. Initial results of the surveys were discussed at the June 3 Advisory Committee meeting and a more in-depth survey will be developed during year 2.
  - ◆ Survey of Environmental Management Training Coordinators
2. A literature search is underway to find information regarding existing training for environmental managers relating to risk as well as core competencies of environmental managers. This supports the needs assessment mentioned above.

#### Advisory Committee

1. An advisory committee was established to support the Professional Education and Training initiative and convened June 3, 1993 in Charleston SC.
  - ◆ Agenda for the June 3, 1993 meeting in Charleston,SC.
  - ◆ List of members serving on Advisory Committee
2. An first draft of advisory committee handbook was created and printed May 28. This handbook serves as a working document which describes the roles and functions of the committee and was distributed at the June 3 meeting. A revision is currently in press.
  - ◆ Draft Handbook.
3. Obtained input and approval from Advisory Committee June 3, 1993 for Environmental Management Professional Development Series and its design and development. This series will initially include the Introduction to Risk Assessment course a Risk Based Decision Making for Environmental Managers course, and a program in Risk Communication/Public Participation.

## Program Design and Development

1. Course design initiated and a initial draft outline was created for the first course in the Professional Development Series. This original outline was discussed at the Advisory Committee meeting.
    - ◆ Draft outlines for the Professional Development seminar Introduction to Risk Assessment for Mid and Upper Level Managers are included. The course is scheduled to be shortened to a two-and onehalf day course upon recommendation of the Advisory Committee.
  2. Environmental compliance courses are being developed. These courses including Hazardous Waste and Lead are currently pending support and direction from the advisory committee. Currently, we have has a re-emphasis on Risk Assessment and Environmental Management Professional Development courses.
    - ◆ The Hazardous Waste lesson plan status report is included.
1. Curriculum Development

The Department of Environmental Health Sciences developed and submitted a draft curriculum for a track in Environmental Health Sciences within the Environmental Studies Graduate Program.

    - ◆ A draft curriculum was developed for the Academic Program to include a masters program in Environmental Management, Industrial Hygiene and Health Physics.
  2. National Search

A national search is currently underway for an Academic Program Director for the Department of Environmental Health Sciences. Another search was conducted for an Environmental Policy position and was completed in June. Two department faculty members participated on the search committee and in interviews with prospective candidates.

## Conferences/Meetings Attended - Professional Education and Training

May 13-14, 1993

Dr. Jan Temple attended and participated in the TRADE Environmental Management (EM) Special Interest Group(SIG) meeting in Augusta, GA. Dr Temple presented information about Professional Education and Training upcoming programs and administered a survey (Attachment 3) to facilitate the needs assessment which is in progress regarding Environmental Management Training in the areas of Risk.

- ◆ Survey

May 26-28, 1993

Dr. Jan Temple attended and participated in the Educational Outreach Workshop for EM-522 in Denver, CO. Dr. Temple administered a survey to the attendees during her presentation regarding the need for Risk training and education for Environmental Managers. The survey functions to support the ongoing needs assessment regarding risk training and education for environmental managers.

## **Family Practice Educators' Perceptions of Environmental Health Training**

Risk communication research has shown that the public perceives physicians as highly credible sources of environmental health information. EHAP (Environmental Hazards Assessment Program) and the Department of Family Medicine at the Medical University of South Carolina are designing a program to train residents to address patients' concerns about environmental health issues. This program will be designed and tested at MUSC and eventually implemented throughout the statewide family practice system.

A needs assessment of environmental health education in the statewide family practice system was conducted as a preliminary step in curriculum development. A qualitative research strategy investigated family practice educators' interest in environmental health education and identified their preferences in curriculum content. Ten in-depth personal interviews of teaching faculty at the seven South Carolina family practice residency sites were conducted.

Results showed general recognition of the importance of environmental education and the need for risk communication training. Several respondents mentioned the importance of training physicians to take a proactive role in disseminating environmental health information at the community level. Lack of time in an already crowded family practice curriculum as well as lack of faculty knowledge of environmental health were perceived as possible drawbacks. The majority of respondents perceived a need for an environmental health self-tutoring educational "package" to be used by both faculty and residents.

# **Medical Educators' Attitudes toward Environmental Health Training**

Catherine Musham, Ph.D., Principal Investigator  
Director of Research and Evaluation of the Outreach Division (EHAP)  
Assistant Professor, Department of Educational Services

David Graber, Ph.D., Co-Investigator  
Assistant Professor, Department of Health Administration and Policy

Jan Bellack, Ph.D., Co-Investigator

Dylan Holmes, Research Associate, Outreach Division (EHAP)

Anne Hainer, Graduate Student, Department of Health Administration and Policy

## **Introduction**

Risk communication, defined as the "exchange of information among interested parties about the nature, magnitude, significance or control of a risk" (Covello, 1993) is a relatively new and rapidly expanding field of academic research. Hundreds of articles and books published in recent years attest to the growing prominence of this aspect of public health communication.

Risk communication research has demonstrated that physicians are perceived by the public to be highly credible sources of information about environmental health issues. The potential role of primary care physicians in disseminating environmental health information is underscored by the public's growing distrust of government and industry-based information sources. Awareness of the adverse effects of chemical and physical agents on human health has grown in recent years, in part, as a result of increased media attention. People are increasingly turning to physicians and other medical practitioners to answer their environmental health questions.

The physician's potential role in environmental risk communication also includes community-level activity. It has been suggested that physicians should be familiar with specific environmental and work

hazards which exist within their communities. They can then take an active role in environmental debates and issues in their community, for example, by providing scientifically based information about the possible health risks associated with a local source of pollution.

It is generally recognized that primary care physicians will have increased responsibility in diagnosing, treating and preventing illnesses caused by physical and chemical agents in the environmental. It has also been predicted that physicians will be drawn into community-level conflicts to explain risks. In addition, physicians will be increasingly sought out by patients as a source of information about the impact of environmental conditions on human health.

To what extent are physicians equipped to take on these new roles? In general, physicians have shown little response to the public's concern with the health hazards associated with chemical and physical agents in food, air, water and soil (Goldstein and Gochfeld). According to Robert Oxford, M.D. few physicians are well-trained on the health consequences of toxins and the link between the environment and illness. At the present time, the vast majority of medical schools offer little, if any, training in environmental health.

The purpose of this study is to assess perceptions about environmental health curricula in medical training among three educator groups: academic deans of medical schools, directors of family practice residency programs, and directors of nurse practitioner programs. The latter group was included because of the growing recognition of the nurse practitioner as a direct provider of basic medical care.

The specific objectives of this study are to measure medical educators' perceptions about:

- a) the primary care physician's ( and nurse practitioner's) functions regarding dissemination of environmental risk information to patients and their community.
- b) the extent to which the educator's program currently emphasizes environmental health in the curriculum

c) groups (inside and outside of the educator's) which have shown most support and least support for inclusion of environmental health in the curriculum

d) the extent to which environmental health is a controversial issue at the educators' program

## **Method**

### **Study 1: Medical School Academic Deans**

#### **Preliminary Study**

Telephone interviews with selected medical school administrators and faculty were conducted to determine the extent of existing efforts toward integrating environmental medicine in the clinical curriculum. This information was used in development of the survey instrument.

#### **Sample**

The sample will consist of individuals identified as "Deans of Academic Affairs" or the equivalent for each US medical school listed in the 1993 edition of the Directory of American Medical Education published by the Association of American Medical Colleges.

#### **Data Collection**

A "survey package" including a cover letter, a written survey instrument (designed according to the Dillman Method) and a self addressed stamped envelop will be sent to academic deans of each medical school in the US. Response to the survey package will be pilot-tested with the Dean of Academic Affairs of MUSC and five other administrators.

Approximately two weeks following the first mailing, a second mailing will be conducted. Identification numbers will be used to determine who did not respond to the first survey. These deans will be sent another survey package with a slightly revised cover letter.

Approximately two weeks following the second mailing, deans who have not responded will be contacted by telephone. They will be asked to participate in the survey either by being interviewed over the phone or being mailed or faxed another questionnaire.

### **Analysis**

Statistical Package for the Social Sciences (SPSS) will be used to analyze the survey data. Statistical procedures such as frequencies, cross-tabulation and cluster analysis will be performed..

## **Study 2: Family Practice Residency Program Directors**

### **Sample**

The sample will consist of individuals identified as "Program Directors" or the equivalent for each US family medicine residency program.

### **Data Collection**

The procedure for data collection will be similar to that described for Study 1. The survey instrument will focus on the family physician's role in environmental health.

### **Analysis**

Similar to that described for Study 1.

### **Study 3: Directors of Nurse Practitioner Programs**

#### **Sample**

The sample will consist of individuals identified as directors of each U.S. nurse practitioner program.

#### **Data Collection**

The procedure for data collection will be similar to that described for Studies 1 and 2. The survey instrument will focus on the nurse practitioners role in environmental health.

## **Family Practice Patients' Perceptions of Environmental Risks**

It is expected that the role of primary care physicians in disseminating environmental health information to patients will gain in importance in the next few years. Risk communication research has shown that the public is more likely to believe physicians than sources of environmental health affiliated with government and industry.

The primary purpose of this study is a) to examine the environmental health-concerns of family practice patients and b) to determine where patients are obtaining environmental health information and c) to assess the extent to which patients are interested in obtaining environmental health information from their family physician.

A written survey is presently being administered to 60 or more practice at each of the seven South Carolina family practice residency programs. Projected sample size is 420 or greater. Data collection will be completed by July 15. Analysis of the data and the final report will be completed by August 30.

The results of this study will provide information about patients' environmental risks concerns and will be used to develop risk communication training programs for family practice physicians. (ABSTRACT.3 ON MUSC DISK)

## **Pharmacists and Environmental Risk Communication**

Many Americans depend on practicing pharmacists for health information. In recognition of the pharmacist's role in disseminating risk information, EHAP (Environmental Hazards Assessment Program) and the College of Pharmacy at the Medical University of South Carolina plans to incorporate environmental health training into the pharmacy curriculum

A study is being conducted to further understanding of the types of environmental risk questions people are most likely to ask pharmacists and the extent to which pharmacists are motivated to provide environmental health information. In addition, pharmacists' knowledge of several basic environmental risk issues will be measured.

In-depth interviews with practicing pharmacists in two rural communities (n=24) and one urban community (n=12) will generate descriptive data pertaining to the research questions.

Data collection will begin on July 1 and will take approximately two weeks. Data analysis and interpretation will be completed by August 15. (ABSTRACT.2 ON MUSC DISC)

# PERCEIVED RISKS AND KNOWLEDGE ASSESSMENT SURVEY

FIPS STATE CODE	STRATUM CODE	PSU NUMBER	RECORD NUMBER	DATE OF INTERVIEW MM DD YY	INTERVIEWER ID
<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>

HELLO. I'm (NAME OF INTERVIEWER) Calling for the Survey Research Center. We're doing a study of the health opinions and concerns of residents of the Southeastern United States.

Your number has been chosen randomly to be included in the study, and we would like to ask some questions about your ideas of things which may affect health.

1. Is this    YES -> GO TO QUESTION 2

NO -> Thank you very much, but I seem to have dialed the wrong number.  
It is possible that your number may be called at a later time. STOP.

2. Is this a private residence? YES -> GO TO PAGE 2.

NO -> Thank you very much, but we are only interviewing in private residences. STOP.

## Refusal Information

FINAL DISPOSITION OF TELEPHONE CALL

- |                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 01- Completed Interview<br>02- Refused Interview<br>03- Non-working Number<br>04- No Answer (multiple tries)<br>05- Business Phone<br>06- No Eligible Respondent at this number<br>07- No Eligible Respondent could be reached during time period | 08- Language barrier prevented completion of interview<br>09- Interview terminated within questionnaire<br>10- Line busy (multiple tries)<br>11- Selected respondent unable to respond because of physical or mental impairment |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Edited by: \_\_\_\_\_ Date: \_\_\_\_\_

Our study requires that we interview only one person who lives in your household.

1. How many members of your household, including yourself, are 18 years of age or older?

IF ONE PERSON HOUSEHOLD  
GO TO "ALL RESPONDENTS"

2. How many are men and how many are women? Men  Women

3. Who is the oldest man/woman presently lives in this household?

4. Who is the next oldest man/woman presently lives in this household?

INTERVIEWER ORDER OF LISTING IS ALL MEN FIRST, OLDEST TO YOUNGEST, THEN ALL WOMEN, OLDEST TO YOUNGEST.

Resident Number	Name/Relationship	LAST DIGIT OF TELEPHONE #										Resident Number
		0	1	2	3	4	5	6	7	8	9	
1		1	1	1	1	1	1	1	1	1	1	1
2		2	1	2	1	2	1	2	1	2	1	2
3		3	1	2	3	1	2	3	1	2	X	3
4		1	2	3	4	1	2	3	4	X	X	4
5		2	3	4	5	1	2	3	4	5	1	5
6		5	6	1	2	3	4	X	X	X	X	6
7		2	3	4	5	6	7	1	X	X	X	7
8		8	1	2	3	4	5	6	7	X	X	8

The person in your household that I need to speak with is \_\_\_\_\_

INTERVIEWER: IF RESPONDENT IS NOT HOME, TRY TO ARRANGE TIME FOR CALLBACK  
Date \_\_\_\_\_ Time \_\_\_\_\_

IF SCREENING WAS NOT DONE WITH RESPONDENT

Hello. I'm (NAME OF INTERVIEWER) calling for the Survey Research Center. I'm a member of a special research team. We're doing a study of residents in the Southeastern United States regarding their health concerns. You have been randomly chosen to be included in the study from among the adult members of your household.

ALL RESPONDENTS

The interview will take about 10 minutes or perhaps a little less and all the information obtained in this study will be confidential.

Your name will not be used, but your responses will be grouped together with information from others participating in the study.

Of course, your part is voluntary and you can refuse to answer any questions or even end this interview anytime you like. ....

ATTITUDE

1. The first questions involve word association. For example, when I mention the word baseball, you might think of the World Series, summertime, hot dogs, or the Atlanta Braves. We are interested in the first three thoughts that come to your mind when you hear Savannah River Site.

What is your first thought or image that comes to mind? \_\_\_\_\_

Second thought or image? \_\_\_\_\_

Third thought or image? \_\_\_\_\_

KNOWLEDGE

2. In your opinion, do people in your community have a greater chance, less chance, or equal chance of getting cancer compared with other people in the state?

- Greater Chance . . . . . 1
- Less Chance . . . . . 2 (Go to Question 5)
- Same Chance . . . . . 3 (Go to Question 6)
- Don't Know . . . . . 7 (Go to Question 6)
- Refused. . . . . 9 (Go to Question 6)

3. (IF GREATER CHANCE) Why do you think people in your community are more likely to get cancer?

- Pollution. . . . . 1
- Genetics . . . . . 2 (Go to Question 6)
- Tobacco Products Use. . . . . 3 (Go to Question 6)
- Eating Habits . . . . . 4 (Go to Question 6)
- Occupation. . . . . 5 (Go to Question 6)
- Other \_\_\_\_\_ . 6 (Go to Question 6)
- Don't Know. . . . . 7 (Go to Question 6)
- Refused. . . . . 9 (Go to Question 6)

4. (IF POLLUTION) What is the major pollution type?

- Water. . . . . 1 (Go to Question 6)
- Air . . . . . 2 (Go to Question 6)
- Radiation . . . . . 3 (Go to Question 6)
- Other \_\_\_\_\_ . 6 (Go to Question 6)
- Don't Know . . . . . 7 (Go to Question 6)
- Refused. . . . . 9 (Go to Question 6)

5. (IF LESS CHANCE) Why do you think people in your community are less likely to get cancer?

- No or Less Pollution . . . . . 1
- Genetics . . . . . 2
- Low Tobacco Products Use. . . . . 3
- Eating Habits . . . . . 4
- Occupation. . . . . 5
- Other \_\_\_\_\_ . 6
- Don't Know. . . . . 7
- Refused. . . . . 9

6. Considering the different types of cancer, what type of cancer do you think people in your community are most likely to get? (Record only one response.)

- Lung . . . . . 1
- Breast . . . . . 2
- Prostate . . . . . 3
- Leukemia . . . . . 4
- Colon/Rectum . . . . . 5
- Other \_\_\_\_\_ . 6
- Don't Know . . . . . 7
- Refused . . . . . 9

7. My next question deals with heart disease and stroke. What do you feel is the major risk factor associated with these conditions? (Record only one response.)

- Diet ..... 1
- High Blood Pressure ..... 2
- Lack of Exercise ..... 3
- High Cholesterol ..... 4
- Cigarette Smoking ..... 5
- Stress ..... 6
- Other ..... 8
- Don't Know ..... 7
- Refused ..... 9

8. Do you feel there is any air pollution in your community that could be harmful to your health?

- Yes ..... 1
- No ..... 2 (Go to Question 10)
- Don't Know ..... 7 (Go to Question 10)
- Refused ..... 9 (Go to Question 10)

9. (IF YES) Where do you think the air pollution comes from?

- Cars/Exhaust ..... 1
- Industry ..... 2
- Savannah River Site ..... 3
- Other \_\_\_\_\_ ..... 6
- Don't Know ..... 7
- Refused. .... 9

10. Do you feel there is any drinking water pollution in your community that could be harmful to your health?

- Yes. .... 1
- No. .... 2 (Go to Question 12)
- Don't Know ..... 7 (Go to Question 12)
- Refused ..... 9 (Go to Question 12)

11. (IF YES) Where do you think the water pollution comes from?

- Industry ..... 1
- Waste Site/Dump..... 2
- Pesticide/Farms ..... 3
- Savannah River Site ..... 4
- Other \_\_\_\_\_ ..... 6
- Don't Know ..... 7
- Refused ..... 9

12. Do you feel there is any chemical pollution in your community that could be harmful to your health?

- Yes..... 1
- No..... 2
- Don't Know ..... 7
- Refused ..... 9

13. Do you feel there is any radiation pollution in your community that could be harmful to your health?

- Yes..... 1
- No..... 2
- Don't Know ..... 7
- Refused ..... 9

14. From which of the following sources do you get information regarding pollution in your community (READ LIST)?

	Yes	No
Newspapers .....	1	2
Television .....	1	2
Radio .....	1	2
Physician .....	1	2
Health Department .....	1	2
Industry Officials .....	1	2

15. Of these sources, which one do you feel provides the most accurate information?  
(Record only one response.)

- Newspapers ..... 1
- Television ..... 2
- Radio..... 3
- Physician..... 4
- Health Department..... 5
- Industry Officials ..... 6
- Don't Know ..... 7
- Refused..... 9

16. Do you feel enough study of pollution is being done in your community?

- Yes..... 1 (Go to Question 18)
- No..... 2
- Don't Know ..... 7 (Go to Question 18)
- Refused ..... 9 (Go to Question 18)

17. (IF NO) What agency or group do you feel should do the studies of pollution?

- State/Local Health Department . 1
- University ..... 2
- Federal Government ..... 3
- Other \_\_\_\_\_ . 6
- Don't Know..... 7
- Refused ..... 9

18. Dose - Use Relationships

	Strongly Disagree	Disagree	Agree	Strongly Agree	No Opinion
A. If you are exposed to a toxic chemical substance, then you are likely to suffer adverse health effects.	1	2	3	4	5
B. If you are exposed to radiation, then you are likely to suffer adverse health effects.	1	2	3	4	5

19. Animal Studies

- |                                                                                                                         |   |   |   |   |   |
|-------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|
| A. The way that an animal reacts to a chemical is a reliable predictor of how a human would react to the same chemical. | 1 | 2 | 3 | 4 | 5 |
|-------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|

20. Attitudes

- |                                                                                               |   |   |   |   |   |
|-----------------------------------------------------------------------------------------------|---|---|---|---|---|
| A. The land, air and water around us are, in general, more contaminated now than ever before. | 1 | 2 | 3 | 4 | 5 |
| B. Use of chemicals has improved our health more than it has harmed.                          | 1 | 2 | 3 | 4 | 5 |
| C. Use of radiation has improved our health more than it has harmed.                          | 1 | 2 | 3 | 4 | 5 |
| D. People worry unnecessarily about what chemicals can do to their health.                    | 1 | 2 | 3 | 4 | 5 |
| E. Chemicals are a major force behind technological advancement.                              | 1 | 2 | 3 | 4 | 5 |
| F. Radiation is a major force behind technological advancement.                               | 1 | 2 | 3 | 4 | 5 |

21. Risk Reduction Attitudes

- |                                                                                 |   |   |   |   |   |
|---------------------------------------------------------------------------------|---|---|---|---|---|
| A. It can never be too expensive to reduce the risks associated with chemicals. | 1 | 2 | 3 | 4 | 5 |
| B. There is always a risk when using chemicals.                                 | 1 | 2 | 3 | 4 | 5 |
| C. You should know as much as possible about the chemicals around you.          | 1 | 2 | 3 | 4 | 5 |

22. Have you ever heard of the Savannah River Region Health Information System?

- Yes. .... 1
- No. .... 2 (Go to Question 24)
- Don't Know ..... 7 (Go to Question 24)
- Refused ..... 9 (Go to Question 24)

23. (IF YES) Where is the System located?

MUSC. .... 1  
 Other \_\_\_\_\_ ..... 6  
 Don't Know ..... 7  
 Refused ..... 9

24. Have you ever heard of the Environmental Hazards Assessment Program?

Yes. .... 1  
 No. .... 2 (Go to Question 26)  
 Don't Know ..... 7 (Go to Question 26)  
 Refused ..... 9 (Go to Question 26)

25. (IF YES) Where is the program located?

MUSC. .... 1  
 Other \_\_\_\_\_ ..... 6  
 Don't Know ..... 7  
 Refused. .... 9

**ACTIONS**

26. Please answer the following questions concerning any of the things that you have done to express your views or concerns that apply to pollution.

	Yes	No	Don't Know	Refused
A. Written a letter to a public official.	1	2	7	9
B. Voted for or against a candidate for public office in part because of his or her position on this issue.	1	2	7	9
C. Attended a public hearing or meeting concerning this issue.	1	2	7	9
D. Joined or contributed money to a special interest group or organization	1	2	7	9
E. Boycotted a company.	1	2	7	9
F. Contacted a physician about health concerns regarding this issue.	1	2	7	9
G. Altered or changed your lifestyle or health practices.	1	2	7	9

27. Overall, do you feel the Savannah River Site is good or bad for the state?

- Good. .... 1
- Bad. .... 2
- Neutral ..... 3
- Don't Know ..... 7
- Refused. .... 9

PART VI: DEMOGRAPHICS

And, finally, these next few questions ask for a little more information about you.

28. How old were you on your last birthday?

- a. CODE AGE IN YEARS ..... \_\_\_\_\_
- Don't know/not sure ..... 0 7
- Refused ..... 0 9

29. What is your race?

Would you say:

(PLEASE READ)

- a. White ..... 1
- b. Black ..... 2
- c. Other - specify ... (\_\_\_\_\_). .... 6
- Don't know/not sure ..... 7
- Refused ..... 9

30. What is the highest grade or year of school you completed?

(READ ONLY IF NECESSARY)

- a. Eighth Grade or Less . . . . . 1
- b. Some High School . . . . . 2
- c. High School Grad or GED Certificate . . . . . 3
- d. Some Technical School . . . . . 4
- e. Technical School Graduate . . . . . 5
- f. Some College . . . . . 6
- g. College Graduate . . . . . 7
- h. Post Grad or Professional Degree . . . . . 8
- Refused . . . . . 9

31. Are you currently: (PLEASE READ)

- a. Employed for wages . . . . . 1
- b. Self employed . . . . . 2
- c. Out of work for more than 1 year . . . . . 3
- d. Out of work for less than 1 year . . . . . 4
- e. Homemaker . . . . . 5
- f. Student . . . . . 6
- g. Retired . . . . . 7
- Refused . . . . . 9

32. And are you: (PLEASE READ)

- a. Married . . . . . 1
- b. Divorced . . . . . 2
- c. Widowed . . . . . 3
- d. Separated . . . . . 4
- e. Never been married . . . . . 5
- f. A member of an unmarried couple . . . . . 6
- Refused . . . . . 9

33. Which of the following categories best describes your annual household income from all sources? (PLEASE READ)

- a. Less than 10,000 ..... 1
- b. 10 to 15,000 ..... 2
- c. 15 to 20,000 ..... 3
- d. 20 to 25,000 ..... 4
- e. 25 to 35,000 ..... 5
- f. 35 to 50,000 ..... 6
- g. Over 50,000 ..... 8
- Don't know/Not sure ..... 7
- Refused ..... 9

34. How many years altogether have you lived in this state?

- a. CODE YEARS. .... -- --
- Don't know/Not sure ..... 7 7
- Refused ..... 9 9

35. Are you a current cigarette smoker?

- Yes ..... 1
- No ..... 2
- Refused ..... 9

36. Have you been told you have high blood pressure?

- Yes ..... 1
- No ..... 2 (Skip to Q 38)
- Don't Know ..... 7 (Skip to Q 38)
- Refused ..... 9 (Skip to Q 38)

37. Are you taking medication for high blood pressure?

- Yes ..... 1
- No ..... 2
- Don't Know ..... 7
- Refused ..... 9

38. INTERVIEWER: INDICATE SEX OF RESPONDENT

ASK IF NECESSARY

- a. Male ..... 1
- b. Female ..... 2

39. How many telephone numbers will reach this household, including the number I used today?

DIFFERENTIATE BETWEEN TELEPHONE NUMBERS AND TELEPHONE SETS IF NECESSARY. INCLUDE ALL TELEPHONE NUMBERS THAT CAN REACH HOUSEHOLD

A. Total Telephone Numbers ..... \_\_\_\_

phone #1 \_\_\_\_\_

phone #2 \_\_\_\_\_

phone #3 \_\_\_\_\_

CLOSING STATEMENT

That's my last question. Everyone's answers will be combined to give us information about the opinions of the people in this community. Thank you very much for your time and cooperation. You will be contacted in the near future about participation in the next phase of the study.

**Summary of EHAP related Research Activity in 92-93**

Zhen Zhang, Department of Biometry and Epidemiology

Physiologically-based pharmacokinetic modeling and simulation have been an integral part of environmental exposure analysis and health risk assessment. During the past year, as an EHAP relevant research activity, I initiated a research effort involving the application of some of the analytical tools that have been traditionally used in the systems science and engineering fields to the theoretical and methodological research of physiologically-based pharmacokinetic modeling and simulation. The following describes briefly the preliminary results of this research effort. Dr. Eberhard O. Voit of the Department of Biometry and Epidemiology and Dr. Hong Zhang of University of Indiana and Purdue University were collaborators in these research activities.

