# Final Progress Report

## NIOSH Training Grant No. T01-CCT910442
## Occupational Health
## Graduate Training Program
## 7/1/95 - 6/30/00

San Diego State University
College of Health & Human Services
Graduate School of Public Health
Division of Occupational and Environmental Health
San Diego, CA 92182-4162

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# ABSTRACT

The purpose of this program is to continue training graduates with a Master's of Science degree in Industrial Hygiene Concentration.

The program of study includes 42 semester units of graduate work including 6 units of core courses in epidemiology and biostatistics, 20 units of specialization courses in industrial hygiene and 16 units of electives, field training, research methods, and an original master's thesis.

This application requests financial support for trainee stipend and fees, partial summer and partial academic year salary for some of the key faculty who are currently on 9-month appointment. The proposal is also requesting travel support for faculty and trainees, laboratory supplies and portable field equipment.

Students are selected from among applicants who have a B.S. degree in basic sciences and/or have adequate background in biological, chemical, and physical sciences. Additional criteria for admission are a GPA of ≥3.0 and GRE ≥1000 in verbal and quantitative (≥550) aspects. While applicants with B.S. degree in biological sciences are considered the most fit for the program, highly qualified graduates in chemistry, physics, and engineering will also be accepted providing they complete courses in biological sciences including human anatomy and physiology.

The NIOSH Trainees are then selected from amongst the most highly qualified pool of applicants who have either been awarded "classified" admission to, or have been determined qualified to enter, the industrial hygiene program. These applicants should also be eligible for financial assistance and provide a written agreement to enroll full-time until graduation.

Owing to the rigorous class, laboratory and field training exercised in this program during the past 15 years, graduates of this program have been able to find immediate employment as practicing industrial hygienists, not only in Southern California region but also throughout the entire nation.

The training is taking place within the Division of Occupational and Environmental Health, Graduate School of Public Health, San Diego State University. The training facility, i.e., Graduate School of Public Health, has several laboratories for student training and student/faculty research. The laboratories are equipped with modern necessary facilities, as well as major analytical equipment. State-of-the-art computer facilities at the school, as well as the University computer center, are feasibly available to the students. With extended hours and abundance of computers, each student would have access to a computer station at anytime and for any length of time. Access to Internet, libraries, medline, and other data banks is readily available to the students.

# SIGNIFICANT FINDINGS IN SUMMARY

## MAJOR ACCOMPLISHMENTS

During the time period covered by this report (7/1/95-6/30/00), 38 students have completed the M.S. degree program in industrial hygiene. Out of this number, 15students were NIOSH trainees (those supported through the NIOSH training grant). All of these graduates have been placed in industrial hygiene positions, mostly in the San Diego area.

During the same reporting period, 5 physicians have completed the MPH program in occupation health. All of these physicians have become involved in occupational medicine practice.

During the report period, the M.P.H. degree in occupational health was phased out due to low enrollment But the Master of Science degree programs in industrial hygiene, toxicology, and environmental health continued to be offered. Currently, the Occupational and Environmental Health Division is offering M.S. and MPH degrees in the following areas:

| | |
|---|---|
| Industrial Hygiene | M.S. |
| Environmental Health | M.S. & MPH |
| Toxicology | M.S. |

During the reporting period, the M.S. program in industrial hygiene was enhanced by expanding the Advanced Industrial Hygiene Course into two new courses both with laboratory components. These new courses are (1) Chemical Agents in the Workplace and (2) Physical and Biological Agents in the Workplace. Also the Principles of Ergonomic course was moved to the list of required specialty core courses. Currently, there are a total of 25 continuing students in the industrial hygiene program. The assistance received from NIOSH has been instrumental in attracting and recruiting highly qualified students as well as in enhancing the quality of graduate training.

A significant addition to the industrial hygiene program was construction of a walk-in environmental chamber through a grant from the Department of Defense. The chamber has been extensively used for the industrial hygiene students thesis research projects.

The OEH faculty has also been active in the areas of research and continuing education of the professional community. Behzad Samimi, MSPH, Ph.D., CIH, has been involved in several research activities including completion of several research projects such as evaluation of assigned protection factors of air-supplied respirators as well as single-use dust masks and half-face respirators under simulated work conditions. Another research accomplishment has been the study of relationship between peak particulate concentrations to incidence of asthmatic symptoms among asthmatic children in Alpine , California by Behzad Samimi and Jenny Quintana. This research grant was funded by the NIH in joint cooperation with the University of California Irvine.

# NARRATIVE

## A. PURPOSE AND PROGRAM CHARACTERISTICS

The purpose of this program is to continue training graduates with M.S. degree in Industrial Hygiene Concentration. The program of study includes 42 semester units of graduate work including 6 units of core courses in epidemiology and biostatistics, 20 units of specialization courses in industrial hygiene, and 16 units of electives, field training, research methods, and an original master thesis.