(1) *Derivation of a "lumping condition" for PB-PK models.* Compared to the traditional multi-compartment pharmacokinetic models, the so-called physiologically-based pharmacokinetic (PB-PK) models often have a higher order of complexity in terms of the number of variables and parameters, although they are used to model the same set of dose response data. From a systems science point of view, the PB-PK models may have a certain degree of "redundancy." In our preliminary work, we derived the necessary conditions for tissue regions connected in parallel in a flow limited PB-PK model to be "lumped together" into a single region without affecting the computation for the remaining parts of the model. This result has several useful implications:

a. In many PB-PK simulation problems, we are interested only in computing concentration changes in a small subset of the tissue regions in a model. By lumping together the remaining regions, based on our derived condition, we can greatly reduce the amount of computational complexity in modeling and simulation.

b. For a flow-limited PB-PK model, if there are no more tissue regions that can be further lumped together under the necessary condition we derived, the PB-PK model becomes "irreducible" and qualifies as a "minimum system." We proved theoretically and verified through simulation that for a given set of dose response data a PB-PK model that has been reduced to a "minimum" system and a traditional multi-compartment model derived from the data set are two possibly different "realizations" of the same system. In other words, although they may look quite different, the two models essentially describe the same system and have exactly the same modeling capacity and level of complexity. Miss E. Charlotte Smith, a student in the EHAP sponsored MUSC summer undergraduate research program, performed a series of computer simulations and experimentally verified these theoretical results.

c. We further proved that a PB-PK model that is a minimum system is also an "observable" system. For many physiologically-based pharmacokinetic models, the drug/toxicant concentrations in some internal organs/tissue regions are often difficult or impossible to

measure directly. However, if the model is an observable system, it may be possible to compute these concentrations indirectly using the more easily measurable concentrations such as the ones in blood/plasma over a period of time. There are still many problems we need to solve, for example, the problem caused by the fact that the blood/plasma concentrations are usually measured at discrete time intervals rather than being monitored continuously.

(2) *A graph-theoretical method for automated PB-PK model development.* The topological structure of a PB-PK model affects significantly the behavior of the model. The structure of a flow limited PB-PK model resembles closely that of an electrical circuit although the former, as we have discovered in our research, is much more difficult to analyze. Based on this observation, we derived the necessary mathematical and algorithmic tools that allow us begin the development of an interactive computer software system for automated development of large scale PB-PK models. Based on our discussions with the Chemical Industrial Institute of Toxicology, Raleigh, NC, such an automated PB-PK model development system will be extremely useful.

(3) *Development of a fast algorithm for nonlinear system simulation and modeling.* We developed a fast algorithm for solving autonomous systems of differential equations based on the Lie Series method. In our work, we successfully solved the convergence problem for differential equations with non-linear Michaelis-Menten terms. This makes it possible to use the fast algorithm to obtain fast solutions for PB-PK models with non-linear elimination.

(4) *Student research.* This summer, we organized a journal club in the Department of Biometry and Epidemiology for students and faculty who are interested in environmental risk assessment. Dr. Hong Zhang made a detailed presentation to explain the mathematical background work in our PB-PK research. We also invited Dr. Thomas Walle of the Department of Pharmacology, MUSC, to give us a talk on the current state of art in pharmacokinetic research.

Based on the research efforts mentioned above, we have finished three abstracts for the 1993 Society of Risk Analysis Annual Meeting. With additional experimental and computer simulation results, we will compile the material into journal articles. Two articles describing our fast computing algorithm are already in preparation.

For the current academic year, I plan to continue to work in these areas. In addition to continuing the development of the theoretical aspects of this work, I intend to apply these results to real data problems in exposure analysis and health risk assessment. I believe that, with demonstrated application potential, the theoretical results can be more readily accepted by practitioners of PB-PK modeling and simulation working in environmental hazard risk assessment.

**A SYSTEMS ANALYSIS APPROACH TO PB-PK MODELING.** Zhen Zhang, Hong Zhang, B. Charlotte Smith, and Eberhard O. Voit; Department of Biometry and Epidemiology, Medical University of SC, Charleston, SC 29425, Department of Mathematical Sciences, Indiana University-Purdue University, Fort Wayne, IN 46805 and Department of Mathematics, College of Charleston, Charleston, SC 29424.

There have been on-going discussions about the relative advantages and disadvantages of mathematically-based multi-compartment pharmacokinetic models and so called physiologically based pharmacokinetic (PB-PK) models. In this paper, we compare the two approaches with methods of systems analysis using a simple flow-limited model. First, we derive the necessary and sufficient conditions for such a PB-PK model to be an irreducible minimal system. These conditions also serve as a criterion for lumping body regions and thus for reducing a given PB-PK model to a minimal system. We then prove that for any given set of pharmacokinetic dose response data that can be appropriately modeled by a PB-PK model, the corresponding traditional multi-compartment model will be mathematically "similar" to the minimal system of the PB-PK model, i.e. the two systems are two (possibly different) realizations of the same system transfer function. In terms of modeling power, flexibility, and level of complexity, they are actually exactly the same. Numerical simulations confirm the theoretical results. In the last part of the presentation, we also discuss a number of interesting properties of minimal PB-PK models that are related to system controllability and observability.

### SEE REVERSE FOR SUBMISSION INSTRUCTIONS

**SOCIETY FOR RISK ANALYSIS**  
ANNUAL MEETING, December 5-8, 1993

**PRESENTING AUTHOR:**  
Zhen Zhang

**AFFILIATION:** Medical Univ. of S. Carolina

**MAILING ADDRESS:**  
Dept. of Biometry and Epidemiology  
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171 Ashley Ave., Charleston, SC 29425

**ZIP** \_\_\_\_\_

**TEL:** ( 803 ) 792-7574

**FAX:** ( 803 ) 792-0539

**Is Presenting Author a Member?** YES

**SRA Membership #** SRA04366

**Key Words** PB-PK, Pharmacokinetics

**Compartment Model, Irreducible Systems**  
**Controllability and Observability**

**ABSTRACT FORM: MINIMUM LENGTH 150**  
**WORDS - DEADLINE JUNE 25, 1993**

**PREFERRED PRESENTATION FORMAT**  
(Check one box)

- Oral Presentation  
 Poster Presentation  
 Poster-Platform

**CATEGORY PREFERENCE (select one)**  
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- Invited Paper? Session \_\_\_\_\_  
 Proffered Paper

Please submit this form, 1 copy of this form, and  
PC Compatible disk by **JUNE 25, 1993** to:

Society for Risk Analysis  
8000 Westpark Drive  
Suite 130  
McLean, VA 22102  
(703) 790-1745



**GRAPH THEORETICAL METHODS FOR PB-PK MODELING.** Hong Zhang, Eberhard O. Voit, and Zhen Zhang, Department of Mathematical Sciences, Indiana University -Purdue University, Fort Wayne, IN 46805 and Department of Biometry and Epidemiology, Medical University of SC, Charleston, SC 29425

We present a new systematic approach to physiologically based pharmacokinetic (PB-PK) modeling using mathematical graph theory. The intuitive way of developing such a graph would be to consider tissue or organ regions as vertices (nodes) and the circulatory systems that connect these regions as edges. However, our analysis suggests that it is much more convenient, even though counter-intuitive at first, to let the vertices of the graph correspond to the junctions in the flow diagram and edges of the graph represent the body regions. Two edges are adjacent if the corresponding body regions are linked in the flow diagram. Based on the graph model we develop general rules that automatically generate the mathematical equations for a flow-limited PB-PK model. Using the incidence matrix of the graph and the parameters associated with the model, we obtain the system equations directly with straightforward matrix operations. The rules can be naturally extended to include nonlinear models and other more general cases. This method is especially useful for computer implementation and simulation of PB-PK models, because it offers a simple algorithm for arbitrarily complex systems. The graph method also provides a powerful tool in the theoretical analysis of PB-PK models. As an example, we use the results about the cycle space of a graph to derive an efficient way to determine a minimal set of independent parameters for complicated models.

### SEE REVERSE FOR SUBMISSION INSTRUCTIONS

SOCIETY FOR RISK ANALYSIS  
ANNUAL MEETING, December 5-8, 1993

PRESENTING AUTHOR: Zhen Zhang

AFFILIATION: Medical Univ. of S. Carolina

MAILING ADDRESS:

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Is Presenting Author a Member? YES

SRA Membership # SRA04366

Key Words PB-PK, Pharmacokinetics  
Graph Theory, Modeling and Simulation

ABSTRACT FORM: MINIMUM LENGTH 150  
WORDS - DEADLINE JUNE 25, 1993

PREFERRED PRESENTATION FORMAT

(Check one box)

- Oral Presentation  
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CATEGORY PREFERENCE (select one)  
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 Proffered Paper

Please submit this form, 1 copy of this form, and  
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Society for Risk Analysis  
8000 Westpark Drive  
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American Statistical Association  
Conference on Radiation & Health

June 26 - July 1, 1994  
Nantucket, Massachusetts

**RADIATION DOSIMETRY AND RISK ASSESSMENT**

**SUNDAY, JUNE 26**

1:00 pm - 5:00 pm           Registration

3:30 pm - 5:30 pm           **CASE STUDY: SELLAFIELD**  
Chair: Richard P. Chiacchierini, U.S. Food & Drug Administration

Duncan Thomas, UCLA  
Geoff Howe, University of Toronto

Discussant: Dale Preston, Radiation Effects Research Foundation

6:00 pm - 8:00 pm           Reception

**MONDAY, JUNE 27**

7:30 am - 8:30 am           Breakfast

8:30 am - 12 noon           **IN UTERO AND PARENTAL RADIATION EXPOSURE**  
Chair: Elaine Ron, National Institutes of Health

In Utero Exposure in Twins  
Peter Inskip, National Cancer Institute

In Utero and Parental Exposure Among Children of Atomic Bomb Survivors  
William J. Schull, University of Texas

Reanalysis of the Oxford Prenatal Study  
Colin Muirhead, NRPB

Parental Exposure and Leukemia Occurance Near Nuclear Reactors  
John McLaughlin, University of Toronto

Discussant: Mike Ginevan, Step 5 Corporation

Floor Discussion

12:30 pm - 1:30 pm            Luncheon

1:30 pm - 5:30 pm            CEDR Demonstration , Bob Goldsmith, DOE  
Animal Data Base On Radiation Risks: Demonstration, Chuck  
Watson, Battelle  
Free Time

5:30 pm - 7:00 pm            Dinner Buffet

7:15 pm - 10:15 pm          UPDATE ON ATOMIC BOMB SURVIVORS  
Chair: Elizabeth Cardis, IARC

Updated Cancer Mortality Among A-Bomb Survivors  
Dale Preston, RERF

Site Specific Cancer Incidents of A-Bomb Survivors  
Elaine Ron, NCI/RERF

Discussant: David Hoel, Medical University of South Carolina

Floor Discussion

## TUESDAY, JUNE 28

7:30 am - 8:30 am            Breakfast

8:30 am - 12 noon            RADON AND LUNG CANCER  
Chair: Claire Weinberg, NIEHS

Swedish Case-control Study of Environmental Radon and Lung Cancer  
G. Pershagen, Karolinska Institute

Indoor Radon and Lung Cancer among Non-smoking Missouri Women  
Michael Alavanja, NCI

Interaction Between Radon and Tobacco Smoke: A Reanalysis of the Colorado and Ontario  
Uranium Miners' data.  
Suresh Moolgavkar, Fred Hutchinson Cancer Research Center.

Discussant : Richard W. Hornung, NIOSH

Floor Discussion

12:30 pm - 1:30 pm            Luncheon

1:30 pm - 5:30 pm            Free Time  
5:30 pm - 7:00 pm            Dinner Buffet  
7:15 pm - 10:15 pm          RADON DOSIMETRY  
                                         Chair: John Dunbar, Medical U of South Carolina

Assessing Exposure at the Level of the Population.  
A.V. Nero, Jr., University of California, Berkeley.

Assessing exposure at the level of the individual: New Approaches.  
C. Samuelsson, University of Lund, Sweden.

Assessing Exposure at the Level of the Cell.  
A. James, Battelle, Pacific Northwest Laboratories.

New Methods for Measuring Radon.  
Gerald Laurer, NYU

Discussant: Claire Weinberg, NIEHS

Floor Discussion

### WEDNESDAY, JUNE 29

7:30 am - 8:30 am            Breakfast  
8:30 am - 12 noon            RADIATION DOSIMETRY  
                                         Chair: Daniel Krewski, Health Canada

Dosimetry Models  
Jack Fix, Battelle

Errors in Radiation Dosimetry.  
Ed Frome, Oak Ridge National Laboratory

Biological Dosimetry  
Dan Stramm, USC

Dosimetry Methods for Chernobyl Studies  
Werner Birkhart, Germany

Discussant: Richard Chiacchierini, U.S. Food & Drug Administration

Floor Discussion

12:30 pm - 1:30 pm Luncheon  
1:30 pm - 5:30 pm Free Time  
5:30 pm - 7:00 pm Dinner Buffet  
7:15 pm - 10:15 pm OCCUPATIONAL RADIATION CARCINOGENESIS  
Chair: Mike Ginevan, Step 5 Corporation

Mortality Experience of Radiation Workers in the National Dose Register of Canada.  
J. Zielinski, D. Krewski, J.P. Ashmore & E. Letourneau, Health Canada.

Radiation Risks in Nuclear Workers.  
E. Cardis, International Agency for Research on Cancer

Lung Cancer Risk Among Underground Miners in a Pooled Analysis of 11 Studies  
J. Lubin, U.S. National Cancer Institute

CEDR  
Mark Durst, Lawrence Berkeley

Discussant: Ethel Gilbert, Battelle

Floor Discussion

#### THURSDAY, JUNE 30

7:30 am - 8:30 am Breakfast  
8:30 am - 12 noon NON-IONIZING RADIATION RISKS  
Chair: Richard Hornung, NIOSH

Melanoma Risks of UV Radiation Exposure.  
Bruce Armstrong, IARC

Electromagnetic Fields.  
Valerie Beral, Oxford

Non-Ionizing Radiation  
William Kaune, EM Factors, Richland, Washington

Discussant: Ben Armstrong, McGill University

Floor Discussion

12:30 - 1:30 pm            Luncheon  
1:30 pm - 5:30 pm        Free Time  
5:30 pm - 7:00 pm        Dinner Buffet  
7:15 pm - 10:15 pm      **ANIMAL MODELS FOR RADIATION RISK ASSESSMENT**  
                                  Chair: Dale Preston, RERF

**Radon Induced Lung Cancer in Rats**  
Fred Cross, Battelle

**Combining Animal Data to Assess Radiation Risks**  
Bruce Carnes, Argon National Labs

**Animal Data on Radiation Risks**  
Chuck Watson, Battelle

Discussant: Daniel Krewski, Health Canada

Floor Discussion

**FRIDAY, JULY 1**

7:00 am - 9:00 am        Breakfast

May 28, 1993

**SOUTH CAROLINA STATEWIDE FAMILY PRACTICE RESIDENCY SYSTEM**

**ENVIRONMENTAL MEDICINE CURRICULUM COMMITTEE**

<u>Site</u>	<u>Faculty</u>
Anderson	Dr. Hunter E. Woodall
Charleston	Dr. Clive D. Brock
Columbia	Dr. Ernest McCutcheon
Florence	Dr. Hilton P. Terrell
Greenville	Dr. D. Scott Grubbs
Greenwood	Dr. David E. Ruiz
Spartanburg	Dr. Mark T. Godenick

## **ENVIRONMENTAL MEDICINE FAX SURVEY - MAY 1993**

### **A SURVEY OF THE DIRECTORS OF THE SOUTH CAROLINA STATEWIDE FAMILY PRACTICE RESIDENCY SYSTEM**

Included in this report are the following items:

1. Summary of the Environmental Medicine Curriculum Fax Survey (one page)
2. Survey Results - Environmental Medicine Curriculum (three pages)
3. Environmental Medicine Curriculum Questionnaire (two pages)

### **SYNOPSIS**

The directors of the seven member sites of the South Carolina Statewide Family Practice Residency System were surveyed for their perceptions on needs for environmental medicine curriculum. All indicated a need for environmental medicine curriculum as an integral part of health care delivery of family practice, not as an added-on subspecialty. They urged us to develop packaged curriculum along family practice lines.

Five directors expressed interest in having access to a MUSC data base for clinical consultations on environmental medicine health concerns. The other two respondents later expressed their interest upon learning there were to be no fees involved for this service.

Curriculum formats most preferred by the directors for their faculty included case histories, literature reviews and self-study monographs. Curriculum formats most preferred by the directors for their residents included case histories, interactive PC programs and videotapes.

The top ranked topics for curriculum development included: 1) taking an environmental/occupational history, 2) clinician's response to environmental cases, 3) risk assessment, 4) toxicology, 5) farm chemicals and pesticides, and 6) use of data bases and consultants.

**AGROMEDICINE PROGRAM/EHAP  
OCCUPATIONAL & ENVIRONMENTAL MEDICINE  
MUSC DEPARTMENT OF FAMILY MEDICINE**

**April 1993 SUMMARY REPORT**

**Public Service:**

Staff members consulted on or researched 16 environmental/occupational medicine cases during the month. Ten cases involved acute and chronic chemical exposure (aldrin, chlordane, chlorpyrifos, cypermethrin [two cases], diazinon, malathion, terbufos and trichloroethylene). Other cases involved green tobacco sickness, drift of pesticides from application to an apple orchard, food poisoning, alleged immunosuppression by organophosphates insecticides, methemoglobinemia caused by well water contaminated by a fertilizer, and a case of probable Newcastle disease in a poultry farmer.

***Case of the Month***

On April 29, a family physician requested consultation on a patient who presented on April 27 with sore throat, conjunctivitis, 103° temperature and left-lower lobe pneumonia. The patient had been discharged from a hospital earlier in the week following a hemorrhoidectomy. The physician prescribed erythromycin. On April 29, the patient was seen again, feeling somewhat better and with a normal temperature. He asked the physician, "Since my turkey breeder flock has a respiratory illness, could this have anything to do with my problem?" A diagnosis of clinical Newcastle disease was made following consultation with the Agromedicine Program. Typically, Newcastle disease affects chickens, turkeys, ducks, geese and infrequently, humans. It is caused by a very contagious virus of Paramyxovirus genus. In humans the disease is characterized by conjunctivitis, lacrimation, mild flu-like infection including sore throat and elevated temperature. The illness usually lasts 3 to 4 days. Antibiotics are advised for secondary infection. This case underscores the importance of occupational history for the physician to make the diagnosis.

**Education:**

On April 20, the Agromedicine Program's five self-study monographs in agricultural medicine received AMA-PRA Category I accreditation from the MUSC office of continuing medical education.

The following lectures were presented: 1) April 13 - "Update on Pesticide Toxicology" to the Tri-County Medical Society in Allendale, 2) April 15 - "Quality of the American Food Supply" to Charleston County Extension homemakers meeting and on April 24 at a meeting of the Food Processors Association held Fripp Island, and 3) April 20 - "Venomous Insect Stings" to 23 MUSC doctor of pharmacy students.

**Research:**

Work continued on the following projects: 1) data collation on a twenty year history of hospitalized pesticide poisonings in SC was completed and 2) consultation on pesticide associated occupations of the parents of children who are patients of the Greenwood Genetics Center as part of a federally sponsored prospective case/control study of prevention of neural tube defects.

**AGROMEDICINE PROGRAM/EHAP  
OCCUPATIONAL & ENVIRONMENTAL MEDICINE  
MUSC DEPARTMENT OF FAMILY MEDICINE**

**MAY 1993 SUMMARY REPORT**

**Public Service:**

Staff members consulted on or researched 35 environmental/occupational medicine cases during the month. Fourteen cases involved acute and chronic chemical exposure. Consultations involving pesticides included boric acid, chlordane, chlorpyrifos, 2,4-D, diquat, glyphosate (2), malathion, methyl bromide and pyrethrin. Other chemical consultations included enamel paint, gasoline fumes, potassium dichromate and trichloroethylene. The remaining cases included 15 consultations on Lyme disease, one on fire ant anaphylaxis, one spider bite, three plant toxicities and one case of delusory parasitosis.

**Education:**

An announcement in the May 15 issue of the *Agromedicine Program Update* informed physicians that the five self-study monographs in agricultural medicine were now available from the program.

The following lectures were presented: 1) May 18 - "Update on Lyme Disease" to the attending physicians at Beaufort Memorial Hospital, and 2) May 24 - "Quality of the American Food Supply" at the annual meeting of the NC/SC Turkey Federation held in Myrtle Beach.

Dr. Schuman and Sam Caldwell attended the May 28 meeting of the Statewide Family Practice Residency Directors to present plans for environmental medicine curriculum.

**Research:**

Work continued on the following projects: 1) data collation on a twenty year history of hospitalized pesticide poisonings in SC was completed and 2) consultation on pesticide associated occupations of the parents of children who are patients of the Greenwood Genetics Center as part of a federally sponsored prospective case/control study of prevention of neural tube defects.

**Other:**

Dr. Schuman and Larry Spell attended the May 25-27, 1993 Environmental Risk Communication Workshop hosted by the Navy Environmental Health Center.

**AGROMEDICINE PROGRAM/EHAP  
OCCUPATIONAL & ENVIRONMENTAL MEDICINE  
MUSC DEPARTMENT OF FAMILY MEDICINE**

**JUNE 1993 SUMMARY REPORT**

**Public Service:**

Staff members consulted on 23 environmental/occupational medicine cases during the month. Twelve cases involved acute and chronic chemical exposure. Consultations involving pesticides included acute health effects of orthene, phosphine, acrifluorfen-sodium and the long-term health effects of exposure to toxaphene, occupational exposure to a variety of agricultural pesticides and three consultations on pesticide residues in the food supply. Other chemical consultations included acute exposure to methanol, chronic exposure to petrochemical/heavy metal sludge and lead contaminated drinking water. The remaining cases included four consultations on Lyme disease, four on insect associated dermatitis, one case of delusory parasitosis, and an astrocytoma cluster associated with high-voltage power lines. Also, recommendations for heat stress management were provided to a company safety director.

**Education:**

*Updates in Agricultural Medicine (Series I)* were mailed to 92 Agromedicine Program Consulting Physicians on June 30.

The following lectures were presented: 1) June 16 - "Multiple Chemical Sensitivity" at the intensive family medicine review held at the Isle of Palms, 2) June 17 - three lectures on fire ant allergy, medical management and epidemiology at the 1993 Imported Fire Ant Conference held in Charleston, 3) "Venomous Insect Stings and Bites" at the 1993 Governor's School held in Charleston, 4) June 22 - "Ten Steps In the Management of Pesticide Poisoning" to the attending physicians of Lee County Memorial Hospital in Bishopville, and 5) "Lyme Disease" to the attending staff of Trident Regional Medical Center.

Planning for three workshops and five self-study curriculum packages was begun with the Statewide Family Practice Environmental Medicine Curriculum Committee.

Jennifer Lamar, a College of Charleston graduate student, began a summer internship with Occupational & Environmental Medicine on June 30. The internship is supported by EHAP.

**Research:**

A concise update summary of 20 years of hospitalized pesticide poisonings in South Carolina was submitted on June 14 to the Letters to the Editor of *Science*.

# SUMMARY of the ENVIRONMENTAL MEDICINE CURRICULUM FAX SURVEY- MAY 1993

## Rank Order (rated as a 4 or 5) of self-study curriculum formats preferred by faculty:

case histories	6 of 7 respondents
literature reviews	6 of 7 "
self-study monographs	4 of 7 "
interactive PC programs	3 of 7 "
HCN	2 of 7 "
videotapes	1 of 7 "
audiotapes	1 of 7 "

## Rank Order (rated as a 4 or 5) of self-study curriculum formats preferred for residents:

case histories	5 of 6 respondents
interactive PC programs	4 of 6 "
videotapes	4 of 6 "
literature reviews	3 of 6 "
self-study monographs	3 of 6 "
HCN	0 of 6 "

## Preference for specific topics:

<u>Rank</u>	<u>Topic</u>	<u>No. Choosing</u>	<u>Average Score</u>
1.	taking an environmental/occupational history	5 of 7	2.0
2.	clinician's response	4 of 7	2.5
3.	risk assessment	3 of 7	3.0
4.	toxicology	3 of 7	3.0
5.	farm chemicals and pesticides	4 of 7	3.25
6.	use of data bases and consultant	3 of 7	3.6
7.	indoor air quality	2 of 7	
8.	water pollution	2 of 7	
9.	explaining risk to patients	2 of 7	
10.	noise induced hearing loss	2 of 7	
11.	air pollution	1 of 7	
12.	asbestos	1 of 7	
13.	cluster epidemiology	1 of 7	
14.	food quality	1 of 7	
15.	lead exposure in children	1 of 7	
16.	radon exposure	1 of 7	
17.	Savannah River Site	1 of 7	
18.	responding to the media	0 of 7	
19.	reproductive damage	0 of 7	
20.	environmental carcinogens	0 of 7	
21.	heavy metal exposure at worksite	0 of 7	
22.	ozone depletion	0 of 7	
23.	risk from nuclear power plants	0 of 7	
24.	exposure to nickel & chemicals in industry	0 of 7	

## SURVEY RESULTS - MAY 7, 1993

### ENVIRONMENTAL MEDICINE CURRICULUM

*(This FAX survey is a follow-up of the study by Drs. Musham and Hainer of the Environmental Curriculum Steering Committee for Environmental Health Activities and Needs Assessment of the SC Statewide Family Practice System.)*

**(NUMBER OF RESPONSES ARE IN PARENTHESES)**

1. Would you like to receive self-study curriculum in environmental medicine?  
Yes - (7)      No - (0)
  
2. Would you like to receive packaged curriculum in environmental medicine for inclusion in residency training?  
Yes - (7)      No - (0)
  
3. Would you like ongoing access to a MUSC data base for clinical consultation and interpretation of environmental medicine health concerns?  
Yes - (5)      No - (1)      (No Answer - 1 This respondent requested more details.)
  
4. Please indicate your preference for self-study formats:

	<b>FOR FACULTY</b>					<b>FOR RESIDENTS</b>				
	<u>Most</u>			<u>Least</u>		<u>Most</u>			<u>Least</u>	
case histories	5(3)	4(3)	3	2	1(1)	5(4)	4(1)	3(1)	2	1
literature reviews	5(3)	4(3)	3(1)	2	1	5(1)	4(2)	3	2(1)	1
HCN	5	4(2)	3(1)	2(2)	1(1)	5	4	3	2(4)	1(1)
videotapes	5	4(1)	3(3)	2(3)	1	5(3)	4(1)	3(1)	2(1)	1
self-study monographs	5	4(4)	3(2)	2(1)	1	5(2)	4(1)	3(2)	2	1
computer programs	5(3)	4	3(2)	2(1)	1(1)	5(1)	4(3)	3(1)	2	1
other:										
audio tape	5(1)	4	3	2	1					

5. Please rank order your top five preferences for specific topics:

**ONE RESPONDENT RANKED SEVEN TOPICS.**

Responses

<u>3</u>	air pollution in SC
<u>2</u>	asbestos
<u>3,1,3,3</u>	clinician's response to the environmental patient/incident
<u>6</u>	cluster epidemiology in environmental medicine
	environmental carcinogens
<u>4,4</u>	explaining risk assessment to patients
	exposure to nickel and other chemicals in industry
<u>5,1,4,3</u>	farm chemicals and pesticides
<u>3</u>	food quality
	heavy metal exposure at the worksite
<u>4,1</u>	indoor air quality
<u>1</u>	lead exposure in children
<u>5,5</u>	noise induced hearing loss at industrial sites
	ozone depletion
<u>4</u>	radon exposure
	reproductive damage
	responding to the media
<u>5,2,2</u>	risk assessment
	risks from nuclear power plants
<u>7</u>	Savannah River site
<u>5,2,2</u>	toxicology
<u>1,2,1,1,5</u>	taking an environmental/occupational medicine history
<u>2,5,4</u>	use of data bases and consultants
<u>2,4</u>	water pollution in SC

6. Please list the most likely environmental health issues which faculty and residents are likely to encounter in your area.

	<u>ANDERSON</u>	<u>CHARLESTON</u>	<u>COLUMBIA</u>	<u>FLORENCE</u>	<u>GREENVILLE</u>	<u>GREENWOOD</u>	<u>SPARTANBURG</u>
<i>farm chemicals</i>	-	-	-	X	-	X	X
<i>chemical exp.</i>	-	-	-	-	-	-	-
<i>lead exposure</i>	-	-	-	-	X	X	X
<i>radon</i>	-	-	-	-	-	-	-
- <i>food quality</i>	-	X	-	-	-	-	-
- <i>indoor air</i>	-	-	-	-	-	-	-
-	-	-	<i>water pollution</i>	-	-	-	-
-	-	-	<i>heavy metals</i>	-	X	-	-
-	-	-	<i>asbestos</i>	-	X	-	-
-	-	-	<i>toxicology</i>	-	-	-	X
-	-	-	-	-	<i>env. cancer</i>	-	-
-	-	-	-	-	<i>NIHL</i>	-	X

## ENVIRONMENTAL MEDICINE CURRICULUM

*(This FAX survey is a follow-up of the study by Drs. Musham and Hainer of the Environmental Curriculum Steering Committee for Environmental Health Activities and Needs Assessment of the SC Statewide Family Practice System.)*

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1. Would you like to receive self-study curriculum in environmental medicine?

Yes \_\_\_ No \_\_\_

2. Would you like to receive packaged curriculum in environmental medicine for inclusion in residency training?

Yes \_\_\_ No \_\_\_

3. Would you like ongoing access to a MUSC data base for clinical consultation and interpretation of environmental medicine health concerns?

Yes \_\_\_ No \_\_\_

4. Please indicate your preference for self-study formats:

	FOR FACULTY					FOR RESIDENTS				
	<u>Most</u>		<u>Least</u>			<u>Most</u>		<u>Least</u>		
case histories	5	4	3	2	1	5	4	3	2	1
literature reviews	5	4	3	2	1	5	4	3	2	1
Health Communications Network	5	4	3	2	1	5	4	3	2	1
videotapes	5	4	3	2	1	5	4	3	2	1
self-study monographs	5	4	3	2	1	5	4	3	2	1
interactive computer programs	5	4	3	2	1	5	4	3	2	1
other:	_____					_____				

*(SEE NEXT PAGE)*

5. Please rank order your top five preferences for specific topics:

- air pollution in SC
- asbestos
- clinician's response to the environmental patient/incident
- cluster epidemiology in environmental medicine
- environmental carcinogens
- explaining risk assessment to patients
- exposure to nickel and other chemicals in industry
- farm chemicals and pesticides
- food quality
- heavy metal exposure at the worksite
- indoor air quality
- lead exposure in children
- noise induced hearing loss at industrial sites
- ozone depletion
- radon exposure
- reproductive damage
- responding to the media
- risk assessment
- risks from nuclear power plants
- Savannah River site
- toxicology
- taking an environmental/occupational medicine history
- use of data bases and consultants
- water pollution in SC

6. Please list the most likely environmental health issues which faculty and residents are likely to encounter in your area.

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7. Please return this survey to Dr. Stanley Schuman - FAX 792-4702.

## SURVEY RESULTS - MAY 7, 1993

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### ENVIRONMENTAL MEDICINE CURRICULUM

*(This FAX survey is a follow-up of the study by Drs. Musham and Hainer of the Environmental Curriculum Steering Committee for Environmental Health Activities and Needs Assessment of the SC Statewide Family Practice System.)*

(NUMBER OF RESPONSES ARE IN PARENTHESES)

1. Would you like to receive self-study curriculum in environmental medicine?  
Yes - (7)      No - (0)
  
2. Would you like to receive packaged curriculum in environmental medicine for inclusion in residency training?  
Yes - (7)      No - (0)
  
3. Would you like ongoing access to a MUSC data base for clinical consultation and interpretation of environmental medicine health concerns?  
Yes - (5)      No - (1)      (No Answer - 1 This respondent requested more details.)
  
4. Please indicate your preference for self-study formats:

	FOR FACULTY					FOR RESIDENTS				
	<u>Most</u>			<u>Least</u>		<u>Most</u>			<u>Least</u>	
case histories	5(3)	4(3)	3	2	1(1)	5(4)	4(1)	3(1)	2	1
literature reviews	5(3)	4(3)	3(1)	2	1	5(1)	4(2)	3	2(1)	1
HCN	5	4(2)	3(1)	2(2)	1(1)	5	4	3	2(4)	1(1)
videotapes	5	4(1)	3(3)	2(3)	1	5(3)	4(1)	3(1)	2(1)	1
self-study monographs	5	4(4)	3(2)	2(1)	1	5(2)	4(1)	3(2)	2	1
computer programs	5(3)	4	3(2)	2(1)	1(1)	5(1)	4(3)	3(1)	2	1
other:										
audio tape	5(1)	4	3	2	1					

5. Please rank order your top five preferences for specific topics:

**ONE RESPONDENT RANKED SEVEN TOPICS.**

**Responses**

<u>3</u>	air pollution in SC
<u>2</u>	asbestos
<u>3,1,3,3</u>	clinician's response to the environmental patient/incident
<u>6</u>	cluster epidemiology in environmental medicine
	environmental carcinogens
<u>4,4</u>	explaining risk assessment to patients
	exposure to nickel and other chemicals in industry
<u>5,1,4,3</u>	farm chemicals and pesticides
<u>3</u>	food quality
	heavy metal exposure at the worksite
<u>4,1</u>	indoor air quality
<u>1</u>	lead exposure in children
<u>5,5</u>	noise induced hearing loss at industrial sites
	ozone depletion
<u>4</u>	radon exposure
	reproductive damage
	responding to the media
<u>5,2,2</u>	risk assessment
	risks from nuclear power plants
<u>7</u>	Savannah River site
<u>5,2,2</u>	toxicology
<u>1,2,1,1,5</u>	taking an environmental/occupational medicine history
<u>2,5,4</u>	use of data bases and consultants
<u>2,4</u>	water pollution in SC

6. Please list the most likely environmental health issues which faculty and residents are likely to encounter in your area.

<u>ANDERSON</u>	<u>CHARLESTON</u>	<u>COLUMBIA</u>	<u>FLORENCE</u>	<u>GREENVILLE</u>	<u>GREENWOOD</u>	<u>SPARTANBURG</u>
<i>farm chemicals</i>	-	-	X	-	X	X
<i>chemical exp.</i>	-	-	-	-	-	-
<i>lead exposure</i>	-	-	-	X	X	X
<i>radon</i>	-	-	-	-	-	-
<i>food quality</i>	-	X	-	-	-	-
<i>indoor air</i>	-	-	-	-	-	-
-	-	<i>water pollution</i>	-	-	-	-
-	-	<i>heavy metals</i>	-	X	-	-
-	-	<i>asbestos</i>	-	X	-	-
-	-	-	<i>toxicology</i>	-	-	X
-	-	-	-	<i>env. cancer</i>	-	-
-	-	-	-	<i>NIHL</i>	-	X

## ENVIRONMENTAL MEDICINE CURRICULUM

*(This FAX survey is a follow-up of the study by Drs. Musham and Hainer of the Environmental Curriculum Steering Committee for Environmental Health Activities and Needs Assessment of the SC Statewide Family Practice System.)*

1. Would you like to receive self-study curriculum in environmental medicine?

Yes \_\_\_\_ No \_\_\_\_

2. Would you like to receive packaged curriculum in environmental medicine for inclusion in residency training?

Yes \_\_\_\_ No \_\_\_\_

3. Would you like ongoing access to a MUSC data base for clinical consultation and interpretation of environmental medicine health concerns?

Yes \_\_\_\_ No \_\_\_\_

4. Please indicate your preference for self-study form:

	<b>FOR FACULTY</b>					<b>FOR RESIDENTS</b>				
	<u>Most</u>	<u>Least</u>	<u>Most</u>	<u>Least</u>	<u>Most</u>	<u>Least</u>	<u>Most</u>	<u>Least</u>	<u>Most</u>	<u>Least</u>
case histories	5	4	3	2	1	5	4	3	2	1
literature reviews	5	4	3	2	1	5	4	3	2	1
Health Communications Network	5	4	3	2	1	5	4	3	2	1
videotapes	5	4	3	2	1	5	4	3	2	1
self-study monographs	5	4	3	2	1	5	4	3	2	1
interactive computer programs	5	4	3	2	1	5	4	3	2	1
other:	_____					_____				

(SEE NEXT PAGE)

5. Please rank order your top five preferences for specific topics:

- \_\_\_ air pollution in SC
- \_\_\_ asbestos
- \_\_\_ clinician's response to the environmental patient/incident
- \_\_\_ cluster epidemiology in environmental medicine
- \_\_\_ environmental carcinogens
- \_\_\_ explaining risk assessment to patients
- \_\_\_ exposure to nickel and other chemicals in industry
- \_\_\_ farm chemicals and pesticides
- \_\_\_ food quality
- \_\_\_ heavy metal exposure at the worksite
- \_\_\_ indoor air quality
- \_\_\_ lead exposure in children
- \_\_\_ noise induced hearing loss at industrial sites
- \_\_\_ ozone depletion
- \_\_\_ radon exposure
- \_\_\_ reproductive damage
- \_\_\_ responding to the media
- \_\_\_ risk assessment
- \_\_\_ risks from nuclear power plants
- \_\_\_ Savannah River site
- \_\_\_ toxicology
- \_\_\_ taking an environmental/occupational medicine history
- \_\_\_ use of data bases and consultants
- \_\_\_ water pollution in SC

6. Please list the most likely environmental health issues which faculty and residents are likely to encounter in your area.

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7. Please return this survey to Dr. Stanley Schuman - FAX 792-4702.

- 1  ARE YOU ALLERGIC TO THE MODERN WORLD?
- 2  MULTIPLE CHEMICAL SENSITIVITY (MCS)
- 3  MCS EXPOSURES
- 4  MCS SYNONYMS
  - 20th - CENTURY DISEASE
  - CLINICAL ECOLOGY ILLNESS
  - ENVIRONMENTAL ILLNESS
  - CHEMICAL AIDS
  - TOTAL ALLERGY SYNDROME
- 5  MCS CASE HISTORIES
 

35 YEAR OLD LONGSHOREMAN EXPOSED TO POTASSIUM DICHROMATE

44 YEAR OLD TRUCK DRIVER WITH HISTORY OF HAULING WASTES

46 YEAR OLD FEMALE COLLEGE PROFESSOR WITH SEVERAL "TRIGGERS"
- 6  35 YEAR OLD LONGSHOREMAN
  - PRESENTS WITH ANXIETY, BROWNISH PURPLE SKIN STAINS ON HANDS, FOREARMS AND ANKLES
  - PATIENT EXAMINATION AND LAB TESTS NEGATIVE
  - 3 DAYS PRIOR, PT WAS EXPOSED TO SPILL OF POTASSIUM DICHROMATE
  - PT IMMEDIATELY SHOWERED, RUSHED TO E.R. REASSURED AND SENT HOME FOR 48 HRS
  - RETURNED TO WORK AND FOUND SPILL SITE RESTRICTED AND DECONTAMINATION TEAM AT WORK IN FULL PROTECTIVE SUITS
  - PT RUSHED TO FAMILY PHYSICIAN
  - DIAGNOSIS? TREATMENT? MANAGEMENT?
- 7  44 YEAR OLD LANDFILL TRUCK DRIVER
  - Sudden onset, one week after new job (landfill)
  - Red, itching rash, hives, especially neck, hands, feet waist
  - Confusion, short term memory loss
  - Fatigue
  - Polyuria, polydipsia
  - Headache, severe
  - Nausea especially at landfill
  - Prednisone (3 weeks) relieved rash and nausea
  - Smokes 1 - 2 packs / day
  - All lab tests, including heavy metals and solvents, negative
  - Symptoms better when out of work for a week
  - DIAGNOSIS? THERAPY? MANAGEMENT?
- 8  46 YEAR OLD COLLEGE PROFESSOR
  - 46 YEAR OLD COLLEGE ART TEACHER
  - POLYSYMPTOMATIC - EARLY MENOPAUSE, CYSTIC OVARIES, IRRITABLE BOWEL
  - 9 MONTHS PRIOR TO VISIT, FOOD TASTED LIKE METAL ODORS WERE EXTREMELY OBNOXIOUS (PAINTS, SOLVENTS, CHANGING THE BED, RIDING IN CARS, GAS PIPE REPAIRED 2 BLOCKS AWAY).
  - ALL LAB TESTS NEGATIVE, INCLUDING PSYCHIATRIST EVALUATION.
  - LOST 20 LBS IN ONE YEAR; FOOD WAS NAUSEATING.
  - MISSING WORK, CANCELLED VACATIONS, LOST ROOMMATE DUE TO ODORS IN HOUSE. CANCELLED SOCIAL LIFE.
  - AIR SAMPLES AT WORKPLACE WITHIN NORMAL LIMITS
  - HISTORY, PHYSICAL, LAB TESTS NORMAL
  - DIAGNOSIS? THERAPY? MANAGEMENT?
- 9  MULTIPLE CHEMICAL SENSITIVITY SYNDROME (MCS)
 

ANY ILLNESS TREATED BY A PRACTITIONER OF CLINICAL ECOLOGY / ENVIRONMENTAL MEDICINE
- 10  CLINICAL ECOLOGY
  - LOW-LEVEL CHEMICAL EXPOSURE TRIGGERS SYMPTOMS
  - IMMUNE DAMAGE MAKES A PERSON SUSCEPTIBLE
  - SYMPTOMS FROM MEDICALLY UNRELATED ORGAN SYSTEMS
  - THEORY EXPLAINS SYMPTOMS BETTER THAN SCIENCE
- 11  PHOTO INDUSTRIAL FIRE
- 12  CHRONOLOGY
  - TG RANDOLPH, M.D. HUMAN ECOLOGY, 1962
  - SOCIETY FOR CLINICAL ECOLOGY, 1965
  - AMERICAN ACADEMY OF ENVIRONMENTAL MEDICINE, 1984.
  - AMERICAN BOARD OF ENVIRONMENTAL MEDICINE, INC., 1988
  - WJ REA, M.D. CHEMICAL SENSITIVITY, 1992

- 13  1990  
**NAME CHANGE**  
 AMERICAN COLLEGE OF OCCUPATIONAL  
 MEDICINE
- AMERICAN COLLEGE OF OCCUPATIONAL **AND** ENVIRONMENTAL MEDICINE.  
 (ACOEM)
- 14  1990 DEFINITION  
 (ACOEM)  
 ENVIRONMENTAL MEDICINE IS THE DISCIPLINE OF MEDICINE THAT:  
 a. ADDRESSES .....  
 b. PROVIDES.....  
 c. UTILIZES.....  
 d. SERVES.....
- 130 WORDS  
 DeHart. J Occup Med 35:265,1993
- 15  PHOTO  
**CROPDUSTER**
- 16  MCS DISEASE PROCESS
- OPTIMUM HEALTH
  - ILL - HEALTH (PRE - DISEASE)
  - FIXED - NAMED DISEASE
  - END - ORGAN FAILURE
- 17  PHOTO  
**CLEAN-UP WORKERS IN PROTECTIVE SUITS**
- 18  MCS ETIOLOGY
- EXPOSURE TO LOW CHEMICAL LEVELS DAMAGES THE IMMUNE SYSTEM
  - MAY "CROSS-OVER" OR SPREAD TO OTHER MAN-MADE CHEMICALS
  - TOTAL LOAD OR BODY BURDEN PRODUCES ILLNESS; NOT DOSE / RESPONSE
  - MAY BE TRIGGERED BY VIRAL INFECTION OR STRESS
  - TREATABLE SYMPTOMS PRECEDE "IRREVERSIBLE FIXED - NAMED DISEASE"
- 19  PHOTO  
**HOUSEHOLD CHEMICALS**
- 20  TYPICAL MCS SYMPTOMS
- ALLERGY-LIKE SYMPTOMS
  - FOOD-CHEMICAL INTOLERANCE
  - FLU-LIKE SYMPTOMS
  - DIFFICULT BREATHING
  - PALPITATIONS
  - FATIGUE & INSOMNIA
  - CONFUSION
  - MENSTRUAL DIFFICULTIES
- 21  PHOTO  
**WORKERS AT ROAD SITE**
- 22  MCS PATIENTS
- LOSE FAITH IN TRADITIONAL MEDICINE
  - FIND SYMPATHY IN SUPPORT GROUPS
  - THEIR SUFFERING IS EXPLAINED
  - WITHDRAW FROM THREATENING SITUATIONS
  - ATTRACT LAWYERS, ACTIVISTS & MEDIA
  - CHANGE LIFE-STYLE
- 23  PHOTO  
**"ALTERNATIVES" NEWSPAPER**
- 24  PHOTO  
**ADVERTISEMENT**  
**ENVIRONMENTAL & PREVENTIVE HEALTH CENTER OF ATLANTA**
- 25  USES OF MCS

- BASIS FOR LAW SUITS
- WORK COMPENSATION
- THIRD-PARTY PAYMENT
- COMMUNITY ALERT
- POLITICAL ACTION

26  **"CHEMICALLY SENSITIVE" REGISTRIES**  
10 STATES HAVE LISTS FOR IDENTIFICATION OF CHEMICALLY SENSITIVE INDIVIDUALS

8 STATES REQUIRE MEDICAL CERTIFICATION  
2 STATES DO NOT REQUIRE MD DIAGNOSIS  
(CONN., WISC.)

(Must Notify PRIOR to pesticide application)

27  **PHOTO**  
**PCO**

28  **MCS 1993**

SINCE 1962,  
NOT ONE WELL-CONTROLLED  
CLINICAL STUDY TO INDICATE A  
CAUSE-AND-EFFECT  
RELATIONSHIP.

29  **Seattle MCS Case/Control Study**

- 41 patients and 34 controls(back clinic)
- No immunologic difference
  - No loss of memory or concentration
  - Predisposed to somatization
  - Anxiety/depression following alleged exposure

Conclusion: MCS has strong psychologic  
component.

*Ann Intern Med* 119:97,1993. Simon GE, et al.

30  **MCS POSITION STATEMENTS**

- AMERICAN ACADEMY OF ALLERGY AND IMMUNOLOGY, 1986
- AMERICAN COLLEGE OF PHYSICIANS, 1989

**MCS CRITICAL APPRAISALS**

- CALIFORNIA MEDICAL ASSOCIATION, 1986
- AMERICAN MEDICAL ASSOCIATION, 1992

31  **PHOTO**  
**WORKER WITH MASK**

32  **MCS**

- NO UNIVERSALLY ACCEPTED DEFINITION
- NO SPECIFIC DIAGNOSTIC TEST
- NO SPECIFIC TREATMENT
- NO CONTROLLED SCIENTIFIC STUDIES

33  **MCS: CONVENTIONAL MEDICINE**

- ALLERGY TREATMENT
- SUPPORTIVE CARE
- PSYCHIATRIC CARE
- BEHAVIOR MODIFICATION  
(STRESS & OLFACTORY)
- OCCUPATIONAL MEDICINE
- ADMIT SCIENTIFIC LIMITS

34  **PHOTO**  
**PHYSICIAN AND PATIENT**

35  **SCIENTIFIC APPROACH TO MCS**

- ✓ PHYSICAL EXAMINATION
- ✓ DETAILED HISTORY (INCLUDE PAST MEDICAL RECORDS & LABELS)
- ✓ OPEN MIND / DIFFERENTIAL DIAGNOSIS
- ✓ CONSISTENT DOCUMENTATION
- ✓ APPROPRIATE LAB TESTS

✓ PREVENT DEPRESSION & SUICIDE  
✓ FOLLOW-UP

36  PHOTO  
RUBBER SUITS Ominous

37  PHOTO  
FAMILY

38  PERCEPTION = REALITY

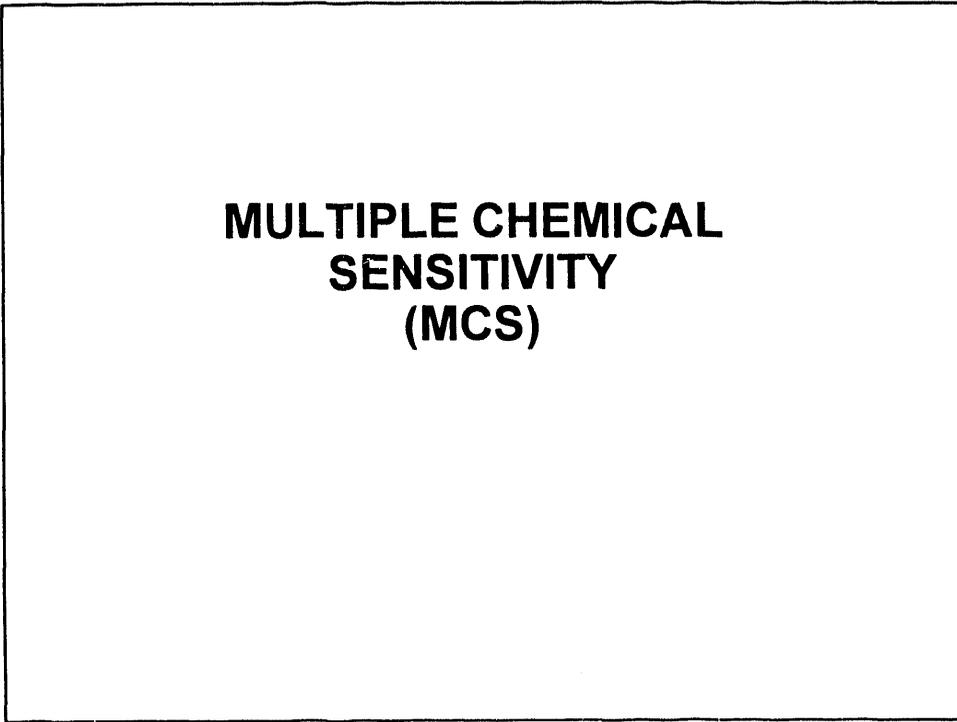
39  MCS POSITION STATEMENTS

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#### MCS CRITICAL APPRAISALS

- CALIFORNIA MEDICAL ASSOCIATION, 1986
- AMERICAN MEDICAL ASSOCIATION, 1992

**ARE YOU ALLERGIC TO THE  
MODERN WORLD?**



**MULTIPLE CHEMICAL  
SENSITIVITY  
(MCS)**

Multiple Chemical Sensitivity is one of many terms used to describe an alleged new disease. This "new" disease is characterized by sensitivity to chemicals in minute concentrations that do not produce ill health in the majority at the same concentration.

## **MCS EXPOSURES**

<b>PESTICIDES</b>	<b>FOOD ADDITIVES</b>
<b>PETROCHEMICALS</b>	<b>FORMALDEHYDE</b>
<b>BUILDING MATERIALS</b>	<b>CIGARETTE SMOKE</b>
<b>COSMETICS</b>	<b>MEDICATIONS</b>
<b>CLEANSERS</b>	<b>ARTS &amp; CRAFTS</b>
<b>NEW CARPETS</b>	<b>VEHICLE EXHAUST</b>
<b>NEW CLOTHING</b>	<b>PAPER</b>
<b>ELECTRO-MAGNETISM</b>	<b>TIGHT BUILDING</b>

These are a few of the thousands of chemicals and environmental conditions that are believed by many to be triggering agents for multiple chemical sensitivity. Since almost everyone in the modern world is exposed to many of these chemicals, the concept of MCS is receiving more and more attention.

## **MCS SYNONYMS**

- 20th - CENTURY DISEASE
- CLINICAL ECOLOGY ILLNESS
- ENVIRONMENTAL ILLNESS
- CHEMICAL AIDS
- TOTAL ALLERGY SYNDROME

Multiple Chemical Sensitivity has a number of alternative names that range from intriguing to alarming. These names include 20th century disease, clinical ecology illness, chemical aids and total allergy syndrome.

## **MCS CASE HISTORIES**

**35 YEAR OLD LONGSHOREMAN EXPOSED TO  
POTASSIUM DICHROMATE**

**44 YEAR OLD TRUCK DRIVER WITH HISTORY  
OF HAULING WASTES**

**46 YEAR OLD FEMALE COLLEGE PROFESSOR  
WITH SEVERAL "TRIGGERS"**

Each of these case histories illustrates some of the challenges associated with treating patients with alleged multiple chemical sensitivity.

## **35 YEAR OLD LONGSHOREMAN**

- PRESENTS WITH ANXIETY, BROWNISH PURPLE SKIN STAINS ON HANDS, FOREARMS AND ANKLES
- PATIENT EXAMINATION AND LAB TESTS NEGATIVE
- 3 DAYS PRIOR, PT WAS EXPOSED TO SPILL OF POTASSIUM DICHROMATE
- PT IMMEDIATELY SHOWERED, RUSHED TO E.R. REASSURED AND SENT HOME FOR 48 HRS
- RETURNED TO WORK AND FOUND SPILL SITE RESTRICTED AND DECONTAMINATION TEAM AT WORK IN FULL PROTECTIVE SUITS
- PT RUSHED TO FAMILY PHYSICIAN  
DIAGNOSIS? TREATMENT? MANAGEMENT?

### **35 YEAR OLD LONGSHOREMAN**

- PRESENTS WITH ANXIETY, BROWNISH PURPLE SKIN STAINS ON HANDS, FOREARMS AND ANKLES
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- PT RUSHED TO FAMILY PHYSICIAN  
DIAGNOSIS? TREATMENT? MANAGEMENT?

## 44 YEAR OLD LANDFILL TRUCK DRIVER

- Sudden onset, one week after new job (landfill)
  - Red, itching rash, hives, especially neck, hands, feet waist
  - Confusion, short term memory loss
  - Fatigue
  - Polyuria, polydipsia
  - Headache, severe
  - Nausea especially at landfill
  - Prednisone (3 weeks) relieved rash and nausea
  - Smokes 1 - 2 packs / day
  - All lab tests, including heavy metals and solvents, negative!
  - Symptoms better when out of work for a week
- DIAGNOSIS? THERAPY? MANAGEMENT?

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- Nausea especially at landfill
- Prednisone (3 weeks) relieved rash and nausea
- Smokes 1 - 2 packs / day
- All lab tests, including heavy metal and solvents, negative!
- Symptoms better when out of work for a week

DIAGNOSIS? THERAPY? MANAGEMENT?

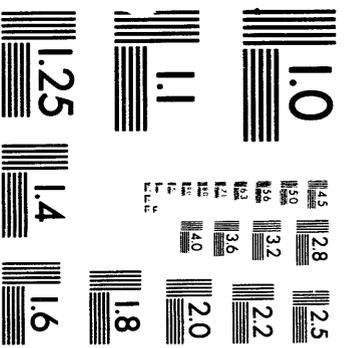
## **46 YEAR OLD COLLEGE PROFESSOR**

- 46 YEAR OLD COLLEGE ART TEACHER
  - POLYSYMPOMATIC - EARLY MENOPAUSE, CYSTIC OVARIES, IRRITABLE BOWEL
  - 9 MONTHS PRIOR TO VISIT, FOOD TASTED LIKE METAL ODORS WERE EXTREMELY OBNOXIOUS (PAINTS, SOLVENTS, CHANGING THE BED, RIDING IN CARS, GAS PIPE REPAIRED 2 BLOCKS AWAY).
  - ALL LAB TESTS NEGATIVE, INCLUDING PSYCHIATRIST EVALUATION.
  - LOST 20 LBS IN ONE YEAR; FOOD WAS NAUSEATING.
  - MISSING WORK, CANCELLED VACATIONS, LOST ROOMMATE DUE TO ODORS IN HOUSE. CANCELLED SOCIAL LIFE.
  - AIR SAMPLES AT WORKPLACE WITHIN NORMAL LIMITS
  - HISTORY, PHYSICAL, LAB TESTS NORMAL
- DIAGNOSIS? THERAPY? MANAGEMENT?

### 46 YEAR OLD COLLEGE PROFESSOR

- 46 Year old college professor
- Polysymptomatic - early menopause, cystic ovaries, irritable bowel
- 9 months prior to visit, food tasted like metal. Odors were extremely obnoxious (paints, solvents, changing the bed, riding in cars, gas pipe repaired 2 blocks away).
- All lab tests negative, including psychiatrist evaluation.
- Lost 20 lbs in one year: food was nauseating.
- Missing work, cancelled vacations, lost roommate due to odors in house. Cancelled social life.
- Air samples at workplace within normal limits
- History, physical, lab tests normal.

DIAGNOSIS? THERAPY? MANAGEMENT?



**2 of 3**

**MULTIPLE CHEMICAL  
SENSITIVITY SYNDROME  
(MCS)**

**ANY ILLNESS TREATED BY A PRACTITIONER  
OF CLINICAL ECOLOGY / ENVIRONMENTAL  
MEDICINE**

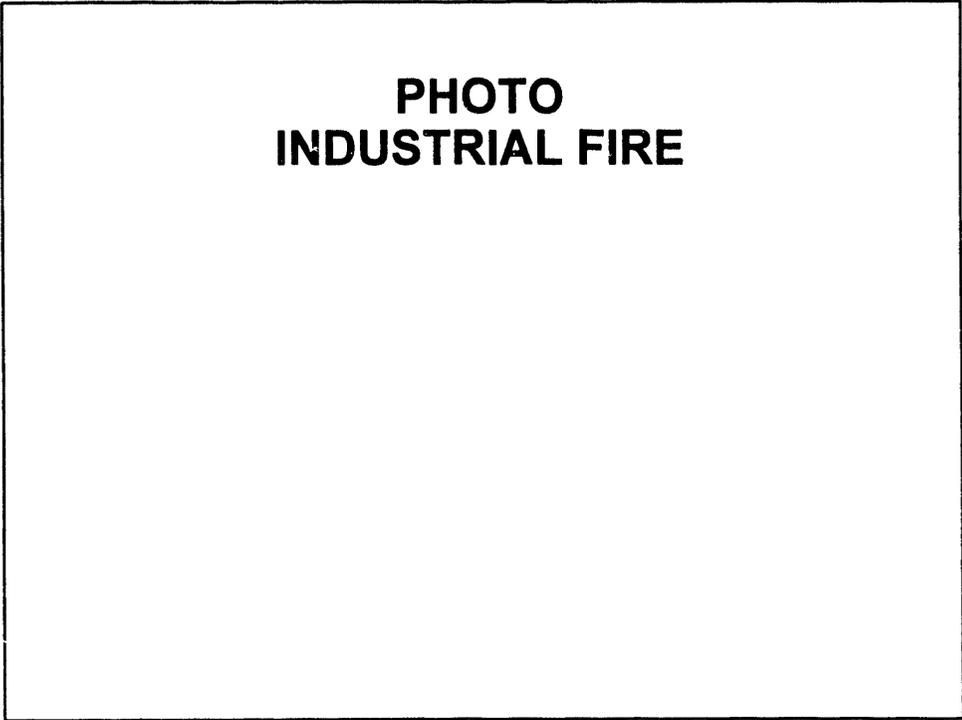
What is multiple chemical sensitivity? One simple definition is "any illness treated by a practitioner of clinical ecology or environmental medicine".

## **CLINICAL ECOLOGY**

- **LOW-LEVEL CHEMICAL EXPOSURE TRIGGERS SYMPTOMS**
- **IMMUNE DAMAGE MAKES A PERSON SUSCEPTIBLE**
- **SYMPTOMS FROM MEDICALLY UNRELATED ORGAN SYSTEMS**
- **THEORY EXPLAINS SYMPTOMS BETTER THAN SCIENCE**

Clinical ecology is that branch of medicine that advocates the theory of multiple chemical sensitivity. Some of the principles of this theory include:

1. Low -level chemical exposure triggers symptoms.
2. Immune damage, caused by chemical exposure, makes a person susceptible to many chemicals.
3. Symptoms from apparently unrelated organ systems may be affected by this damage to the immune system.
4. The MCS theory provides a better explanation of some patients symptoms than traditional science.



**PHOTO  
INDUSTRIAL FIRE**

Some occupations, such as chemical industry workers and firefighters, are associated with higher exposure to chemicals and toxic by-products.

An industrial fire may also expose the community to additional risk and definitely increases community concern. MCS theory provides an elaborate system that supports the belief that even minute levels of chemical exposure may produce long term debility in sensitive individuals.

## CHRONOLOGY

- TG RANDOLPH, M.D. HUMAN ECOLOGY ,1962
- SOCIETY FOR CLINICAL ECOLOGY, 1965
- AMERICAN ACADEMY OF ENVIRONMENTAL MEDICINE, 1984.
- AMERICAN BOARD OF ENVIRONMENTAL MEDICINE, INC., 1988
- WJ REA, M.D. CHEMICAL SENSITIVITY ,1992

Important events in the development of clinical ecology as a specialty include:

- 1962 - T.G. Randolph, M.D. wrote the book *Human Ecology and Susceptibility to the Chemical Environment*.
- 1965 - The Society for Clinical Ecology was established.
- 1984 - The American Academy of Environmental Medicine was founded.
- 1988 - the American Board of Environmental Medicine.
- 1992 - W.J. Rea, M.D. wrote the book *Chemical Sensitivity*.

**1990  
NAME CHANGE**

**AMERICAN COLLEGE OF OCCUPATIONAL  
MEDICINE**



**AMERICAN COLLEGE OF OCCUPATIONAL  
AND ENVIRONMENTAL MEDICINE.  
(ACOEM)**

In 1990 the American College of Occupational Medicine changed the name of the college to the American College of Occupational and Environmental Medicine (ACOEM). This name change reflects the growing interest in the environment and environmental influence on health.

## **1990 DEFINITION (ACOEM)**

**ENVIRONMENTAL MEDICINE IS THE  
DISCIPLINE OF MEDICINE THAT:**

- a. ADDRESSES .....**
- b. PROVIDES.....**
- c. UTILIZES.....**
- d. SERVES.....**

**130 WORDS**

**DeHart. J Occup Med 35:265,1993**

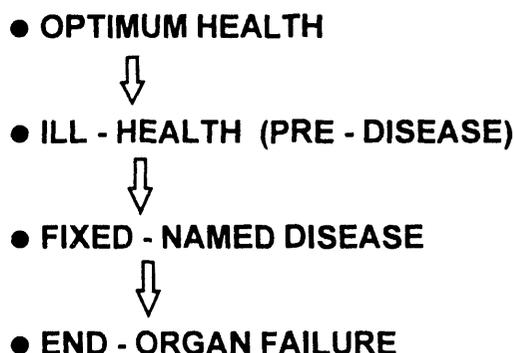
1990 ACOEM definition of Environmental Medicine

“Environmental Medicine is the discipline of medicine that:

- a. Addresses the prevention of adverse health effects caused by physical, chemical, biological, mechanical, and psychosocial factors of individual and group interaction with the environment;
- b. Provides assessment, diagnosis and treatment of those individuals who experience observable adverse health effects from their interaction with such factors in the environment;
- c. Utilizes clinical skills and experience in biostatistics, exposure assessment, epidemiology, toxicology, radiation biology, and ergonomics to help achieve these objectives;
- d. Serves as interface between clinical and population-based medicine by virtue of knowledge and expertise in public health and clinical medicine.”

**PHOTO  
CROPDUSTER**

## MCS DISEASE PROCESS



The multiple chemical sensitivity syndrome (as described by clinical ecologists) has four distinct phases.

The first phase of "optimum health" is prior to exposure to the sensitizing chemical or triggering event.

The second phase of "ill health" is characterized by breakdown of defense mechanisms that leave the individual more vulnerable than the healthy population to minute levels of chemicals. "Spreading" of signs and symptoms from one organ to another is described and offered as explanation for the difficulty in diagnosing chemical sensitivity. This is the phase that is targeted by clinical ecologists as the most important to treat, reduce total body burden of environmental toxicants, and prevent progression to the next phase.

Phase three is described by Rhea as "fixed - named disease". Untreated chemically sensitive individuals suffer additional damage to the defense mechanisms resulting in pathology recognized by traditional medicine.

Phase four is end - organ failure and death. If the fixed - named disease is initially caused by sensitivity to environmental triggers, then the compromised immune system is unable to reverse the disease process.

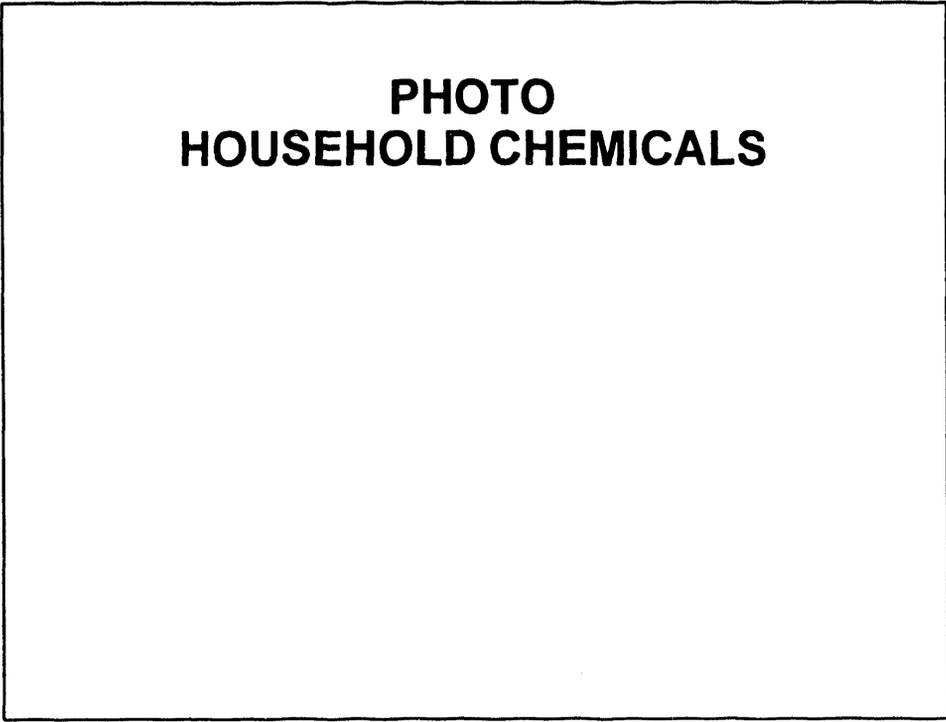
**PHOTO  
CLEAN-UP WORKERS IN  
PROTECTIVE SUITS**

Protective clothing and the clean-up procedure illustrated here emphasize the growing awareness of adverse health effects of some chemicals.

## **MCS ETIOLOGY**

- **EXPOSURE TO LOW CHEMICAL LEVELS DAMAGES THE IMMUNE SYSTEM**
- **MAY "CROSS-OVER" OR SPREAD TO OTHER MAN-MADE CHEMICALS**
- **TOTAL LOAD OR BODY BURDEN PRODUCES ILLNESS; NOT DOSE / RESPONSE**
- **MAY BE TRIGGERED BY VIRAL INFECTION OR STRESS**
- **TREATABLE SYMPTOMS PRECEDE "IRREVERSIBLE FIXED - NAMED DISEASE"**

Here again are some of the key points in the etiology of the multiple chemical sensitivity syndrome.



**PHOTO  
HOUSEHOLD CHEMICALS**

Industrial chemicals are not the only chemicals alleged to provoke the MCS response. Many household chemicals have produced allergic reactions in sensitive individuals.

## TYPICAL MCS SYMPTOMS

- ALLERGY-LIKE SYMPTOMS
- FOOD-CHEMICAL INTOLERANCE
- FLU-LIKE SYMPTOMS
- DIFFICULT BREATHING
- PALPITATIONS
- FATIGUE & INSOMNIA
- CONFUSION
- MENSTRUAL DIFFICULTIES
- ADDICTION TO FOOD, ALCOHOL OR DRUGS
- ANXIETY, DEPRESSION & MOOD SWINGS
- HEADACHE
- IRRITABILITY
- SHORT TERM MEMORY LOSS

Symptoms associated with MCS are diverse and appear to be unrelated when viewed by tradition diagnostic methods. Clinical ecologists emphasize that these apparently unrelated symptoms are related through a generalized depression of defense mechanisms.

**PHOTO  
WORKERS AT ROAD SITE**

## **MCS PATIENTS**

- **LOSE FAITH IN TRADITIONAL MEDICINE**
- **FIND SYMPATHY IN SUPPORT GROUPS**
- **THEIR SUFFERING IS EXPLAINED**
- **WITHDRAW FROM THREATENING SITUATIONS**
- **ATTRACT LAWYERS, ACTIVISTS & MEDIA**
- **CHANGE LIFE-STYLE**

Many patients find reassurance and are more satisfied with a clinical ecology approach to treatment of health problems. Because symptoms often do not fit traditional disease classifications, patients become frustrated with traditional medicine. MCS theory provides an elaborate explanation for perceived illness.

Patients may accept expensive prolonged treatments that require radical alterations in life-style.

MCS is difficult to disprove. It often pits the individual against the chemical industry. This combination attracts lawyers, activists with agendas and the media.

**PHOTO**  
**"ALTERNATIVES"**  
**NEWSPAPER**

This photo shows the front page of a newspaper that advocates alternatives in health

**PHOTO  
ADVERTISEMENT  
ENVIRONMENTAL &  
PREVENTIVE HEALTH CENTER  
OF ATLANTA**

Within the newspaper is an advertisement promoting "the only environmentally safe 'chemical-free' medical center in the Southeast!"

Does this mean that all other medical centers in the Southeast are not environmentally safe?

Who requires environmentally safe medical centers?

How much will this unique medical care cost and who pays for it?

## **USES OF MCS**

- **BASIS FOR LAW SUITS**
- **WORK COMPENSATION**
- **THIRD-PARTY PAYMENT**
- **COMMUNITY ALERT**
- **POLITICAL ACTION**

MCS has been listed as a disease condition in law suits, worker compensation applications, third - party insurance payment, community alerts, and in political action to reduce the use of man-made chemicals.

## “CHEMICALLY SENSITIVE” REGISTRIES

**10 STATES HAVE LISTS FOR IDENTIFICATION OF  
CHEMICALLY SENSITIVE INDIVIDUALS**

**8 STATES REQUIRE MEDICAL CERTIFICATION  
2 STATES DO NOT REQUIRE MD DIAGNOSIS  
(CONN., WISC.)**

**(Must Notify PRIOR to pesticide application)**

STATE	START	STATUS	DESIGNATION	LIMITS	NUMBER
Colorado	90	Mandatory	Pesticide Sensitive	Abutting	14
Connecticut	91	Mandatory		Abutting	143
Florida	91	Mandatory	Pesticide Sensitive Extra Sensitive	Contiguous ≤ 1/2 mile	50
Louisiana	89	Voluntary	Pesticide Sensitive		25
Maryland	88	Mandatory	Pesticide Sensitive	Adjacent	50-75
Michigan	1100	Mandatory	Pesticide Sensitive	Adjacent	57
Penn.	88	Voluntary	Pesticide sensitive	500 feet	430
Washington	92	Mandatory	Pesticide Sensitive		30
W. Virginia	91	Voluntary	Pesticide Sensitive Emphasis / drift		27
Wisconsin	93	Mandatory	Pesticide Sensitive	up to 9 blocks	500

**PHOTO**  
**PCO**

The professional pesticide applicator

**MCS 1993**

**SINCE 1962,  
NOT ONE WELL-CONTROLLED  
CLINICAL STUDY TO INDICATE A  
CAUSE-AND-EFFECT  
RELATIONSHIP.**

Prior to 1993, there was no published clinical study that documented a cause-and-effect relationship between low dose exposure to any chemical and multiple chemical sensitivity syndrome.

## **Seattle MCS Case/Control Study 41 patients and 34 controls(back clinic)**

- **No immunologic difference**
- **No loss of memory or concentration**
- **Predisposed to somatization**
- **Anxiety/depression following alleged exposure**

**Conclusion: MCS has strong psychologic component.**

*Ann Intern Med* 119:97,1993. Simon GE, et al.

In 1993, the report of an important MCS/Case Control Study was published. The study compared clinical test values of 41 patients with alleged MCS to test values of 34 controls. There was no statistically significant difference in immunologic test values between MCS patients and controls. No loss of memory or concentration was demonstrated in either group. The authors stated that MCS patients in the study were predisposed to somatization and that anxiety and/or depression followed alleged exposure. The authors concluded that, for patients in the study, MCS has a strong psychologic component.

The report is important because it may be the only case control study of MCS to date.

## **MCS POSITION STATEMENTS**

- **AMERICAN ACADEMY OF ALLERGY AND IMMUNOLOGY, 1986**
- **AMERICAN COLLEGE OF PHYSICIANS, 1989**

## **MCS CRITICAL APPRAISALS**

- **CALIFORNIA MEDICAL ASSOCIATION, 1986**
- **AMERICAN MEDICAL ASSOCIATION, 1992**

In position statements issued by the American Academy of Allergy and Immunology (1986) and the American College of Physicians (1989) both groups stated that no proof of MCS as a separate identifiable disease condition has been published .

Critical appraisals of MCS and Clinical Ecology issued by the California Medical Association (1986) and the American Medical Association (1992) noted that claims of Clinical Ecologists were not supported by established scientific methods of proof (i.e. double blind studies and publication in peer-reviewed journals).

**PHOTO  
WORKER WITH MASK**

This worker has an obvious potential exposure to toxic material.  
An individual with perceived MCS may feel that the environment poses a similar threat.

## **MCS**

- **NO UNIVERSALLY ACCEPTED DEFINITION**
- **NO SPECIFIC DIAGNOSTIC TEST**
- **NO SPECIFIC TREATMENT**
- **NO CONTROLLED SCIENTIFIC STUDIES**

MCS is a difficult disease to prove or disprove.

There is no universally accepted definition of MCS.

There is no specific diagnostic test for MCS.

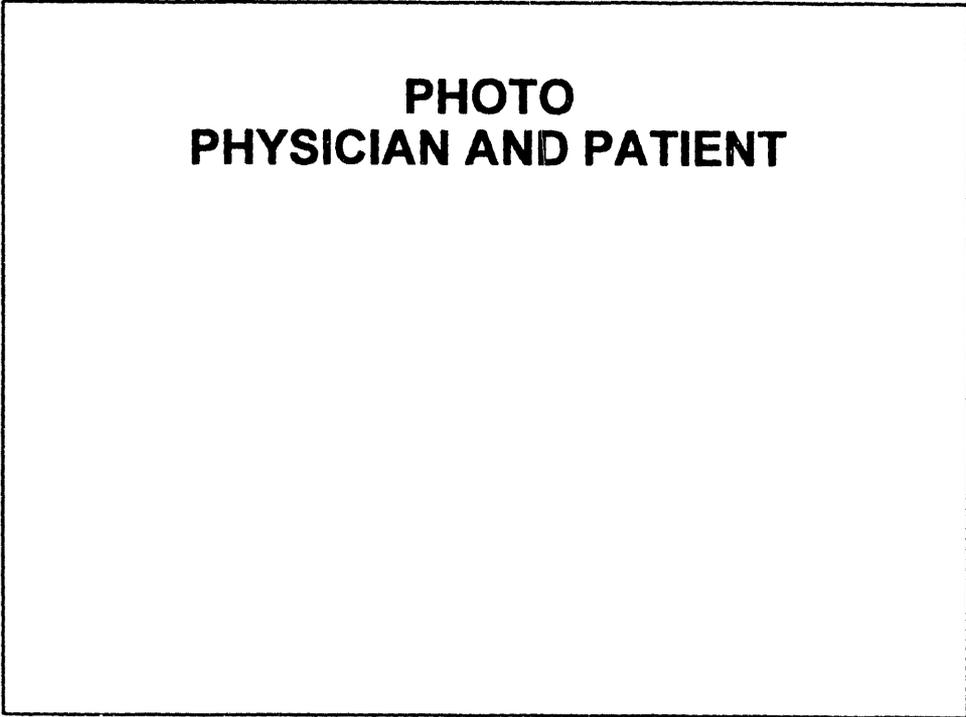
There is no specific treatment or drug of choice for MCS.

There are few controlled scientific studies.

## **MCS: CONVENTIONAL MEDICINE**

- ALLERGY TREATMENT
- SUPPORTIVE CARE
- PSYCHIATRIC CARE
- BEHAVIOR MODIFICATION  
(STRESS & OLFACTORY)
- OCCUPATIONAL MEDICINE
- ADMIT SCIENTIFIC LIMITS

Patients with diffuse symptoms described for MCS may receive one or more of these conventional medicine therapies.

**PHOTO  
PHYSICIAN AND PATIENT**



The doctor-patient relationship is important to the success of any patient treatment.

## **SCIENTIFIC APPROACH TO MCS**

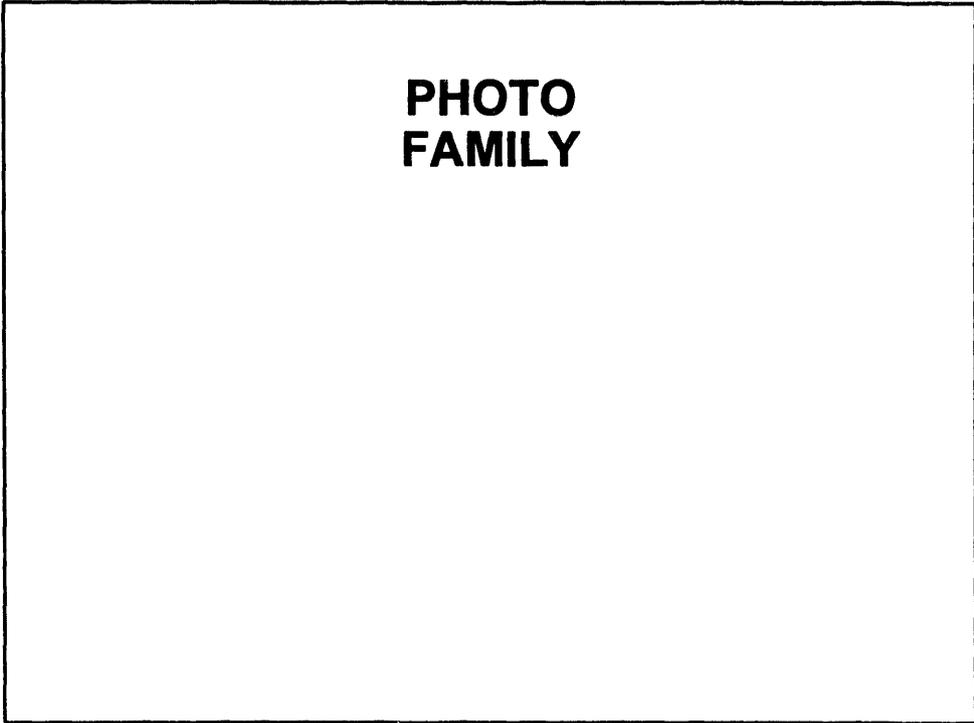
- ✓ **PHYSICAL EXAMINATION**
- ✓ **DETAILED HISTORY (INCLUDE PAST  
MEDICAL RECORDS & LABELS)**
- ✓ **OPEN MIND / DIFFERENTIAL DIAGNOSIS**
- ✓ **CONSISTENT DOCUMENTATION**
- ✓ **APPROPRIATE LAB TESTS**
- ✓ **PREVENT DEPRESSION & SUICIDE**
- ✓ **FOLLOW-UP**

This checklist is a recommended approach to treatment of the patient with alleged MCS.

1. Perform a physical examination .
2. Take a detailed history. Include past medical records and labels of medications . Include an occupational history including chemical exposures.
3. Keep an open mind. Perform differential diagnosis.
4. Keep consistent documentation for medical and legal purposes.
5. Get appropriate lab tests. Document.
6. Prevent depression and suicide.,
7. Follow-up. Patients with alleged MCS have real physical problems.

**PHOTO**  
**RUBBER SUITS Ominous**

Many view the world as a very threatening environment.

**PHOTO  
FAMILY**



There is much evidence to support the view that science has improved the overall quality of life .

**PERCEPTION = REALITY**

**PERCEPTION = REALITY**

**IN ITS CONSEQUENCES**

If an individual perceives the world as a hostile, threatening environment, that perception may contribute to poor health.

## **MCS POSITION STATEMENTS**

- **AMERICAN ACADEMY OF ALLERGY AND IMMUNOLOGY, 1986**
- **AMERICAN COLLEGE OF PHYSICIANS, 1989**

## **MCS CRITICAL APPRAISALS**

- **CALIFORNIA MEDICAL ASSOCIATION, 1986**
- **AMERICAN MEDICAL ASSOCIATION, 1992**

Physicians should keep an open mind toward new approaches to patient therapy provided that scientific proof of effectiveness is documented.

## PROFILE SHEET

NAME: Julie Recknor

BIRTHPLACE: South Carolina

UNIVERSITY ATTENDED: Furman Univ., Clemson Univ.

GRADUATE DEGREES: B.S. (Furman), M.S. (Clemson)

RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)

I am interested in applying a new model that I am developing in survival analysis that can be used to study environmental health hazards and their risk assessments. Survival analysis involves the study of time to an event, such as death, or collapse of patients with certain diseases, etc. The model that I am developing also includes other covariate effects. Covariates are variables describing, for instance, length of exposure to a toxic substance, amount of exposure, etc., or any such variable that may affect the survival time of a individual. The model can be used to compare survival curves of different groups of individuals, and identify variables related to increasing hazard rates. Professor: Dr. Alan Gross

## PROFILE SHEET

NAME: Jean M. Cantey

BIRTHPLACE: Charleston, S. C.

UNIVERSITY ATTENDED: Clemson University

GRADUATE DEGREES: \_\_\_\_\_

RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)

Because I started graduate school this past Fall, I am very much involved in completing my course work. I have not yet begun my research; however, I am currently pursuing several topics of interest to me. I would like to incorporate my background in education and my interest in school-age children into my research. The topics which I am currently investigating include: 1) Use of school records to track cohorts, 2) adjusting exposure models to reflect the physiologic changes occurring during adolescence, 3) developing a program to educate school children on risk, environmental exposure, epidemiology, etc.

## PROFILE SHEET

NAME: W. Leonard Balthis

BIRTHPLACE: Rock Hill, S. C.

UNIVERSITY ATTENDED: Univ. of South Carolina

GRADUATE DEGREES: (none)

**RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)**

I am interested in the trophic transfer of, and subsequent risk of human exposure to, certain environmental contaminants, notably mercury/methyl mercury and PCB's. Exposure to environmental contaminants by way of the marine food chain occurs through consumption of fish and shellfish, and certain sub-populations, such as recreational and subsistence fishermen, may experience an increased risk due to higher consumption rates.

I am currently working on a project with Dr. Eberhard Voit in which we are using the S-system distribution to characterize observed frequency distributions of contaminants in various size classes of fish. These distributions, together with human consumption information, can then be used in "conditional" Monte Carlo simulations to predict a distribution of exposure outcomes.

**PROFILE SHEET**

**NAME:** Paul H. Berg

**BIRTHPLACE:** Greenfield, IN

**UNIVERSITY ATTENDED:** University of Notre Dame

**GRADUATE DEGREES:** Ph.D. (in progress)

**RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)**

Currently, I am completing the data collection for the Anderson and Pee Dee Stroke Study, a cross-sectional study of stroke morbidity and mortality in two biracial areas of South Carolina. I plan to use the data generated from this project and from the related Anderson and Pee Dee Heart Study to develop methods for analyzing the uncertainty of risk created by missing data in surveys. My mentor for this project is Dr. Daniel Lackland.

## PROFILE SHEET

NAME: Michael K. Pisarcik

BIRTHPLACE: Homer City, Pennsylvania

UNIVERSITY ATTENDED: Indiana University of Pennsylvania,  
Clemson University, South Carolina

GRADUATE DEGREES: B.S. in Mathematics Education from  
I.U.P., 1984  
M.S. in Analysis from Clemson  
University, 1989

### RESEARCH PROJECT:

I came to the Department of Biostatistics, Epidemiology and Systems  
Science at the Medical University of SC in August, 1990. I am  
pursuing a Ph. D. in Epidemiology with a minor in Biostatistics. My  
educational focus has been the study of chronic disease among  
populations at risk to environmental pathogens and behavior related  
health risks. I am involved with the Savannah River Region Health  
Information System, recently completing a technical report on the  
Geographic Patterns in SC Cancer Mortality, 1953-1987. I continue  
to work with Dr. Daniel T. Lackland to develop my plan of research.  
The project will focus on breast cancer issues, combining data from  
incidence, mortality and survey data bases.

## PROFILE SHEET

NAME: Paul Nietert

BIRTHPLACE: Poughkeepsie, N.Y.

UNIVERSITY ATTENDED: Duke University, B.S., Mathematics

GRADUATE DEGREES: \_\_\_\_\_

RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)

I am interested in the field of biostatistics. Somehow I would like to study environmental hazards and how they relate to the overall health of the US population. I am interested in risk assessment and am open to any suggestions on how to tie these ideas together. Dr. Voit has been advising me thus far, but as he is leaving for several months I might choose another professor to help guide me.

## PROFILE SHEET

**NAME:** Joyce S. Nicholas

**BIRTHPLACE:** Columbia, SC

**UNIVERSITY ATTENDED:** Lenoir-Rhyne College - BA  
Clemson Univ. - MS  
Univ. of Tennessee - MS

**GRADUATE DEGREES:** MS Biomedical Engineering  
MS Mathematics

**RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)**

The project objective is to analyze experimental cancer data using a biologically-based oncogenic computer model derived from two-mutation conceptualization of the cancer process. This model accounts explicitly for genotoxic and nongenotoxic-proliferative effects at the cellular level, and can therefore be used to study the mechanisms of spontaneous and chemically-induced tumor formation in various tissues.

Project professor: Dr. Chan Lam

## PROFILE SHEET

**NAME:** Kevin Nelson

**BIRTHPLACE:** New York, NY

**UNIVERSITY ATTENDED:** Univ. of Chicago  
Wesleyan Univ.  
Univ. of Alabama at Birmingham

**GRADUATE DEGREES:** MA, MPH

**RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)**

I am currently in the doctoral program in environmental risk assessment at the Medical University of South Carolina. I am interested in cancer, e.g. leukemia. I hope to get involved with the Savannah River Project which Dr. Dunbar coordinates. I am especially interested in examining the link(s) between low level radiation and cancers. A side interest of mine is the development of epidemiologic research methods.

## PROFILE SHEET

**NAME:** Tomas Radivoyevitch

**BIRTHPLACE:** Elyria, Ohio

**UNIVERSITY ATTENDED:** Case Western Reserve  
Ohio State

**GRADUATE DEGREES:** MS - System Engineering; MS - Chemistry

**RESEARCH PROJECT OR INTERESTS:** (1 to 2 paragraphs, also list project professor)

Modeling of cell style with S-systems to study interactions of toxins with the cell. Interested in the regulation of cell growth and the causes of cancer. Also interested in mathematical control theory as a means of understanding the inherently complex regulatory mechanisms of cell growth. I will be working with Dr. E. O. Voit.

**PROFILE SHEET**

**NAME:** Jennifer Mattox Schultz

**BIRTHPLACE:** Portsmouth, VA

**UNIVERSITY ATTENDED:** College of Charleston

**GRADUATE DEGREES:** None

**RESEARCH PROJECT OR INTERESTS:** (1 to 2 paragraphs, also list project professor)

**PROFILE SHEET**

**NAME:** Richard B. Daehler-Wilking

**BIRTHPLACE:** New Orleans, LA

**UNIVERSITY ATTENDED:** Reed College, BA Math

**GRADUATE DEGREES:** Univ. of Oregon, MA Math

**RESEARCH PROJECT OR INTERESTS: (1 to 2 paragraphs, also list project professor)**

Mathematical modelling

Project Professor: Dr. Chan Lam

The Search Committee for the Academic Program Director consisted of:

Dr. James Johnson  
Dr. Alan Junkins  
Dr. John Dunbar  
Dr. Maralynne Mitcham  
Mr. Michael Reed  
Mr. Jim Graves

There were 17 applicants for this position. Four candidates were invited for interviews. They were: Dr. Denis Bourcier, Dr. Leslie Alexander, Dr. Paul Mushak, and Dr. Nurtan Esmen. At this time, no decisions have been made on the position.

The Search Committee members for the Health Policy faculty position were:

Dr. James Johnson  
Dr. Walter Jones  
Dr. Jeff Hoomani  
Dr. Andy Felts  
Mr. Michael Reed

There were 31 applicants for this position. Two were invited for interviews. They were: Dr. David Graber and Dr. Arthur Rubens. Dr. Graber was offered the position and was appointed 8/1/93.

DAVID R. GRABER

ADDRESS: 894 Burnley Road  
Charleston, South Carolina 29414  
(803) 769-9833

EXPERIENCE: ASSISTANT PROFESSOR (August 1993-present)  
Responsible for preparing and presenting organizational theory and behavior course and community health analysis course. Currently directing studies of the adoption of environmental medicine coursework in U.S. medical schools and of international environmental indicators.

RESEARCH ASSOCIATE (1992-1993)  
Pew Health Professions Commission, Durham, N.C.  
Responsibilities include preparation of Healthy America: Practitioners for 2005 and research in health issues and trends. Designing national study of innovative medical, nursing, and allied health educational programs and evaluating the adoption of biopsychosocial issues in health education curricula.

ADMINISTRATOR (1988-1990)  
Lytton Gardens Health Care Center, Palo Alto, California  
Directed nonprofit rehabilitation center and skilled nursing facility. Developed facility into principal referral setting for Stanford Hospital and Kaiser Hospital rehabilitation patients. Implemented unique rehabilitation technician training program.

ADMINISTRATOR (1985-1987)  
Casa Serena Skilled Nursing and Rehabilitation Hospital  
San Jose, California  
Managed premier 153-bed hospital with 64-bed Alzheimer's Special Care Unit. Established Casa Serena as most requested orthopedic and Alzheimer's program in San Francisco area.

PROGRAM DIRECTOR (1982-1984)  
Quality Care Centers, Portland, Oregon  
Responsibilities included: writing and presenting two successful (CON) health facility applications, developing corporate personnel policies, and conducting financial feasibility studies for proposed health facilities. Directed JCAH accreditation program. Administrator of ICF and residential care facilities.

SENIOR REVIEW ASSOCIATE (1981-1982)  
Three Rivers Health Systems Agency, Columbia, S.C.  
Specific responsibilities included: the analysis and evaluation of applications for new health facilities and services, providing technical assistance to applicants in complying with review procedures, developing policies, and assisting in agency health planning.

PRIOR POSITIONS

Restaurant manager at Sand Dunes Hotel, Myrtle Beach, S.C.  
English Language teacher at Air Force Academy of Iran, and  
Ishikawa Institute, Kyoto, Japan.

EDUCATION:

University of North Carolina (1993)  
Ph.D. in Health Policy and Administration  
Successfully defended dissertation on January 12, 1993.

Major Areas of Study:

Aging and Long-term care  
Health Policy  
Organizational Behavior  
Health Professions Education  
Biostatistics

Dissertation Topic:

The Influence of Nursing Home Characteristics and  
Task Environment on Complaints and Survey Performance

Projects and Positions during doctoral program:

- Assisted faculty member in applying LISREL models to evaluate relationships (among hospital patients) between fear of death, independence, desire for prolonged life, and other constructs.
- Developed and prepared a graduate level course - Aging and Health.
- Assisted in program and curriculum development for the Executive Master's Program of the School of Public Health. Designed survey to evaluate the opinions of health care executives on the conceptual, technical, and human relations skills needed by effective managers.

University of South Carolina (1981)  
Master of Public Health in Health Administration  
Coursework included health economics, health planning, biostatistics, epidemiology, gerontology, etc.

University of San Francisco (1978)  
B.A. in Psychological Services

University of California, Berkeley (1977)  
Certificate in Teaching English as a Foreign Language and Persian studies.

PROJECTS/  
PROGRAMS:

Developed Personnel Policies for Quality Care Centers.  
Editor of Quality Care Journal.  
Three approved CON's for acute and long-term care facilities.  
Co-author of Health Systems Area Health Plan and Project Review Manual.  
Developed company-wide Guest Relations Program for LTC chain.

MEMBERSHIPS AND AWARDS: Summa cum laude graduate, M.P.H. program  
Certified Administrator preceptor, California and Oregon  
American Public Health Association  
Association for Health Services Research  
Community Housing Executive Committee, Palo Alto, California

PUBLICATIONS Gustafson, R.S., Aldrich, T.E., Griffith, J.E., & Graber, D.G.  
"Chapter 11 - Risk Communication and Risk Management,"  
in T.E. Aldrich & J.E. Griffith (Eds.) Environmental  
Epidemiology and Risk Assessment. 1992, New York: Van Nostrand  
Reinhold.

Graber, D., and Aldrich, T. Working with Community  
Organizations to Evaluate Potential Disease Clusters.  
(forthcoming in Social Science & Medicine)

Graber, D., and Mutran, B. The Influence of Nursing Home  
Characteristics on Health Survey Violations. (submitted to  
Inquiry, 8/93)

Graber, D., and Aldrich, T. A Citizen Participation Model for  
Cooperative Studies of Environmental and Health Hazards.  
Carolina Health Services Review, Spring/Summer 1993.

Graber, D. Health Care Demography. Medical Information and  
Technology. Primary Care (3 chapters). In D. Shugars, E.  
O'Neil, J. Bader, D. Graber (Eds.), Healthy America:  
Practitioners for 2005. San Francisco. The Pew Health  
Professions Commission, 1993. (forthcoming)

Graber, D., and Jinnette, B. Calls for Reform in Medical  
Education. (Research Report). San Francisco. The Pew Health  
Professions Commission, 1993.

Graber, D., and Sloane, P. Nursing Home Survey Violations for  
Restraint Use: Implications for Quality of Care. (submitted to  
Medical Care, 5/93).

Graber, D. Innovative Psychosocial and Humanistic Programs at  
U.S. Medical Schools. (Research Report). The Fetzer Foundation,  
1993.

COMPUTER & STATISTICAL SKILLS: Familiar with SAS, Lisrel VII, Word Perfect, Excel. Have also  
used Systat, Limdep, and Kwikstat. Familiar with multiple  
regression, Logit, Probit, multinomial Logit, factor analysis,  
structural equation models, event history analysis, etc.

REFERENCES: UNC faculty

Dr. Carol Tresolini	919-489-5905
Dr. Betty Mutran	919-966-6818
Dr. Tim Aldrich	919-733-4728
Dr. Sagar Jain	919-966-7378
James Porto	919-966-7354

Other References

Linda Harrop, RN	(Director of Nursing)	508-526-1910	(h)
		508-688-1212	(w)
Pat Fitzgerald, RN	(Director of Nursing)	408-251-2660	(h)
		408-998-8447	(w)

## COURSE DESCRIPTION

Course No. 10-737

COURSE TITLE Epidemiology of Cardiovascular Disease  
 DEPARTMENT DBESS PRINCIPAL INSTRUCTOR Daniel T. Lackland  
 APPROVED *[Signature]* DATE May 28, 1993  
 Department Chairman

### COURSE OFFERED

Year \_\_\_\_\_  
 Alternate X  
 On Demand \_\_\_\_\_

### METHODS OF EVALUATION      % of GRADE

### WHEN OFFERED

Fall Semester (15 wks) X  
 Spring Semester (15 wks) \_\_\_\_\_  
 Maymester (3 wks) \_\_\_\_\_  
 Summer Semester (10 wks) \_\_\_\_\_

Written Assignment(s) \_\_\_\_\_  
 Written Report (s) 25  
 Written Examinations 50  
 Discussion/Presentation 25  
 Oral Examination(s) \_\_\_\_\_  
 Attitude/Application \_\_\_\_\_  
 Laboratory Projects \_\_\_\_\_

LENGTH OF COURSE 15 Wks.

<u>TYPE OF SESSION</u>	<u>Outside Prep. Est. Hrs/Week</u>	<u>No. of Hrs/Week</u>	<u>Semester Hrs. Credit</u>	<u>No. Student Acc.</u>
Lecture	<u>10</u>	<u>3</u>	<u>3</u>	Minimum <u>3</u>
Recitation or Discussion	_____	_____	_____	Maximum <u>None</u>
Laboratory	_____	_____	_____	Prerequisites: Epidemiologic Found or permission of Instr.
Field Work	_____	_____	_____	_____
Independent Study	_____	_____	_____	_____
			Total Credit	<u>3</u>

### CATALOG DESCRIPTION (Include general objectives, content coverage, and student to whom it is directed).

This is an advanced course designed to acquaint students with the use of epidemiology in the study and investigation of cardiovascular diseases. This course teaches concepts and skills necessary to conduct epidemiologic investigations of cardiovascular disease. Particular attention will be given to assessment techniques specific to the study of hypertension, coronary heart disease and stroke. The students will participate in discussions and lectures with epidemiologists, neurologists, cardiologists and pharmacologists.

COURSE TITLE Epidemiology of Cardiovascular Disease

DETAILED STATEMENT OF OBJECTIVES (i.e. what will be student gain from the course)?

The students will learn the quantitative and epidemiologic skills needed to assess cardiovascular disease processes. In addition, the students will become familiar with the specific techniques for the study of hypertension, heart disease and stroke.

Successful completion of this course should enable the student to:

- Know the epidemiology of coronary heart disease, its risk factors and manifestation.
- Know the epidemiology of cerebrovascular disease, its risk factors and manifestation.
- Know the epidemiology of hypertension, its etiology and manifestation.
- Have an understanding of the pathophysiology of cardiovascular diseases.
- Have an appreciation of the epidemiologic literature of cardiovascular diseases.
- Have insight into the major research designs used in the study of cardiovascular diseases.

### ASSIGNED TEXT AND OTHER REFERENCE MATERIALS

*Preventive Cardiology* by Gary Fraser and other assigned references

### COURSE OUTLINE

General topics to be discussed include:

- Descriptive Epidemiology of Coronary Heart Disease
- Description of Ischemic Heart Disease Syndrome
- Pathologic Basis of Coronary Heart Disease
- Serum Cholesterol as a Risk Factor for Coronary Heart Disease
- Hypertension, Left Ventricular Hypertrophy and Coronary Heart Disease
- Epidemiology of Hypertension
- Psychosocial, Socioeconomic Variables, and Coronary Heart Disease
- Physical Activity and Coronary Heart Disease
- Alcohol Consumption and Coronary Heart Disease
- Diabetes and Cardiovascular Disease
- Epidemiology of Sudden Death
- Children and Cardiovascular Disease
- Epidemiology of Cerebrovascular Disease
- Multiple Risk Intervention Studies

COURSE TITLE Epidemiology of Cardiovascular Disease

**TYPES AND AMOUNT OF WORK EXPECTED OF STUDENTS**

Participation in lectures, discussions, and panel discussions. Participation in an investigative project of cardiovascular diseases.

**SPECIAL FACILITIES REQUIRED** (Including Library and other Learning Resources) (List and indicate whether presently available or must be obtained)

Library presently available

<u>Other Personnel Involved:</u>	<u>In What Capacity?</u>	
_____	_____	_____
_____	_____	_____

**RELATION TO OTHER COURSES**

How does this course fit into the Department's Graduate Program?

Strongly recommended elective for epidemiology students. Will also be suitable for DBESS and other department graduate students.

Is this course a prerequisite for any other course? If yes, what courses(s)?

NO

Do other course(s) cover some of the same material? Which ones (explain extent)?

NO

**PROJECT SIZE AND SOURCE OF ENROLLMENT**

Graduate Students:	Per Year	Other Students: (Specify)	Per Year
Within Department	<u>5</u>	_____	_____
Outside Department	<u>3</u>	_____	_____

## COURSE DESCRIPTION

Course No. 10 - 780

COURSE TITLE Environmental Health Risk Assessment  
 DEPARTMENT BESS PRINCIPAL INSTRUCTOR David G. Hoel, Ph.D.  
 APPROVED [Signature] DATE 29 April 1993  
 Department Chairman

### COURSE OFFERED

Yearly	<u>x</u>	<u>METHODS OF EVALUATION</u>	<u>% of GRADE</u>
Alternate Years	<u>    </u>	Written Assignment(s)	<u>10</u>
On Demand	<u>    </u>	Written Report (s)	<u>    </u>
<u>WHEN OFFERED</u>		Written Examinations	<u>90</u>
Fall Semester (15 wks)	<u>    </u>	Discussion/Presentation	<u>    </u>
Spring Semester (15 wks)	<u>x</u>	Oral Examination (s)	<u>    </u>
Maymester (3 wks)	<u>    </u>	Attitude/Application	<u>    </u>
Summer Semester (10 wks)	<u>    </u>	Laboratory Projects	<u>    </u>

LENGTH OF COURSE 15 WKS.

<u>TYPE OF SESSION</u>	<u>Outside Prep. Est. Hrs/Week</u>	<u>No. of Hrs/Week</u>	<u>Semester Hrs. Credit</u>	<u>No. Students Acc.</u>
Lecture	<u>6</u>	<u>3</u>	<u>4</u>	Minimum <u>6</u>
Recitation or Discussion	<u>    </u>	<u>    </u>	<u>    </u>	Maximum <u>30</u>
Laboratory	<u>    </u>	<u>    </u>	<u>    </u>	Prerequisites
Field Work	<u>    </u>	<u>    </u>	<u>    </u>	10-700, 10-736
Independent Study	<u>    </u>	<u>1</u>	<u>    </u>	<u>    </u>
Total Credits				<u>4</u>

**CATALOG DESCRIPTION** (Include general objectives, content coverage, and student to whom it is directed).

*The course begins with a historical account of risk assessment and risk management. It then introduces statistical and epidemiological concepts, including competing risks, odds ratios, and proportional hazard models. Next it describes hazard and risk identification and the basics of toxicological testing. Mathematical models for toxicologic phenomena and risk-based decision making are outlined. Questions of risk, uncertainty, and causation, as well as the disparities between real and perceived risk are addressed. All concepts are illustrated with actual examples.*



COURSE TITLE Environmental Health Risk Assessment

DETAILED STATEMENT OF OBJECTIVES (i.e. what will be student gain from the course)?

*The student will understand the process of quantitative risk assessment especially in carcinogenesis. Also the student will know the scientific issues and controversies in this area.*

ASSIGNED TEXT AND OTHER REFERENCE MATERIALS

*Current scientific literature*

COURSE OUTLINE

1. History and principles of risk analysis, perceptions of risk
2. Toxicity testing: chronic, subchronic, in vitro; cancer, reproductive, immunology
3. Statistical analysis of toxicity testing
4. Animals → man extrapolation, safety factors, ADI, NOAEL etc. species scaling
5. Potency, dose-response models, adducts, oncogenes, TD<sub>50</sub>, HERP
6. Pharmacokinetic models, Michalis-Menten kinetics, 2-stage models; example: methylene chloride
7. Controversies in toxicity testing: Mouse-man extrapolation, high-dose low-dose extrapolation, hormesis, mixed exposures
8. Case Studies: In 1993: Dioxin (Times Beech, Agent Orange)
9. Epidemiological studies - cohort, case control, ecological clusters, analysis methods
10. Statistical risk models in epidemiological studies
11. Meta-analysis
12. Case study: In 1993: Ionizing radiation
13. Weight of the evidence
- 14-15. Exam, review, make-up

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COURSE DESCRIPTION

Course  
No. \_\_\_\_\_ - \_\_\_\_\_

COURSE TITLE: Environmental Biology

DEPARTMENT: Microbiology & Immunology PI: Schmidt, Dolan & McMillan

APPROVED: *[Signature]* DATE: 5/1/93  
DEPARTMENT CHAIRMAN

COURSE OFFERED

		<u>METHODS OF EVALUATION</u>	<u>% OF GRADE</u>
Yearly	<u>X</u>	Written Assignment(s)	_____
Alternate Years	_____	Written Report(s)	_____
On Demand	_____	Written Examinations	<u>95%</u>
WHEN OFFERED		Discussion/Presentation	<u>05%</u>
Fall Semester (15wks)	<u>X</u>	Oral Examination(s)	_____
Spring Semester (15wks)	<u>X</u>	Attitude/Application	_____
Maymester (3wks)	_____	Laboratory Projects	_____
Summer Semester (10wks)	_____		

LENGTH OF COURSE \_\_\_\_\_ WKS.

<u>TYPE OF SESSION</u>	<u>Outside Prep. Est. Hrs/Week</u>	<u>No. of Hrs/Week</u>	<u>Semester Hrs. Credit</u>	<u>No. Students Acc</u>
Lecture	<u>3</u>	<u>3</u>	<u>4</u>	Minimum <u>10</u>
Recitation or Discussion	_____	<u>1</u>	_____	Maximum <u>120</u>
Laboratory	_____	_____	_____	
Field Work	_____	_____	_____	Prerequisites
Independent Study	_____	_____	_____	_____
			<b>Total Credits</b>	<u>4</u>

CATALOG DESCRIPTION (Include general objectives, content coverage, and student to whom it is directed).

The course emphasizes the application of fundamental toxicological and microbiological concepts to problems which exist in the real world. The course should prepare the student interested in environmental problems with the necessary practical information to make sound judgments in assessing meaningful solutions to existing environmental problems.

Course  
No. \_\_\_\_ - \_\_\_\_

COURSE TITLE: Environmental Biology

TYPES AND AMOUNT OF WORK EXPECTED OF STUDENTS

**Methods of Evaluation**

The final grade will be based on the following criteria:

**Exams-** Exams will be objective in nature. They will all be weighted equally and comprise 95% of the final grade.

**Class Participation.** Everyone will be expected to take an active oral role in the class discussions. 5 %.

The merit grade will be determined from the table printed on page 33-34 of the Medical University of South Carolina Bulletin.

SPECIAL FACILITIES REQUIRED (Including Library and other Learning Resources)  
(List and indicate whether presently available or must be obtained)

Other Personnel Involved:

In What Capacity

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

RELATION TO OTHER COURSES

How does this course fit into the Department's Graduate Program?

This course will serve as one of the required science electives in the Environmental Studies Core Curriculum. It could also serve as an elective to the traditional programs in Microbiology and Immunology, Pharmacology, Biochemistry and to the program in Molecular, Cellular and Pathobiology.

Is this course a prerequisite for any other course? If yes, what course(s) No.

Do other course(s) cover some of the same material? Which ones (explain extent)?

Yes, Environmental Microbiology. The second unit of material offered in Environmental biology will be similar to the material presented as the first unit in Environmental Microbiology. The course in Environmental Microbiology is intended for majors in the program in Environmental Microbiology and will emphasize in greater detail the application of fundamental microbiological concepts to problems which exist in the real world.

PROJECTED SIZE AND SOURCE OF ENROLLMENT

	#Expected Per Year	Other Students: (Specify)	Expected Per Year
Graduate Students:			
Within Department	<u>2-5 Micro</u>	<u>EHAP Unclassified</u>	_____
Outside Department	<u>5-120</u>	<u>College of Charleston</u>	_____

COURSE TITLE: Environmental Biology

DETAILED STATEMENT OF OBJECTIVES (i.e. what will the student gain from the course)?

The course emphasizes the **application** of fundamental toxicological and microbiological concepts to problems which exist in the real world. It will not offer grand theoretical schemes for the solution of current environmental problems, but will focus on the potential and limitations of our available possibilities.

Environmental Toxicology concerns itself with the identification of hazardous chemicals in the environment and, subsequently, identifying the adverse effects of exposure to such chemicals on biological organisms, learning the mechanisms by which these chemicals act, and using these data to develop strategies for blocking or reversing the adverse effects.

Environmental Microbiology concerns itself with the role of microorganisms in the causes and solutions of environmental problems, the detection and enumeration of significant microorganisms and their products in natural and man-made environments, and the microbial production and transformations of environmentally important molecules.

It is anticipated that the course will prepare the student interested in environmental problems with the necessary practical information to make sound judgments in assessing meaningful solutions to existing problems.

ASSIGNED TEXT AND OTHER REFERENCE MATERIALS

**Texts: Recommended :** Biochemistry , Stryer  
Biology of Microorganisms, 6th ed. by Brock and Madigan. 1991. Prentice Hall.  
Casarett and Doull's Toxicology: The Basic Science of Poisons, 3rd ed. by Doull, Klaassen and Amdur, 1986, Macmillan Publishing.

**Recommended Supplemental Text Books:**

Physiology of the Bacterial Cell, A Molecular Approach, by Neidhardt, Ingraham, and Schaechter, 1990. Sinauer Associates, Inc.

The Microbial World, 5th Ed. by Stanier, Ingraham, Wheelis and Painter, 1986. Prentice-Hall.

Molecular Cell Biology, 2nd ed., by Darnell, Lodish and Baltimore. 1990. Scientific American Books.

Microbial Genetics by Freifelder, 1987. Jones and Bartlett.

Escherichia coli and Salmonella typhimurium, Cellular and Molecular Biology. b Neidhardt, Ingraham, Brooks, Magasanik, Schaechter and Umbarger, 1987. American Society for Microbiology.

COURSE OUTLINE

See Attached.

COURSE DESCRIPTION

Course  
No. \_\_\_\_\_ - \_\_\_\_\_

COURSE TITLE: Pollution Microbiology

DEPARTMENT: Microbiology & Immunology PI: Michael Schmidt

APPROVED: [Signature] DATE: 5/1/93

DEPARTMENT CHAIRMAN

COURSE OFFERED

Yearly	_____	<u>METHODS OF EVALUATION</u>	<u>% OF GRADE</u>
Alternate Years	X _____	Written Assignment(s)	_____
On Demand	_____	Written Report(s)	_____
WHEN OFFERED		Written Examinations	<u>95%</u>
Fall Semester (15wks)	_____	Discussion/Presentation	<u>05%</u>
Spring Semester (15wks)	X _____	Oral Examination(s)	_____
Maymester (3wks)	_____	Attitude/Application	_____
Summer Semester (10wks)	_____	Laboratory Projects	_____

LENGTH OF COURSE 15 WKS.

<u>TYPE OF SESSION</u>	<u>Outside Prep. Est. Hrs/Week</u>	<u>No. of Hrs/Week</u>	<u>Semester Hrs. Credit</u>	<u>No. Students Acc</u>
Lecture	<u>3</u>	<u>3</u>	<u>3</u>	Minimum <u>5</u>
Recitation or Discussion	_____	_____	_____	Maximum <u>45</u>
Laboratory	_____	_____	_____	
Field Work	_____	_____	_____	Prerequisites
Independent Study	_____	_____	_____	_____
			Total Credits	<u>3</u>

CATALOG DESCRIPTION (Include general objectives, content coverage, and student to whom it is directed).

This course is designed to give the student a practical as well as academic introduction to "real world" pollution problem that can be addressed biologically. Biochemical and genetic mechanisms of biodegradation of aromatic and aliphatic compounds, chlorinated compounds, nitroaromatics, and hydrocarbons will be explored with special emphasis placed on the microbial transformations responsible for the degradation. In addition the microbiology of activated sludge, anaerobic digestion, composting, and other liquid, air, and solid phase waste treatment processes will be developed in this course.

COURSE TITLE: Pollution Microbiology

DETAILED STATEMENT OF OBJECTIVES (i.e. what will the student gain from the course)?

Pollution Microbiology concerns itself with the role of microorganisms in the solutions of environmental problems. The course emphasizes the application of fundamental microbiological concepts to problems that exist in the environment. The course will focus on the potential and limitations of the use of microorganisms in addressing the issues of biotreatment/ bioremediation.

ASSIGNED TEXT AND OTHER REFERENCE MATERIALS

**Texts:** Environmental Microbiology, Ralph Mitchell, ed. 1992. Wiley Liss. or Biology of Microorganisms, 6th ed. by Brooke and Madigan. 1991. Prentice Hall.

**Recommended Supplemental Text Books:**

Physiology of the Bacterial Cell, A Molecular Approach, by Neidhardt, Ingraham, and Schaechter, 1990. Sinauer Associates, Inc.

The Microbial World, 5th Ed. by Stanier, Ingraham, Wheelis and Painter, 1986. Prentice-Hall.

Molecular Cell Biology, 2nd ed., by Darnell, Lodish and Baltimore. 1990. Scientific American Books.

Microbial Genetics by Freifelder, 1987. Jones and Bartlett.

Escherichia coli and Salmonella typhimurium, Cellular and Molecular Biology. b Neidhardt, Ingraham, Brooks, Magasanik, Schaechter and Umbarger, 1987. American Society for Microbiology.

COURSE OUTLINE

See Attached.

Course  
No. \_\_\_\_\_

COURSE TITLE: Pollution Microbiology

TYPES AND AMOUNT OF WORK EXPECTED OF STUDENTS

Lecture Attendance  
Class Participation

SPECIAL FACILITIES REQUIRED (Including Library and other Learning Resources)  
(List and indicate whether presently available  
or must be obtained)

Other Personnel Involved:

In What Capacity

Micro Faculty to be

recruited

RELATION TO OTHER COURSES

How does this course fit into the Department's Graduate Program?

This course will complement the current track graduate program in Microbiology and Immunology and will serve as an elective for that program. It will be also be an elective course in the new masters and doctoral program in Environmental Microbiology that will be offered through the department and may serve as an elective in the Mastes in Environmental Studies offered in conjunction with the University of Charleston.

Is this course a prerequisite for any other course? If yes, what course(s)

Yes, Pollution Microbiology Laboratory.

Do other course(s) cover some of the same material? Which ones (explain extent)?

Yes, Enviornmental Microbiology but not at this level or depth.

PROJECTED SIZE AND SOURCE OF ENROLLMENT

Graduate Sudents:	#Expected Per Year	Other Students: (Specify)	Expected Per Year
Within Department	<u>3-5</u>	_____	_____
Outside Department	<u>5-10</u>	<u>EHAP</u>	_____

## *Pollution Microbiology*

**Course Director:** Michael G. Schmidt, Ph.D.  
Department of Microbiology and Immunology

**Course Offered:** The course will be offered on a biannual in conjunction with the pollution microbiology laboratory course. The length of the course will be 15 weeks. It will consist of three lecture periods per week and will carry 3 credit hours.

**Course Prerequisites:** Microbial Physiology and Genetics (30-622) and Environmental Microbiology (30-???)

### **Course/ Catalog Description:**

This course is designed to give the student a practical as well as academic introduction to "real world" pollution problem that can be addressed biologically. Biochemical and genetic mechanisms of biodegradation of aromatic and aliphatic compounds, chlorinated compounds, nitroaromatics, and hydrocarbons will be explored with special emphasis placed on the microbial transformations responsible for the degradation. In addition the microbiology of activated sludge, anaerobic digestion, composting, and other liquid, air, and solid phase waste treatment processes will be developed in this course.

### **Detailed Statement of Objectives:**

Pollution Microbiology concerns itself with the role of microorganisms in the solutions of environmental problems. The course emphasizes the application of fundamental microbiological concepts to problems that exist in the environment. The course will focus on the potential and limitations of the use of microorganisms in addressing the issues of biotreatment/ bioremediation.

**Texts:** *Environmental Microbiology*, Ralph Mitchell, ed. 1992. Wiley Liss. or *Biology of Microorganisms*, 6th ed. by Brooke and Madigan. 1991. Prentice Hall.

### **Recommended Supplemental Text Books:**

*Physiology of the Bacterial Cell, A Molecular Approach*, by Neidhardt, Ingraham, and Schaechter, 1990. Sinauer Associates, Inc.

*The Microbial World*, 5th Ed. by Stanier, Ingraham, Wheelis and Painter, 1986. Prentice-Hall.

*Molecular Cell Biology*, 2nd ed., by Darnell, Lodish and Baltimore. 1990. Scientific American Books.

*Microbial Genetics* by Freifelder, 1987. Jones and Bartlett.

*Escherichia coli and Salmonella typhimurium, Cellular and Molecular Biology*. b Neidhardt, Ingraham, Brooks, Magasanik, Schaechter and Umberger, 1987. American Society for Microbiology.

## *Course Outline*

### **PRINCIPLES OF BIODEGRADATION**

Lecture 1	Introduction - Principles of Biodegradation - catabolism
Lecture 2	Principles of Biodegradation - cometabolism
Lecture 3	Principles - mixed populations - biotransformations/mineralization
Lecture 4	Principles - Populational changes

### **AROMATIC COMPOUNDS**

Lecture 5	Aromatic Compounds - Why they are important pollutants
Lecture 6	Aromatic Compounds - Aerobic degradation - oxygenases
Lecture 7	Aromatic Compounds - meta and ortho cleavage, gentisate pathway
Lecture 8	Aromatic Compounds - fungal metabolism - organisms
Lecture 9	Aromatic Compounds - anaerobic pathways
Lecture 10	Aromatic compounds - genetics, co-metabolic pathways
Lecture 11	Nitroaromatics

#### ***Exam I*** *Material through Nitroaromatics*

Lecture 13	Mechanisms of dehalogenation
Lecture 14	Halogenated aromatic compounds - Why are they important pollutants ? effects of the halogen

### **ALIPHATIC COMPOUNDS**

Lecture 15	Oil and hydrocarbon degradation - Aerobic pathways
Lecture 16	Oil and hydrocarbon degradation - Anaerobic pathways
Lecture 17	halogenated aliphatics

### **SOLID WASTE TREATMENT**

Lecture 18	Solid waste treatment - what are they?- landfilling
Lecture 19	Solid waste treatment - incineration, composting, reactors, methods, organisms
Lecture 20	Bacterial corrosion
Lecture 21	Metal recovery - chelants

### **LIQUID WASTE TREATMENT**

Lecture 22	Liquid waste treatment - What liquid wastes?
Lecture 23	Sewage treatment - primary treatment

#### ***Exam II*** *Material through Metal recovery-chelants*

Lecture 25	Sewage treatment - secondary treatment
Lecture 26	Sewage treatment - tertiary treatment
Lecture 27	Anaerobic digestion and septic tanks bioreactors -
Lecture 28	Bioreactors
Lecture 29	Adhesion - solubilization
Lecture 30	Halophiles

Lecture 31 Nitifiers - denitrifiers  
 Lecture 32 Sulfur oxidation and reduction  
 Lecture 33 Heterogeneous waste

**VAPOR PHASE TREATMENT**

Lecture 34 Odor control  
 Lecture 35 Bioreactors for vapor treatment

**MICROBIAL GROWTH AND CONTROL**

Lecture 36 Population growth and measurement

**Exam III** *Material through Lecture 35, Heterogeneous waste*

Lecture 38 Nutrient Effects- continuous culture  
 Lecture 39 Environmental effects  
 Lecture 40 Energetics of bacterial growth

**GENETIC ENGINEERING**

Lecture 41 Basic principles of genetic transfer  
 Lecture 42 Resistance genes  
 Lecture 43 Novel pathways  
 Lecture 44 Release of genetically engineered microbes

**Final Exam**

**Methods of Evaluation**

The final grade will be based on the following criteria:

**Exams-** Exams will be Essay in nature. They will all be weighted equally and comprise 95% of the final grade.

- **Class Participation.** Everyone will be expected to take an active oral role in the class discussions. 5 %.

The merit grade will be determined from the table printed on page 33-34 of the Medical University of South Carolina Bulletin.

Raw Score	Merit Grade
95 %	4.0
94	3.9
93	3.8
92	3.7
91	3.6
90	3.5
89	3.4
88	3.3
87	3.2
86	3.1
85	3.0

## Relation to Other Courses

**How does this course fit into the Department's graduate Program ?**

This course will complement the current track graduate program in Microbiology and Immunology and will serve as an elective for that program. It will be also be an elective course in the new masters and doctoral program in Environmental Microbiology that will be offered through the department and may serve as an elective in the Mastes in Environmental Studies offered in conjunctionwith the University of Charleston.

**Is this course a prerequisite for any other course ? If yes, what course(s) ?**

Pollution Microbiology Laboratory

**Do other course(s) cover some of the material ? Which one (explain extent)?**

Yes, Environmental Microbiology. Selected lectures in Environmental Microbiology will be similar to the material presented in this course. The material offered in pollution microbiology will be delivered at a more advanced level. Lectures delivered in this course will thus build on those given in the course prerequisite, Environmental Microbiology.

COURSE DESCRIPTION

Course  
No. \_\_\_\_\_ - \_\_\_\_\_

COURSE TITLE: Environmental Microbiology

DEPARTMENT: Microbiology & Immunology PI: Michael Schmidt

APPROVED: *R. Schmid* DATE: 5/1/93  
DEPARTMENT CHAIRMAN

COURSE OFFERED

Yearly	<u>X</u>	<u>METHODS OF EVALUATION</u>	<u>% OF GRADE</u>
Alternate Years	_____	Written Assignment(s)	_____
On Demand	_____	Written Report(s)	_____
WHEN OFFERED		Written Examinations	<u>95%</u>
Fall Semester (15wks)	<u>X</u>	Discussion/Presentation	<u>05%</u>
Spring Semester (15wks)	<u>X</u>	Oral Examination(s)	_____
Maymester (3wks)	_____	Attitude/Application	_____
Summer Semester (10wks)	_____	Laboratory Projects	_____

LENGTH OF COURSE 15 WKS.

<u>TYPE OF SESSION</u>	<u>Outside Prep. Est. Hrs/Week</u>	<u>No. of Hrs/Week</u>	<u>Semester Hrs. Credit</u>	<u>No. Students Acc</u>
Lecture	<u>3</u>	<u>3</u>	<u>4</u>	Minimum <u>5</u>
Recitation or Discussion	_____	<u>1</u>	_____	Maximum <u>120</u>
Laboratory	_____	_____	_____	
Field Work	_____	_____	_____	Prerequisites
Independent Study	_____	_____	_____	_____
			<u>Total Credits</u>	<u>4</u>

CATALOG DESCRIPTION (Include general objectives, content coverage, and student to whom it is directed).

The course emphasizes the application of fundamental microbiological concepts to problems which exist in today's environment. The course should prepare the student interested in environmental problems and issues with the necessary practical information to make sound judgments in assessing meaningful solutions to existing environmental problems and the role microorganisms play in those processes.

COURSE TITLE: Environmental Microbiology

DETAILED STATEMENT OF OBJECTIVES (i.e. what will the student gain from the course)?

The course emphasizes the application of fundamental microbiological concepts to problems that exist in the environment. The course will not offer grand theoretical schemes for the solution of current environmental problems, but will focus on the potential and limitations of the use of microorganisms in addressing the issues of biotreatment/bioremediation. Environmental Microbiology concerns itself with the role of microorganisms in the causes and solutions of environmental problems. This subdiscipline of microbiology also includes the detection and enumeration of significant or indicator microorganisms (biomarkers), their products in natural and man-made environments, and the microbial production and transformations of environmentally relevant molecules. It is anticipated that the course will prepare the student well for the Case Based course in Environmental Sciences as the necessary practical information to make sound judgments in assessing the use of microorganisms in addressing meaningful solutions to existing problems will be emphasized throughout the course.

ASSIGNED TEXT AND OTHER REFERENCE MATERIALS

**Texts:** *Environmental Microbiology*, Ralph Mitchell, ed. 1992. Wiley Liss. or *Biology of Microorganisms*, 6th ed. by Brooke and Madigan. 1991. Prentice Hall.

**Recommended Supplemental Text Books:**

*Physiology of the Bacterial Cell, A Molecular Approach*, by Neidhardt, Ingraham, and Schaechter, 1990. Sinauer Associates, Inc.

*The Microbial World*, 5th Ed. by Stanier, Ingraham, Wheelis and Painter, 1986. Prentice-Hall.

*Molecular Cell Biology*, 2nd ed., by Darnell, Lodish and Baltimore. 1990. Scientific American Books.

*Microbial Genetics* by Freifelder, 1987. Jones and Bartlett.

*Escherichia coli and Salmonella typhimurium, Cellular and Molecular Biology*. b Neidhardt, Ingraham, Brooks, Magasanik, Schaechter and Umbarger, 1987. American Society for Microbiology.

COURSE OUTLINE

See Attached.

Course  
No. \_\_\_\_\_ - \_\_\_\_\_

COURSE TITLE: Environmental Microbiology

TYPES AND AMOUNT OF WORK EXPECTED OF STUDENTS

**Methods of Evaluation**

The final grade will be based on the following criteria:

**Exams**- Exams will be objective in nature. They will all be weighted equally and comprise 95% of the final grade.

**Class Participation.** Everyone will be expected to take an active oral role in the class discussions. 5 %.

The merit grade will be determined from the table printed on page 33-34 of the Medical University of South Carolina Bulletin.

SPECIAL FACILITIES REQUIRED (Including Library and other Learning Resources)  
(List and indicate whether presently available or must be obtained)

Other Personnel Involved:

In What Capacity

Micro Faculty to be

recruited

\_\_\_\_\_  
\_\_\_\_\_

RELATION TO OTHER COURSES

How does this course fit into the Department's Graduate Program?

This course will complement the current track graduate program in Microbiology and Immunology and will serve as an elective for that program. It will be also be a required course in the new masters and doctoral program in Environmental Microbiology that will be offered through the program in MCBP.

Is this course a prerequisite for any other course? If yes, what course(s) No.

Do other course(s) cover some of the same material? Which ones (explain extent)?

Yes, Environmental Biology. The second unit of material offered in that course will be similar to the material presented as the first unit in this course. The course in Environmental Biology will emphasize the application of fundamental toxicological and microbiological concepts to problems which exist in the real world so it is appropriate that some of the material in this course should overlap.

PROJECTED SIZE AND SOURCE OF ENROLLMENT

Graduate Students: #Expected  
Per Year

Other Students: (Specify)

Expected  
Per Year

Within Department 5

EHAP Unclassified

30

Outside Department 30

College of Charleston

## *Environmental Microbiology*

**Course Director:** Michael G. Schmidt, Ph.D.  
Department of Microbiology and Immunology

**Course Offered:** The course will be offered yearly, in the fall semester. The length of the course will be 15 weeks. It will consist of three lecture periods per week with one period for recitation or discussion. It will carry 4 credit hours.

**Course Prerequisites:** Major in Biology or Chemistry with at least 1 course in microbiology.

### **Course/ Catalog Description:**

The course emphasizes the application of fundamental microbiological concepts to problems which exist in today's environment. The course should prepare the student interested in environmental problems and issues with the necessary practical information to make sound judgments in assessing meaningful solutions to existing environmental problems and the role microorganisms play in those processes.

### **Detailed Statement of Objectives:**

The course emphasizes the application of fundamental microbiological concepts to problems that exist in the environment. The course will not offer grand theoretical schemes for the solution of current environmental problems, but will focus on the potential and limitations of the use of microorganisms in addressing the issues of biotreatment/bioremediation. Environmental Microbiology concerns itself with the role of microorganisms in the causes and solutions of environmental problems. This subdiscipline of microbiology also includes the detection and enumeration of significant or indicator microorganisms (biomarkers), their products in natural and man-made environments, and the microbial production and transformations of environmentally relevant molecules. It is anticipated that the course will prepare the student well for the Case Based course in Environmental Sciences as the the necessary practical information to make sound judgments in assessing the use of microorganisms in addressing meaningful solutions to existing problems will be emphasized throught the course.

**Texts:** *Environmental Microbiology*, Ralph Mitchell, ed. 1992. Wiley Liss. or *Biology of Microorganisms*, 6th ed. by Brooke and Madigan. 1991. Prentice Hall.

### **Recommended Supplemental Text Books:**

*Physiology of the Bacterial Cell, A Molecular Approach*, by Neidhardt, Ingraham, and Schaechter, 1990. Sinauer Associates, Inc.

*The Microbial World, 5th Ed.* by Stanier, Ingraham, Wheelis and Painter, 1986. Prentice-Hall.

*Molecular Cell Biology, 2nd ed.*, by Darnell, Lodish and Baltimore. 1990. Scientific American Books

*Microbial Genetics* by Freifelder, 1987. Jones and Bartlett.

*Escherichia coli and Salmonella typhimurium, Cellular and Molecular Biology.* b Neidhardt, Ingraham, Brooks, Magasanik, Schaechter and Umberger, 1987. American Society for Microbiology.

## *Course Outline*

### Tentative Schedule of Lectures

#### Unit I General Microbiology and Biological Background

**Lecture 1: Competition for Energy and Nutrients in the Microbial World:** Generalizations on energy flow in biological systems; importance of available water; major atomic components and amounts required for microbial growth; restricted small molecules.

**Lecture 2: Primary Energy Sources:** Photosynthetic and chemosynthetic autotrophs: their energy sources and elemental requirements; types of chemosynthetic autotrophs; consequences of autotrophic growth

**Lecture 3: Secondary Energy Sources:** Major or ubiquitous organic compounds; unique compounds; spectrum of utilization of organic compounds; consequences of heterotrophic growth.

**Lecture 4: Secondary Metabolism and its Consequences:** Chemical diversity of accumulating end-products of metabolism: secondary metabolites, their properties and production.

**Lecture 5: Consequences of Colonization of Extreme Environments:** Microbial oxygen relationships, measurement and attainment of anaerobiosis, man-made anaerobic environments. Temperature: psychrophiles, types and methods for study and man-made environments;

**Lecture 6: Thermophiles:** Types and methods of study and man-made environments; halophiles, types and methods of study, man-made environments; acidophiles and alkalophiles and their environments.

**Lecture 7: Biogeochemical Cycles:** Requirements for life in a closed system; oxidation states of elements.

**Lecture 8: Interconversions of Carbon, Hydrogen, and Oxygen Respiration,** photosynthesis, carbon monoxide utilization;

**Lecture 9: Hydrogen production and utilization;** methanogenesis and methane oxidation;

**Lecture 10: Nitrogen Interconversions:** Dinitrogen fixation, methods of study, microbial types-symbiotic and non-symbiotic.

**Lecture 11: production and utilization of ammonia;** production and utilization of nitrate.

**Lecture 12: Sulfur Interconversions:** Conversion of sulfate to inorganic sulfur containing compounds; oxidation of sulfur compounds; production of hydrogen sulfide.

**Lecture 13: Phosphorus "Conversions"** Phosphate cycle; oxidation of hypophosphite and phosphite; hypothetical phosphorus cycle.

**Lecture 14:** Examination on Unit I.

**Lecture 15:** Review of Examination I.

## Unit II: Microbial Conversions of Innocuous Compounds to Toxic Ones

**Lecture 16: Carcinogens:** types of cancers; chemical carcinogens; mutagens and carcinogens; metabolic activation.

**Lecture 17: Detection of carcinogens by microbial systems;** procaryotic systems, eucaryotic systems, advantages and limitations.

**Lecture 18: Ames Test:** Utility, advantages and limitations

**Lecture 19: Microtox Assay:** Utility, advantages and limitations

**Lecture 20: Microbial Toxins as Carcinogens:** Characteristics, sources, and detection of mycotoxins: aflatoxins, ochratoxin, and others.

**Lecture 21: Microbial Reduction of Nitrate and its consequence:** Sources of nitrate; accumulation of nitrate by microbial activity; conditions necessary for nitrosamine production and consequences.

**Lecture 22: Microbial Reduction of Metals:** microbial metabolism of mercury selenium, tellurium, arsenic and the consequences.

**Lecture 23: Continued**

**Lecture 24: Remote sensing;**

**Lecture 25: Sampling;**

## **Unit III: Microbial Conversions of Innocuous Compounds to Useful Ones**

**Lecture 26: Regulatory Mechanisms and their Applications;** Introduction to bacterial operons; Induction; catabolite repression; enzyme repression; end-product inhibition.

**Lecture 27: Regulatory Mechanisms con't: Transcription vs. Translational Control**

**Lecture 28: Mutations:** natural & man made and increased production of primary and secondary metabolites.

**Lecture 29: Genetic Engineering Part 1: Cloning, plasmids, l and other**

**Lecture 30: Genetic Engineering Part 2: Stability, control, regulation, suicide vectors.**

**Lecture 31: GEMs:** Use outside of the lab, ice minus, regulatory issues. When mother nature is better than man made.

**Lecture 32: Single-Step Conversions:** Oxidations by the acetic acid bacteria and / applications; other single step conversions; steroid transformation.

**Lecture 30: Antibiotics:** Isolation; development of assays; production and evaluation; types of antibiotics, natural and semi-synthetic;

**Lecture 32: Antibiotics as environmental pollutants;** social and economic impact.

**Lecture 33: Microbial Enzymes:** Uses and sources of industrial enzymes; increased production; immobilization of enzymes.

**Lecture 34: Single-Cell Proteins:** Advantages of microbial proteins; microorganisms, advantages and disadvantages; production; nutritional value of endproduct.

#### **Unit IV: Microbial Conversions of Toxic Compounds to Innocuous Ones**

##### **BioTreatment/Bioremediation**

**Lecture 35: Methodology of Microbial Degradation Studies:** Pure cultures, enrichments, soil percolators, their advantages and limitations, co-metabolism: molecular recalcitrance;

**Lecture 36: Pesticides:** Types, microbial susceptibility effects on microorganisms, detection in the environment; microbial insecticides.

**Lecture 38: Surfactants:** environmental problems; chemistry, detection, microbial susceptibility, a solvable problem.

**Lecture 39: Microbiology of Disposable Wastes:** Types of wastes; biochemical oxygen demand, its measurement and significance; COD, TOD;

**Lecture 40: Microbiology of sludge digestion;** microbiology of activated sludge, trickling filters and lagoons.

#### **Unit V: Sanitary Significance of Microorganisms in Water and Foods**

**Lecture 41: Biological Properties of Intestinal Microorganisms:** Enterobacteria and the fecal streptococci.

**Lecture 42: Microbial Analysis as a Measure of Water Quality:** Coliforms, fecal coliforms, fecal streptococci, staphylococci, pseudomonads; viruses.

**Lecture 43: Continued**

**Lecture 44: Microbial Analysis as a Measure of Food Quality:** Significance of microorganisms in foods; principles of microbiological analysis of foods.

#### **Unit VI: Sanitary Significance of Microorganisms in Water and Foods**

**Lecture 41: Biological Properties of Intestinal Microorganisms:** Enterobacteria and the fecal streptococci.

**Lecture 42: Microbial Analysis as a Measure of Water Quality:** Coliforms, fecal coliforms, fecal streptococci, staphylococci, pseudomonads; viruses.

**Lecture 43: Continued**

**Lecture 44: Microbial Analysis as a Measure of Food Quality:** Significance of microorganisms in foods; principles of microbiological analysis of foods.

**Lecture 45: Final Exam**

### Methods of Evaluation

The final grade will be based on the following criteria:

**Exams-** Exams will be objective in nature. They will all be weighted equally and comprise 95% of the final grade.

**Class Participation.** Everyone will be expected to take an active oral role in the class discussions. 5 %.

The merit grade will be determined from the table printed on page 33-34 of the Medical University of South Carolina Bulletin.

Raw Score	Merit Grade
95 %	4.0
94	3.9
93	3.8
92	3.7
91	3.6
90	3.5
89	3.4
88	3.3
87	3.2
86	3.1
85	3.0

### Relation to Other Courses

**How does this course fit into the Department's graduate Program ?**

This course will complement the current track graduate program in Microbiology and Immunology and will serve as an elective for that program. It will be also be a required course in the new masters and doctoral program in Environmental Microbiology that will be offered through the program in MCBP.

**Is this course a prerequisite for any other course ? If yes, what course(s) ?**  
No.

**Do other course(s) cover some of the material ? Which one (explain extent)?**

Yes, Environmental Biology. The second unit of material offered in that course will be similar to the material presented as the first unit in this course. The course in Environmental Biology will emphasize the application of fundamental toxicological and microbiological concepts to problems which exist in the real world so it is appropriate that some of the material in this course should overlap.

COURSE DESCRIPTION

No. 51 - 740  
~~777~~

COURSE TITLE ~~Introduction to~~ Toxicology  
 DEPARTMENT Pharmacology PRINCIPAL INSTRUCTOR JoEllyn McMillan, Ph.D.  
 APPROVED *Harry Maglier* DATE 4/22/93  
 DEPARTMENT CHAIRMAN

COURSE OFFERED

	<u>METHODS OF EVALUATION</u>	<u>% OF GRADE</u>
Yearly <u>  x  </u>	Written Assignment(s)	_____
Alternate Years _____	Written Report(s)	<u>  10  </u>
On Demand _____	Written Examinations	<u>  85  </u>
WHEN OFFERED	Discussion/Presentation	<u>    5  </u>
Fall Semester (15 wks) _____	Oral Examination(s)	_____
Spring Semester (15 wks) <u>  x  </u>	Attitude/Application	_____
Maymester (3 wks) _____	Laboratory Projects	_____
Summer Semester (10 wks) _____		

LENGTH OF COURSE   15   WKS.

<u>TYPE OF SESSION</u>	<u>Outside Prep. Est. Hrs/Week</u>	<u>No. of Hrs/Week</u>	<u>Quarter Hrs. Credit</u>	<u>No. Students Acc</u>
Lecture	<u>    8    </u>	<u>    4    </u>	<u>    4    </u>	Minimum <u>    2    </u>
Recitation or Discussion	_____	_____	_____	Maximum <u>   20   </u>
Laboratory	_____	_____	_____	Prerequisites **
Field Work	_____	_____	_____	
Independent Study	_____	_____	_____	
**Major in Biology or Chemistry with at least one course in organic chemistry and biochemistry or permission of instructor				_____
Total Credits				<u>    4    </u>

CATALOG DESCRIPTION (Include general objectives, content coverage, and student to whom it is directed).

The course emphasizes the application of fundamental toxicological concepts to problems which exist in the real world. The course should prepare the student interested in toxicological problems with the necessary practical information to make sound judgments in assessing meaningful solutions to existing environmental problems.

Course  
No. 51 - ???

COURSE TITLE Introduction to Toxicology

DETAILED STATEMENT OF OBJECTIVES (i . e. what will the student gain from the course )?

The course emphasizes the application of fundamental toxicological concepts to problems which exist in the real world. Toxicology concerns itself with a) the identification of hazardous chemicals in personal, occupational, community and global environments and, subsequently, b) identifying the adverse effects of exposure to such chemicals on biological organisms, learning the mechanisms by which these chemicals act, and using these data to develop strategies for preventing, blocking, or reversing the adverse effects. It is anticipated that the course will prepare the student interested in toxicological problems with the necessary practical information to make sound judgments in assessing meaningful solutions to existing environmental problems.

ASSIGNED TEXT AND OTHER REFERENCE MATERIALS

Assigned text: Casarett and Doull's Toxicology: The Basic Science of Poisons, 4th ed. by Doull, Klaassen and Amdur, 1991 Pergamon Press.

COURSE OUTLINE

Tentative Schedule of Lectures

- Lecture 1: Basic concepts of toxicology
- Lecture 2: Dose-response relationships
- Lecture 3: Absorption, distribution, excretion I
- Lecture 4: Absorption, distribution, excretion II
- Lecture 5: Metabolism: oxidation-reduction
- Lecture 6: Metabolism: conjugation
- Lecture 7: Factors influencing metabolism and toxicity
- Lecture 8: Carcinogens
- Lecture 9: Genetic Toxicology
- Lecture 10: Teratogens
- Lecture 11: Central nervous system
- Lecture 12: Liver
- Lecture 13: Renal
- Lecture 14: Exam 1
- Lecture 15: Inhalation
- Lecture 16: Ocular
- Lecture 17: Blood
- Lecture 18: Reproductive system
- Lecture 19: Pesticides
- Lecture 20: Metals
- Lecture 21: Halogenated aromatics
- Lecture 22: Food additives
- Lecture 23: Solvents
- Lecture 24: Air-water-soil pollutants
- Lecture 25: Analysis of toxicants
- Lecture 26: Biomarkers
- Lecture 27: Exam 2
- Lecture 28: Oral presentations
- Lecture 29: Oral presentations
- Lecture 30: Review for Final Exam

Course  
No. 51 - ???

COURSE TITLE Introduction to Toxicology

TYPES AND AMOUNT OF WORK EXPECTED OF STUDENTS

**Exams-** Exams (2 plus Final) will be objective in nature. They will all be weighted equally and comprise **85%** of the final grade.

**Paper presentations-** Everyone will present a short oral report on a topic of relevance to environmental toxicology. The presentation will comprise **10%** of the final grade.

**Class Participation-** Everyone will be expected to take an active oral role in the class discussions. **5%**

SPECIAL FACILITIES REQUIRED (Including Library and other Learning Resources)  
(List and indicate whether presently available or must be obtained)

None

Other Personnel Involved:

In What Capacity:

David J Jollow, Ph.D.

Co-Instructor

RELATION TO OTHER COURSES

**How does this course fit into the Department's Graduate Program?**

This course will complement the current track graduate program in Pharmacology and will serve as an elective for that program. It will also be a required course in the new masters program in Environmental Studies that will be offered.

**Is this course a prerequisite for any other course? If yes, what course(s)**

No.

**Do other course(s) cover some of the same material? Which ones (explain extent)?**

Yes.

A) Environmental Biology. The third unit of material offered in that course will be similar, though less inclusive, to the material presented in this course. The course in Environmental Biology will emphasize the application of fundamental toxicological and microbiological concepts to problems which exist in the real world, so it is appropriate that some of the material in this course should overlap.

B) Drug Metabolism and Pharmacokinetics. The material offered in the first seven lectures of this course will be similar, though less inclusive, to the material presented in that course.

PROJECTED SIZE AND SOURCE OF ENROLLMENT

Graduate Students:	#Expected	Other Students: (Specify)	#Expected
Within Department	Per Year	<u>Marine Biology Majors (U of C)</u>	Per Year
Outside Department	<u>2-5</u>		<u>2-4</u>
	<u>2-15</u>		

**ENVIRONMENTAL RISK MANAGEMENT  
ADVISORY COMMITTEE**

**Environmental Hazards Assessment Program (EHAP)  
Medical University of South Carolina (MUSC)  
June 3, 1993  
Charleston, SC**

**Morning Agenda**

8:00-8:15	Welcome and Introduction	Jan Temple
8:15-8:25	MUSC Welcome	Steve Jones
8:25-8:45	EHAP Overview	Martin Jones
8:45-9:30	EHAP Educational Initiative	Eberhard Voit
	1)Overview of the Academic Initiative	
	•PhD and Masters programs	
	2)Environmental Health Sciences Masters Program	
	•National Search	
	•Environmental Health Sciences Masters Program Curricula	
9:30-9:45	Department of Energy /EM - goals	Ike Sewell/DOE
9:45-10:00	Break	
10:00-10:15	Overview of Environmental Risk Management Education and Training Initiative (Task 5)	Jan Temple
10:15-10:45	Advisory Committee Role and Function	Jan Temple
10:45-12:00	Immediate Goals	
	1)Literature Search	Nancy Kierstead
	2)Needs Assessments	Bill Hotle
	•Survey Results	
	Perceptions of EM trainers	
	Perceptions of Educational Outreach Group	
	•Profile survey: Identify Competency	Jan Temple
	Requirements for Environmental Managers	
	Option 1-Compare DOE, DOD, Business & Industry	
	Option 2-Compare 2 DOE sites	
12:00-1:00	Working Lunch	

**ENVIRONMENTAL RISK MANAGEMENT  
ADVISORY COMMITTEE  
June 3, 1993  
Charleston, SC**

**Afternoon Agenda**

- 1:00-1:45      Immediate Goals (continued)
- 3)Course: Risk Assessment for Environmental Risk Managers Mike Reed
- Proposed Outline
  - Length
  - Course Text
  - Method of Delivery
  - Exams
  - Test-site Delivery
  - Instructor's/Consultants
  - Reference Documents
- 1:45-3:00      Long Term Goals
- 1)Professional Development Seminars
- Risk Based Decision Making for Environmental Managers Nancy Kierstead
  - Risk as it applies to Compliance Mike Reed
- 2)Standardization Jan Temple
- 3)Schedule for Implementation & Delivery
- 4)Accrediting Bodies/Certification
- 5)Other
- 3:00-3:15      Break
- 3:15-4:00      Recommendations and Directives
- 1)Needs Assessments and Surveys
  - 2)Course: Risk Assessment for Environmental Risk Managers
  - 3)Future Initiatives in Environmental Risk Management & Compliance
  - 4)Academic Initiatives
  - 5)Reciprocity
  - 6)Advisory Committee
    - Committee Procedures and Appointments
    - Meetings
    - Committee/Special Task Force
    - Assignments
    - Expense Reports
    - Next meeting - Date and Location
  - 7)Other Topics/Concerns

**ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM**

**ENVIRONMENTAL RISK MANAGEMENT ADVISORY COMMITTEE**

**DEPARTMENT OF DEFENSE**

Mr. Rick Lemaire  
Environmental Specialist  
Deputy Undersecretary of Defense for Environmental Security Department  
Department of Defense  
Room 206  
400 Army - Navy Drive  
Arlington, VA 22202-2884  
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**REGULATORY**

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Dr. Hugh W. McKinnon  
Director Human Health Assessment Group  
US Environmental Protection Agency  
RD 689 USEPA  
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**PUBLIC INTEREST**

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Director  
Energy Research Foundation  
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Columbia, SC 29205  
Telephone (803) 256-7298

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Waste Technology Development Department

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Dr. Curtis C. Travis

Director

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## BUSINESS AND INDUSTRY

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## **UNION REPRESENTATIVES**

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Ms. Sylvia Kieding or Representative: Randy Foster  
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## **EDUCATION/RESEARCH**

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Professor and Chairman  
MUSC Department of Biostatistics Epidemiology and Systems Science (DBESS)  
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*The following are non voting MUSC and DOE Representatives*

## **MUSC**

Mr. Mike Reed  
Assistant Professor  
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Chairman  
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**DEPARTMENT OF ENERGY**

Ms. June Ollero  
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US Department of Energy  
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Ms. Susan M. Prestwich  
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EM-52  
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*or*

Mr. Isiah O. Sewell (Ike)  
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US Department of Energy  
EM522

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Fax (303) 237-0428

**DRAFT**

**COURSE AGENDA**

**RISK ASSESSMENT TRAINING**

**Monday:**

<b>8:00 a.m. - - 8:30 a.m.</b>	<b>Registration</b>
<b>8:30 a.m. - - 9:00 a.m.</b>	<b>Course Overview</b>
<b>9:00 a.m. - - 10:00 a.m.</b>	<b>Chemical Risk Assessment -- Background Information</b>
<b>10:00 a.m. - - 10:15 a.m.</b>	<b>BREAK</b>
<b>10:15 a.m. - - 12:00 noon</b>	<b>TSCA/RCRA/CERCLA/SARA Regulations</b>
<b>12:00 noon - - 1:00 p.m.</b>	<b>LUNCH</b>
<b>1:00 p.m. - - 1:30 p.m.</b>	<b>Remedial Investigation/ Feasibility Study</b>
<b>1:30 p.m. - - 3:00 p.m.</b>	<b>Data Collection -- Soil, Groundwater, Surface Water and Sediment, Air, and Biota</b>
<b>3:00 p.m. - - 3:15 p.m.</b>	<b>BREAK</b>
<b>3:15 p.m. - - 4:00 p.m.</b>	<b>Sampling Strategies</b>
<b>4:00 p.m. - - 5:00 p.m.</b>	<b>Quality Assurance/ Control</b>

## COURSE AGENDA

### RISK ASSESSMENT TRAINING

#### Tuesday:

8:00 a.m. - - 8:45 a.m.	Review
8:45 a.m. - - 10:00 a.m.	Data Evaluation
10:00 a.m. - - 10:15 a.m.	BREAK
10:15 a.m. - - 12:00 noon	Exposure Assessment
12:00 noon - - 1:00 p.m.	LUNCH
1:00 p.m. - - 3:00 p.m.	Toxicity Assessment
3:00 p.m. - - 3:15 p.m.	BREAK
3:15 p.m. - - 5:00 p.m.	Risk Characterization

**COURSE AGENDA**  
**RISK ASSESSMENT TRAINING**

**Wednesday:**

<b>8:00 a.m. - - 8:45 a.m.</b>	<b>Review</b>
<b>8:45 a.m. - -10:00 a.m.</b>	<b>Baseline Risk Assessment Report</b>
<b>10:00 a.m. - -10:15 a.m.</b>	<b>BREAK</b>
<b>10:15 a.m. - -11:00 a.m.</b>	<b>Review Process</b>
<b>11:00 a.m. - -12:00 noon</b>	<b>Risk Management</b>
<b>12:00 noon - - 1:00 p.m.</b>	<b>LUNCH</b>
<b>1:00 p.m. - - 3:00 p.m.</b>	<b>Risk Communication</b>
<b>3:00 p.m. - - 3:15 p.m.</b>	<b>BREAK</b>
<b>3:15 p.m. - - 5:00 p.m.</b>	<b>Remedial Technology</b>

## **COURSE AGENDA**

### **RISK ASSESSMENT TRAINING**

#### **Thursday:**

<b>8:00 a.m. - - 8:45 a.m.</b>	<b>Review</b>
<b>8:45 a.m. - - 9:30 a.m.</b>	<b>Radiation Risk Assessment -- Background Information</b>
<b>9:30 a.m. - -10:00 a.m.</b>	<b>NRC Regulations</b>
<b>10:00 a.m. - -10:15 a.m.</b>	<b>BREAK</b>
<b>10:15 a.m. - -11:00 a.m.</b>	<b>Data Collection/Evaluation</b>
<b>11:00 a.m. - -12:00 noon</b>	<b>Exposure/Dose Assessment</b>
<b>12:00 noon - - 1:00 p.m.</b>	<b>LUNCH</b>
<b>1:00 p.m. - - 2:00 p.m.</b>	<b>Toxicity Assessment</b>
<b>2:00 p.m. - - 3:00 p.m.</b>	<b>Risk Characterization</b>
<b>3:00 p.m. - - 3:15 p.m.</b>	<b>BREAK</b>
<b>3:15 p.m. - - 4:00 p.m.</b>	<b>Baseline Risk Assessment Report/ Review Process</b>
<b>4:00 p.m. - - 4:30 p.m.</b>	<b>Risk Management/Communication</b>
<b>4:30 p.m. - - 5:00 p.m.</b>	<b>Remedial Technology</b>

**COURSE AGENDA**

**RISK ASSESSMENT TRAINING**

**Friday:**

**8:00 a.m. - - 8:45 a.m.**

**Review**

**8:45 a.m. - -10:00 a.m.**

**Chemical Risk Assessment  
Case Study**

**10:00 a.m. - -10:15 a.m.**

**BREAK**

**10:15 a.m. - -11:30 a.m.**

**Radiation Risk Assessment  
Case Study**

**11:30 a.m. - -12:30 p.m.**

**Course Evaluation/  
Examination**

# HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE MAIN COMPONENTS

APRIL 16

I. TEXTBOOK	96%
II. SCHEDULE OF IMPLEMENTATION (AGENDAS)	99%
III. LESSON PLANS	44%
IV. EVALUATION INSTRUMENTS (TEST QUESTIONS)	26%
V. VISUAL AIDS	20%
VI. TRAINING AIDS	34%

# TEXTBOOK STATUS

96% COMPLETE APRIL 16

## CHAPTER

## STATUS

1 INTRODUCTION

COMPLETED

2 HAZARDS

COMPLETED

3 PLANNING AND ORGANIZATION

COMPLETED

4 TRAINING

COMPLETED

5 MEDICAL PROGRAM

ASSIGNED

6 SITE CHARACTERIZATION

COMPLETED

7 AIR MONITORING

COMPLETED

8 PERSONAL PROTECTIVE EQUIPMENT

COMPLETED

9 SITE CONTROL

COMPLETED

10 DECONTAMINATION

COMPLETED

11 HANDLING DRUMS AND OTHER CONTAINERS

COMPLETED

12 SITE EMERGENCIES

COMPLETED

13 HAZARDOUS CHEMICALS COMPATABILITY

COMPLETED

## APPENDICES

A. LIST OF ABBREVIATIONS AND ACRONYMS	COMPLETED
B. GENERIC SITE SAFETY PLAN	COMPLETED
C. SAMPLE HAZARDOUS SUBSTANCE INFORMATION FORM	COMPLETED
D. SAMPLE DECONTAMINATION PROCEDURES FOR THREE TYPICAL LEVELS OF PROTECTION	COMPLETED
E. NIOSH, OSHA, AND EPA REGIONAL OFFICE AND USCG DISTRICT OFFICES	COMPLETED
1. LIST OF CHEMICAL SUBSTANCES	COMPLETED
2. LIST OF CONSTITUENTS BY CHEMICAL CLASS AND REACTIVITY	COMPLETED
3. INDUSTRY INDEX AND LIST OF GENERIC NAMES OF WASTE STREAMS	COMPLETED
4. LIST OF INCOMPATIBLE BINARY COMBINATIONS OF HAZARDOUS WASTES BY REACTIVITY GROUPS AND POTENTIAL ADVERSE REACTION CONSEQUENCES	COMPLETED
5. CASE HISTORIES OF ACCIDENTS CAUSED BY MIXING INCOMPATIBLE WASTES	COMPLETED
OTHER TEXT	STATUS
NFPA 471	COMPLETED
NFPA 472	COMPLETED
STANDARD 1910.120	COMPLETED
REFERENCES CH. 13	COMPLETED

**SCHEDULE OF IMPLEMENTATION  
(AGENDAS)**

**99% COMPLETE APRIL 16**

**ALL**

**AGENDAS**

**ARE**

**COMPLETED**

**(SOME MINOR EDITING MUST STILL TAKE PLACE)**

# LESSON PLANS

44% COMPLETE APRIL 16

TITLE		STATUS
1. Introduction	!!!	COMPLETED
2. Health Effects	!!!	COMPLETED
3. Medical Surveillance	!!!	COMPLETED
4. Introduction to Hazard Communication		COMPLETED
5. Hazard Communication	!!!	COMPLETED
6. Training Requirements		COMPLETED
7. Hazardous Chemical Inventory		*UNASSIGNED
8. Labeling Requirements		*UNASSIGNED
9. Material Safety Data Sheets (MSDSs)		*UNASSIGNED
10. Hazard Determination		*UNASSIGNED
11. Introduction To Chemical Compatibility		COMPLETED
12. Determining Chemical Compatibility Of Hazardous Wastes		COMPLETED COMPLETED
13. Hazardous Waste Compatibility Chart		COMPLETED
14. Handling Drums And Other Containers		COMPLETED
15. Engineering Controls	!!!	COMPLETED
16. Decontamination	!!!	COMPLETED
17. Spill Containment	!!!	COMPLETED
18. Regulatory Review -- OSHA	!!!	ASSIGNED
19. Safety Considerations Confined Space Entry	!!!	ASSIGNED
20. Respiratory Protection	!!!	COMPLETED
21. Respirator Selection, Maintenance, And Care To Include The Components Of A Respiratory Protection Program		COMPLETED
22. Selection And Use Of Protective Clothing	!!!	COMPLETED
23. Emergency Response Plan	!!!	COMPLETED
24. Safety And Health Plan	!!!	COMPLETED
25. Employee Responsibilities		*UNASSIGNED
26. Command And Control Exercise		*UNASSIGNED
27. Site Characterization	+	*UNASSIGNED
28. Site Control		*UNASSIGNED
29. Illumination Requirements	+	*UNASSIGNED

+ Indicates that the Objectives are written for this Lesson Plan.

!!! Indicates Phase 1.

TITLE	STATUS
30. Sanitation Requirements	COMPLETED
31. Technology Transfer	+ *UNASSIGNED
32. Personal Decontamination Procedures	*UNASSIGNED
33. Chemistry and Toxicology of Hazardous Materials	COMPLETED
34. Monitoring	!!! COMPLETED
35. Hazardous Materials Control	+ *UNASSIGNED
36. Safety Considerations	+ *UNASSIGNED
37. Resources and Planning	+ *UNASSIGNED
38. Incident Management	+ *UNASSIGNED
39. Hazard Classification, Identification and Verification	+ *UNASSIGNED
40. Recognition of Hazardous Materials	+ *UNASSIGNED
41. Incident Command System	*UNASSIGNED
42. Material Identification Monitoring	*UNASSIGNED
43. New Technologies	*UNASSIGNED
44. Termination Procedures	+ *UNASSIGNED
45. Hazard and Risk Assessment	+ *UNASSIGNED
46. Qualitative Respirator Fit-Testing	*UNASSIGNED
47. Level A Protection	*UNASSIGNED
48. Level B Protection	*UNASSIGNED
49. Level C Protection	*UNASSIGNED
50. Basic Chemical and Toxicological Terminology and Behavior	*UNASSIGNED

+ Indicates that the Objectives are written for this Lesson Plan.  
 !!! Indicates Phase 1.

# EVALUATION INSTRUMENTS

26% COMPLETE APRIL 16

TITLE		STATUS
1. Introduction	!!!	*UNASSIGNED
2. Health Effects	!!!	COMPLETED
3. Medical Surveillance	!!!	COMPLETED
4. Introduction to Hazard Communication		COMPLETED
5. Hazard Communication	!!!	COMPLETED
6. Training Requirements		*UNASSIGNED
7. Hazardous Chemical Inventory		*UNASSIGNED
8. Labeling Requirements		*UNASSIGNED
9. Material Safety Data Sheets (MSDSs)		*UNASSIGNED
10. Hazard Determination		*UNASSIGNED
11. Introduction To Chemical Compatibility		*UNASSIGNED
12. Determining Chemical Compatibility Of Hazardous Wastes		*UNASSIGNED
13. Hazardous Waste Compatibility Chart		*UNASSIGNED
14. Handling Drums And Other Containers		COMPLETED
15. Engineering Controls	!!!	COMPLETED
16. Decontamination	!!!	COMPLETED
17. Spill Containment	!!!	COMPLETED
18. Regulatory Review -- OSHA	!!!	ASSIGNED
19. Safety Considerations Confined Space Entry	!!!	ASSIGNED
20. Respiratory Protection		COMPLETED
21. Respirator Selection, Maintenance, And Care To Include The Components Of A Respiratory Protection Program		COMPLETED
22. Selection And Use Of Protective Clothing	!!!	*UNASSIGNED
23. Emergency Response Plan	!!!	ASSIGNED
24. Safety And Health Plan	!!!	COMPLETED
25. Employee Responsibilities		*UNASSIGNED
26. Command And Control Exercise		*UNASSIGNED
27. Site Characterization	+	*UNASSIGNED
28. Site Control		*UNASSIGNED
29. Illumination Requirements	+	*UNASSIGNED

+ Indicates that the Objectives are written for this Lesson Plan.

!!! Indicates Phase 1.

TITLE	STATUS
30. Sanitation Requirements	COMPLETED
31. Technology Transfer	+ *UNASSIGNED
32. Personal Decontamination Procedures	*UNASSIGNED
33. Chemistry and Toxicology of Hazardous Materials	*UNASSIGNED
34. Monitoring	!!! COMPLETED
35. Hazardous Materials Control	+ *UNASSIGNED
36. Safety Considerations	+ *UNASSIGNED
37. Resources and Planning	+ *UNASSIGNED
38. Incident Management	+ *UNASSIGNED
39. Hazard Classification, Identification and Verification	+ *UNASSIGNED
40. Recognition of Hazardous Materials	+ *UNASSIGNED
41. Incident Command System	*UNASSIGNED
42. Material Identification Monitoring	*UNASSIGNED
43. New Technologies	*UNASSIGNED
44. Termination Procedures	+ *UNASSIGNED
45. Hazard and Risk Assessment	+ *UNASSIGNED
46. Qualitative Respirator Fit-Testing	*UNASSIGNED
47. Level A Protection	*UNASSIGNED
48. Level B Protection	*UNASSIGNED
49. Level C Protection	*UNASSIGNED
50. Basic Chemical and Toxicological Terminology and Behavior	*UNASSIGNED

+ Indicates that the Objectives are written for this Lesson Plan.

!!! Indicates Phase 1.

# VISUAL AIDS

20% COMPLETE APRIL 16

TITLE		STATUS
1. Introduction	!!!	*UNASSIGNED
2. Health Effects	!!!	COMPLETED
3. Medical Surveillance	!!!	*UNASSIGNED
4. Introduction to Hazard Communication		COMPLETED
5. Hazard Communication	!!!	COMPLETED
6. Training Requirements		*UNASSIGNED
7. Hazardous Chemical Inventory		*UNASSIGNED
8. Labeling Requirements		*UNASSIGNED
9. Material Safety Data Sheets (MSDSs)		*UNASSIGNED
10. Hazard Determination		*UNASSIGNED
11. Introduction To Chemical Compatibility		*UNASSIGNED
12. Determining Chemical Compatibility Of Hazardous Wastes		*UNASSIGNED
13. Hazardous Waste Compatibility Chart		*UNASSIGNED
14. Handling Drums And Other Containers		COMPLETED
15. Engineering Controls	!!!	COMPLETED
16. Decontamination	!!!	COMPLETED
17. Spill Containment	!!!	NONE
18. Regulatory Review -- OSHA	!!!	ASSIGNED
19. Safety Considerations Confined Space Entry	!!!	ASSIGNED
20. Respiratory Protection		COMPLETED
21. Respirator Selection, Maintenance, And Care To Include The Components Of A Respiratory Protection Program		*UNASSIGNED
22. Selection And Use Of Protective Clothing	!!!	*UNASSIGNED
23. Emergency Response Plan	!!!	ASSIGNED
24. Safety And Health Plan	!!!	COMPLETED
25. Employee Responsibilities		*UNASSIGNED
26. Command And Control Exercise		*UNASSIGNED
27. Site Characterization	+	*UNASSIGNED
28. Site Control		*UNASSIGNED
29. Illumination Requirements	+	*UNASSIGNED

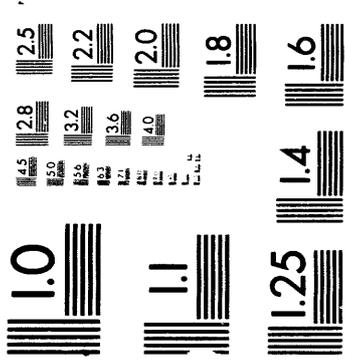
+ Indicates that the Objectives are written for this Lesson Plan.

!!! Indicates Phase 1.

TITLE		STATUS
30. Sanitation Requirements		*UNASSIGNED
31. Technology Transfer	+	*UNASSIGNED
32. Personal Decontamination Procedures		*UNASSIGNED
33. Chemistry and Toxicology of Hazardous Materials		*UNASSIGNED
34. Monitoring	!!!	COMPLETED
35. Hazardous Materials Control	+	*UNASSIGNED
36. Safety Considerations	+	*UNASSIGNED
37. Resources and Planning	+	*UNASSIGNED
38. Incident Management	+	*UNASSIGNED
39. Hazard Classification, Identification and Verification	+	*UNASSIGNED
40. Recognition of Hazardous Materials	+	*UNASSIGNED
41. Incident Command System		*UNASSIGNED
42. Material Identification Monitoring		*UNASSIGNED
43. New Technologies		*UNASSIGNED
44. Termination Procedures	+	*UNASSIGNED
45. Hazard and Risk Assessment	+	*UNASSIGNED
46. Qualitative Respirator Fit-Testing		*UNASSIGNED
47. Level A Protection		*UNASSIGNED
48. Level B Protection		*UNASSIGNED
49. Level C Protection		*UNASSIGNED
50. Basic Chemical and Toxicological Terminology and Behavior		*UNASSIGNED

+ Indicates that the Objectives are written for this Lesson Plan.

!!! Indicates Phase 1.



3

of

3

# TRAINING AIDS

34% COMPLETE APRIL 16

TITLE		STATUS
1. Introduction		NONE REQUIRED
2. Health Effects		NONE REQUIRED
3. Medical Surveillance		NONE REQUIRED
4. Introduction to Hazard Communication	!!!	NONE REQUIRED
5. Hazard Communication	!!!	NONE REQUIRED
6. Training Requirements		NONE REQUIRED
7. Hazardous Chemical Inventory		*UNASSIGNED
8. Labeling Requirements		*UNASSIGNED
9. Material Safety Data Sheets (MSDSs)		*UNASSIGNED
10. Hazard Determination		*UNASSIGNED
11. Introduction To Chemical Compatibility		NONE REQUIRED
12. Determining Chemical Compatibility Of Hazardous Wastes		NONE REQUIRED
13. Hazardous Waste Compatibility Chart		NONE REQUIRED
14. Handling Drums And Other Containers		NONE REQUIRED
15. Engineering Controls	!!!	NONE REQUIRED
16. Decontamination		*UNASSIGNED
17. Spill Containment	!!!	NONE REQUIRED
18. Regulatory Review -- OSHA	!!!	ASSIGNED
19. Safety Considerations Confined Space Entry	!!!	ASSIGNED
20. Respiratory Protection		NONE REQUIRED
21. Respirator Selection, Maintenance, And Care To Include The Components Of A Respiratory Protection Program	!!!	*UNASSIGNED
22. Selection And Use Of Protective Clothing		*UNASSIGNED
23. Emergency Response Plan	!!!	ASSIGNED
24. Safety And Health Plan	!!!	NONE REQUIRED
25. Employee Responsibilities		*UNASSIGNED
26. Command And Control Exercise		*UNASSIGNED
27. Site Characterization	+	*UNASSIGNED
28. Site Control		*UNASSIGNED
29. Illumination Requirements	+	*UNASSIGNED

+ Indicates that the Objectives are written for this Lesson Plan.

!!! Indicates Phase 1.

TITLE	STATUS
30. Sanitation Requirements	NONE REQUIRED
31. Technology Transfer	+ *UNASSIGNED
32. Personal Decontamination Procedures	*UNASSIGNED
33. Chemistry and Toxicology of Hazardous Materials	NONE REQUIRED
34. Monitoring <span style="float: right;">!!!</span>	NONE REQUIRED
35. Hazardous Materials Control	+ *UNASSIGNED
36. Safety Considerations	+ *UNASSIGNED
37. Resources and Planning	+ *UNASSIGNED
38. Incident Management	+ *UNASSIGNED
39. Hazard Classification, Identification and Verification	+ *UNASSIGNED
40. Recognition of Hazardous Materials	+ *UNASSIGNED
41. Incident Command System	*UNASSIGNED
42. Material Identification Monitoring	*UNASSIGNED
43. New Technologies	*UNASSIGNED
44. Termination Procedures	+ *UNASSIGNED
45. Hazard and Risk Assessment	+ *UNASSIGNED
46. Qualitative Respirator Fit-Testing	*UNASSIGNED
47. Level A Protection	*UNASSIGNED
48. Level B Protection	*UNASSIGNED
49. Level C Protection	*UNASSIGNED
50. Basic Chemical and Toxicological Terminology and Behavior	*UNASSIGNED

+ Indicates that the Objectives are written for this Lesson Plan.

!!! Indicates Phase 1.

# KEY LESSON PLANS NEEDED TO FINISH SEVEN COURSES

81% COMPLETE APRIL 16

TITLE	STATUS
Introduction	COMPLETED
Health Effects	COMPLETED
Medical Surveillance	COMPLETED
Hazard Communication	COMPLETED
Engineering Controls	COMPLETED
Decontamination	COMPLETED
Spill Containment	COMPLETED
Regulatory Review -- OSHA	ASSIGNED
Safety Considerations Confined Space Entry	ASSIGNED
Respiratory Protection	COMPLETED
Selection and Use of Protective Clothing	COMPLETED
Emergency Response Plan	COMPLETED
Safety And Health Plan	COMPLETED
Monitoring	COMPLETED

GRADUATE DEGREE

PROGRAMS

IN

ENVIRONMENTAL HEALTH

SCIENCES



## ENVIRONMENTAL MANAGEMENT

### ELECTIVES:

ENVI 7XX (MUSC)	Fundamentals of Environmental Management (3)
ENVI 7XX (MUSC)	Fundamentals of Industrial Hygiene (3)
ENVI 7XX (MUSC)	Fundamentals of Health Physics (3)
ENVI 7XX (MUSC/UoC)	Environmental Biology (3)
BIOL 640 (UoC)	Environmental Microbiology (3)
CHEM 522 (UoC)	Environmental Chemistry (3)
GEOL 6XX (UoC)	Hydrogeology (3)
ENVI 7XX (MUSC)	Concepts in Environmental Engineering (3)
ENVI 7XX (MUSC)	Management of Hazardous Waste Sites (3)
ENVI 7XX (MUSC)	Physics of Aerosols (3)

### THESIS, INTERNSHIP, LIBRARY RESEARCH, OR COURSE ELECTIVES:

ENVI 7XX (MUSC/UoC)	Thesis (6)
ENVI 7XX (MUSC/UoC)	Internship (6)
ENVI 7XX (MUSC/UoC)	Library Research (6)
ENVI 7XX (MUSC/UoC)	Course Electives (6)

ENVIRONMENTAL MANAGEMENT

**PREREQUISITES:**

**Mathematics:**

**One year of college level mathematics.**

**Science:**

**Two courses in biology.**

**Two courses in chemistry.**

**Statistics:**

**One course at the 500 level or above.**

## INDUSTRIAL HYGIENE

### CORE:

#### Science:

DBESS 7XX                      Environmental Health Risk Assessment (4)  
    (MUSC)  
PHARM 7XX                      Environmental Toxicology (3)  
    (MUSC/UoC)

#### Policy:

PUBA 602                      The Policy Process (3)  
    (UoC)  
PUBA 706                      Economic Theory for Policy Analysis (3)  
    (UoC)

#### Interdisciplinary:

ENVI 7XX                      Environmental Science -- Case Studies (4)  
    (MUSC/UoC)  
ENVI 7XX                      Capstone Seminar (3)  
    (MUSC/UoC)

#### INDUSTRIAL HYGIENE:

ENVI 7XX                      Industrial Hygiene I (4)  
    (MUSC)                      (Physical Hazards in the Workplace)  
ENVI 7XX                      Industrial Hygiene II (4)  
    (MUSC)                      (Chemical Hazards in the Workplace)  
ENVI 7XX                      Industrial Ventilation (4)  
    (MUSC)

## INDUSTRIAL HYGIENE

### ELECTIVES:

ENVI 7XX (MUSC)	Fundamentals of Environmental Management (3)
ENVI 7XX (MUSC)	Fundamentals of Industrial Hygiene (3)
ENVI 7XX (MUSC)	Fundamentals of Health Physics (3)
ENVI 7XX (MUSC)	Air Pollution and Control Technology (3)
ENVI 7XX (MUSC)	Concepts in Environmental Engineering (3)
ENVI 7XX (MUSC)	Management of Hazardous Waste Sites (3)
ENVI 7XX (MUSC)	Physics of Aerosols (3)
ENVI 7XX (MUSC)	Radiation Protection I (3) (Radioactive Materials and X-ray Radiation)
ENVI 7XX (MUSC)	Radiation Protection II (3) (Radiofrequency, Laser, Infrared, Visible, and Ultraviolet Radiation)
ENVI 7XX (MUSC)	Environmental Law (3)

### THESIS, INTERNSHIP, LIBRARY RESEARCH, OR COURSE ELECTIVES:

ENVI 7XX (MUSC/UoC)	Thesis (6)
ENVI 7XX (MUSC/UoC)	Internship (6)
ENVI 7XX (MUSC/UoC)	Library Research (6)
ENVI 7XX (MUSC/UoC)	Course Electives (6)

INDUSTRIAL HYGIENE

**PREREQUISITES:**

**Mathematics:**

**One year of college level mathematics.**

**Science:**

**Two courses in biology.**

**Two courses in chemistry.**

**Statistics:**

**One course at the 500 level or above.**

## HEALTH PHYSICS

### CORE:

#### Science:

DBESS 7XX (MUSC)	Environmental Health Risk Assessment (4)
PHARM 7XX (MUSC/UoC)	Environmental Toxicology (3)

#### Policy:

PUBA 602 (UoC)	The Policy Process (3)
PUBA 706 (UoC)	Economic Theory for Policy Analysis (3)

#### Interdisciplinary:

ENVI 7XX (MUSC/UoC)	Environmental Science -- Case Studies (4)
ENVI 7XX (MUSC/UoC)	Capstone Seminar (3)

#### HEALTH PHYSICS:

ENVI 7XX (MUSC)	Radiation Protection I (3) (Radioactive Materials and X-ray Radiation)
ENVI 7XX (MUSC)	Radiation Protection II (3) (Radiofrequency, Laser, Infrared, Visible, and Ultraviolet Radiation)
ENVI 7XX (MUSC)	Radiation Instrumentation (3)
ENVI 7XX (MUSC)	Environmental Law (3)

## HEALTH PHYSICS

### ELECTIVES:

ENVI 7XX (MUSC)	Fundamentals of Environmental Management (3)
ENVI 7XX (MUSC)	Fundamentals of Industrial Hygiene (3)
ENVI 7XX (MUSC)	Fundamentals of Health Physics (3)
ENVI 7XX (MUSC)	Nuclear Reactor Operations (3)
ENVI 7XX	Medical Physics (3) (Radiobiology, Radiation Therapy, Nuclear Medicine, and Radioimmunoassay Techniques)
ENVI 7XX (MUSC)	Environmental Radiation (3)
ENVI 7XX (MUSC)	Waste Management and Control Technology (3)
ENVI 7XX (MUSC)	Concepts in Environmental Engineering (3)
ENVI 7XX (MUSC)	Management of Hazardous Waste Sites (3)
ENVI 7XX (MUSC)	Physics of Aerosols (3)

### THESIS, INTERNSHIP, LIBRARY RESEARCH, OR COURSE ELECTIVES:

ENVI 7XX (MUSC/UoC)	Thesis (6)
ENVI 7XX (MUSC/UoC)	Internship (6)
ENVI 7XX (MUSC/UoC)	Library Research (6)
ENVI 7XX (MUSC/UoC)	Course Electives (6)

HEALTH PHYSICS

**PREREQUISITES:**

**Mathematics:**

**One year of college level mathematics.**

**Science:**

**Two courses in biology.  
Two courses in chemistry.**

**Statistics:**

**One course at the 500 level or above.**

## ENVIRONMENTAL HEALTH SCIENCES

### ENVIRONMENTAL MANAGEMENT:

- ENVI 7XX Fundamentals of Environmental Management (3)
- ENVI 7XX Air Pollution and Control Technology (3)
- ENVI 7XX Water Pollution and Control Technology (3)
- ENVI 7XX Waste Management and Control Technology (3)
- ENVI 7XX Environmental Law (3)
- ENVI 7XX Concepts in Environmental Engineering (3)
- ENVI 7XX Management of Hazardous Waste Sites (3)
- ENVI 7XX Environmental Science -- Case Studies (4)  
(Environmental Management)
- ENVI 7XX Capstone Seminar (3)  
(Environmental Management)

### INDUSTRIAL HYGIENE:

- ENVI 7XX Fundamentals of Industrial Hygiene (3)
- ENVI 7XX Industrial Hygiene I (4)  
(Physical Hazards in the Workplace)
- ENVI 7XX Industrial Hygiene II (4)  
(Chemical Hazards in the Workplace)
- ENVI 7XX Industrial Ventilation (4)
- ENVI 7XX Physics of Aerosols (3)
- ENVI 7XX Environmental Science -- Case Studies (4)  
(Industrial Hygiene)
- ENVI 7XX Capstone Seminar (3)  
(Industrial Hygiene)

**HEALTH PHYSICS:**

- ENVI 7XX**            **Fundamentals of Health Physics (3)**
- ENVI 7XX**            **Radiation Protection I (3)**  
**(Radioactive Materials and X-ray Radiation)**
- ENVI 7XX**            **Radiation Protection II (3)**  
**(Radiofrequency, Laser, Infrared, Visible,  
and Ultraviolet Radiation)**
- ENVI 7XX**            **Radiation Instrumentation (3)**
- ENVI 7XX**            **Nuclear Reactor Operations (3)**
- ENVI 7XX**            **Medical Physics (3)**  
**(Radiobiology, Radiation Therapy, Nuclear  
Medicine, and Radioimmunoassay Techniques)**
- ENVI 7XX**            **Environmental Radiation (3)**
- ENVI 7XX**            **Environmental Science -- Case Studies (4)**  
**(Health Physics)**
- ENVI 7XX**            **Capstone Seminar (3)**  
**(Health Physics)**

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**ENVIRONMENTAL MANAGEMENT:**

**7XX Fundamentals of Environmental Management (3) --** This is an introductory course in basic environmental management concepts. The student will achieve a clear understanding of air pollution, water pollution, and waste management issues. Waste management will include municipal waste, regulated waste, hazardous waste, and radioactive waste. Emphasis is placed on theory, application, waste stream characterization, reprocessing waste, waste minimization strategies, and control technology.

**7XX Air Pollution and Control Technology (3) --** This course provides a basic understanding of air pollution theory, application, modeling, and control technology. Guidelines necessary to comply with the most recent air pollution standards and regulations are discussed. Air pollution control equipment is described to include operation, design principles, cost-effectiveness, and performance record. Emergency response procedures and toxic corridor calculations in the event of a fire, spill, or accidental release of a hazardous material are also presented.

**7XX Water Pollution and Control Technology (3) --** This course provides a basic understanding of water pollution theory, application, groundwater modeling, and control technology. Guidelines necessary to comply with the most recent water pollution standards and regulations are discussed. Water pollution control equipment is described to include operation, design principles, cost-effectiveness, and performance record. Drinking water standards and treatment are also presented.

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**ENVIRONMENTAL MANAGEMENT:**

**7XX Waste Management and Control Technology (3) --** This course provides a basic understanding of waste management theory, application, waste stream characterization, reprocessing waste, waste minimization strategies, and control technology. Guidelines necessary to comply with the most recent waste management standards and regulations to include municipal waste, regulated waste, hazardous waste, and radioactive waste are discussed. Waste management equipment is described to include operation, design principles, cost-effectiveness, and performance record. Proper processing of mixed wastes are also discussed.

**7XX Environmental Law (3) --** This course provides a clear understanding of regulatory policy with application to Title 10CFR, Nuclear Regulatory Commission (NRC), Title 29CFR, Occupational Safety and Health Administration (OSHA), Title 40CFR, Environmental Protection Agency (EPA), and Title 49CFR, Transportation. Emphasis is placed on how standards and regulations are developed, economic impact, cost-benefit analysis, interpretation for enforcement purposes, compliance, and penalties.

**7XX Concepts in Environmental Engineering (3) --** This course addresses the basic engineering concepts required to provide solutions to environmental concerns. The objectives are to expose the student to technological advances in air pollution control technology, water treatment processes, pretreatment procedures for hazardous waste, reprocessing techniques, and waste processing technology. New technologies will be explained which are used to reclaim land contaminated with toxic materials.

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**ENVIRONMENTAL MANAGEMENT:**

**7XX Management of Hazardous Waste Sites (3) -- This course focuses on the requirements necessary for identification of a proper location for a hazardous waste site, design and construction of the necessary facilities to process and store hazardous waste, segregation of hazardous wastes based upon compatibility criteria, and management of an actual operating facility. Existing hazardous waste sites designated for remediation will be studied using risk assessment techniques and the appropriate environmental restoration technology selected.**

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**INDUSTRIAL HYGIENE:**

**7XX Fundamentals of Industrial Hygiene (3) -- This is an introductory course in basic industrial hygiene concepts. The student will achieve a clear understanding of worker protection issues directly associated with occupational safety and health. Physical hazards to include noise, heat stress, cold stress, and ergonomics will be studied. Chemical hazards will focus on health hazards to include carcinogens, reproductive toxins, and specific target organ effects. Radiation hazards will emphasize laser safety and radiofrequency, ultraviolet, and infrared radiation. Biological hazards will focus on communicable diseases and modes of transmission.**

**7XX Industrial Hygiene I (4) -- This course provides an understanding of industrial hygiene principles which will enable the student to recognize, evaluate, and control physical hazards and biological hazards in the workplace. Noise will be studied to include identification of noise sources, measurement techniques and instruments, personal protective equipment, and acoustical engineering design. Students will understand how to manage a hearing conservation program and to prevent hearing loss. Students will focus on the management of heat stress and cold stress. Students will study ergonomic concerns associated with the interface of man and machine. They will learn how to prevent injury from vibration and repetitive motion. Biological hazards will focus on communicable diseases and modes of transmission. Emphasis will be placed on the bloodborne pathogens and infection control procedures. Laboratory exercises will be provided to support the learning objectives.**

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**INDUSTRIAL HYGIENE:**

**7XX Industrial Hygiene II (4) --** This course provides an understanding of industrial hygiene principles which will enable the student to recognize, evaluate, and control chemical hazards in the workplace. Students will study hazardous materials used in the workplace and understand the physical hazards and the health hazards associated with the use of chemicals in the workplace. Students will focus on the management of a hazard communication program with emphasis on performing a hazard determination. Students will be able to implement the necessary control measures such as emergency procedures, engineering controls, administrative controls, and personal protective equipment. Laboratory exercises will be provided to support the learning objectives.

**7XX Industrial Ventilation (4) --** This course provides an understanding of the design of industrial ventilation systems which are used in the workplace to protect employees from airborne contaminants. This course will include hood design, selection of duct sizes and flow rates, balancing of air flow, and fan selection. Students will be able to understand measurement techniques and air flow instruments. Laboratory exercises will be provided to support the learning objectives.

**7XX Physics of Aerosols (3) --** This course provides the student with the aerosol science theory, application, and practice to understand bioaerosols, explosive dusts, air pollution, and sampling equipment design. Students will be able to design protocols for isokinetic stack sampling and perform other sampling schemes. The application of aerosol science theory to industrial hygiene and air pollution control technology is emphasized.

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**HEALTH PHYSICS:**

**7XX Fundamentals of Health Physics (3) -- This is an introductory course in basic health physics concepts. The student will achieve a clear understanding of radiation protection issues directly associated with the handling of radioactive material and X-ray equipment. The focus of this course will be nuclear weapons technology, nuclear power generation, industrial applications, nuclear medicine, radiation therapy, and medical diagnostic radiography.**

**7XX Radiation Protection I (3) -- This course provides an understanding of health physics principles which will enable the student to recognize, evaluate, and control ionizing radiation hazards in the workplace and to the general public. The students will focus on the use of radioactive material in nuclear weapons technology, nuclear power generation, industrial applications, nuclear medicine, and radiation therapy. The students will also focus on the use of X-ray radiation in industrial applications and medical diagnostic radiography. The students will be able to work with radiation detection instruments, radiation dosimetry, airborne release of radioactive materials, and shielding design.**

**7XX Radiation Protection II (3) -- This course provides an understanding of nonionizing radiation principles which will enable the student to recognize, evaluate, and control nonionizing radiation in the workplace and to the general public. The students will focus on the use of radiofrequency, laser, infrared, visible, and ultraviolet radiation. The students will be able to work with radiation detection instruments and be able to implement safety procedures to prevent injury.**

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**HEALTH PHYSICS:**

**7XX Radiation Instrumentation (3) --** This course provides laboratory exercises with radiation detection instruments to assist the student with understanding basic principles of radiation measurement techniques. Students will work with sources of radioactive material, X-ray, radiofrequency, and laser radiation. Exercises using radiation dosimetry will also be provided. This laboratory will support the courses in Radiation Protection I and Radiation Protection II.

**7XX Nuclear Reactor Operations (3) --** This course provides the student with a background in nuclear systems engineering in the generation of steam from a nuclear reactor. The student will become familiar with the operation and maintenance of a nuclear facility. Guidelines necessary to comply with the most recent radiation protection standards and regulations are discussed. The students will be able to work with radiation detection instruments, radiation dosimetry, airborne release of radioactive materials, and shielding design. Emphasis is placed on the management of nuclear facilities from power generation to waste management.

**7XX Medical Physics (3) --** This course provides the student with a background in radiobiology, radiation therapy, nuclear medicine, and radioimmunoassay techniques. Guidelines necessary to comply with the most recent radiation protection standards and regulations are discussed. The students will be able to work with radiation detection instruments, radiation dosimetry, airborne release of radioactive materials, and shielding design. Emphasis is placed on the management of medical treatment facilities from patient exposure techniques to waste management.

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES  
COURSE DESCRIPTIONS

**HEALTH PHYSICS:**

**7XX Environmental Radiation (3) -- This course provides the student with a background in radioactive waste management. Radioactive waste issues from disposal of low level radioactive waste in landfill operations to permanent disposal of high level radioactive waste are discussed. Management of radioactive waste treatment, storage, and disposal sites to include incineration, short-term and long-term storage, and disposal in a landfill is presented. Issues associated with surface and groundwater contamination are addressed with emphasis on public awareness issues.**

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