## B. TRAINING OBJECTIVES AND GOALS

The ultimate goal of this training program has been to train highly skilled industrial hygienists to be responsive to the ongoing demand in the job market for academically-trained industrial hygienists both in government and private sectors and contribute to the promotion of health and safety of our workers by improvement of the working environmental conditions. The specific aims of this program have been to:

- Focus on training leading to the M.S. degree in industrial hygiene and MPH degree in occupational health.
- To enhance the training of industrial hygiene and occupational health by providing selected electives areas such as ergonomics and industrial safety.
- Replace the MPH program with two focuses in industrial hygiene and occupational health with two independent and more extensive graduate programs; i.e., M.S. degree program in industrial hygiene and MPH program in occupational health.
- To focus on the MPH in occupational health toward training physicians and nurses who wish to switch to the areas of occupational medicine and nursing.
- To recruit as many highly qualified NIOSH trainees as possible for the industrial hygiene program through the available stipend provided by the training grant.
- Maintain at least 6 NIOSH trainees in the program at any time.
- Continue to enhance teaching and research quality by further improvement of the laboratory facilities and providing significance in the quality of thesis research projects conducted by industrial hygiene students.

## C. DETAIL REPORT OF TRAINING ACTIVITIES & ACCOMPLISHMENTS

### 1. Background

*Rationale and the Need for Training in Industrial Hygiene:* The continuous demand for academically trained occupational health professionals, particularly industrial hygienists, during

the past two decades has prompted several educational institutions across the country to respond to this on-going demand by developing graduate and undergraduate programs in areas related to occupational health. As a result of the shortage of academically trained industrial hygienists, many industrial hygiene positions are still being filled by individuals without formal academic industrial hygiene training. In addition to fresh college graduates, a great majority of the individuals involved in industrial hygiene or environmental health, while learning on the job, desire to pursue higher academic education in industrial hygiene through part-time enrollment while they continue to work.

In Southern California, despite the existence of other graduate occupational health training programs at U.C. Irvine and UCLA, there is clear evidence of persisting regional and national demands for industrial hygienists and other occupational health professionals. More rigorous occupational safety and health regulations enforced by the California Safety and Health Administration (CAL OSHA), have forced industries to seek technical industrial hygiene assistance in order to bring their occupational and environmental conditions to compliance. The demand in San Diego County -- which has been experiencing a rapid growth during the past 15 years -- has been to the extent that all of our graduates (many prior to completing their thesis) and part-time students have found employment in local industries. At the same time, our school has continually received job opening announcements from industries and/or recruiting firms in San Diego and other areas of California requesting us to introduce our graduates for full-time industrial hygienists, as well as students for assistants or internships. Unfortunately, we have not been able to respond favorably to all of these requests since all of our students and graduates were already involved in work or field training within the County.

Industries/organizations in San Diego where our graduates and graduating students are currently working include NASSCO, General Dynamics, Solar Turbines Inc., U.S. Navy, Hughes Aircraft, Hewlett Packard, Chemtronics, Northern Telecon, ROHR Industries (Currently BF Goodrich), Johnson and Johnson, San Diego County Health Department, University of California in San Diego (UCSD), Hyberitech, CAL OSHA, ISIS Pharmaceuticals, La Jolla Pharmaceuticals San Diego State University (SDSU), Sweetwater Authorities, Escondido Water Utilities, and several other industries and consulting firms. Less than 50% of our graduates have left San Diego to work in their location of choice; their places of employment extend from NIOSH and OSHA to industrial and private consulting firms.

The Graduate School of Public Health (GSPH) at SDSU is in many ways well suited to undertaking the needed training programs in industrial hygiene and occupational health. As one of the largest campuses in the California State University system, SDSU's faculty has acquired an excellent reputation for undergraduate and master's level teaching in basic and applied fields. In the past two decades, emphasis on strengthening research capabilities has resulted in the attraction of more research-oriented faculty, with national and international reputations in their areas of research. For example, the amount of extramural research and training grant funding acquired by the GSPH faculty during 1993 has been near $17 million.

SDSU, is in a unique position to offer students both quality academic training and practical training. In addition, the San Diego's industrial and professional communities have become increasingly concerned about occupational and environmental health issues and enthusiastically

support our efforts in training occupational and environmental health professionals. As is evident from the forthcoming pages, the GSPH has the strength and the resources to successfully conduct such training programs.

*Relevant History and Background:* The GSPH was founded in 1980 within the College of Health and Human Services of the SDSU. The establishment of the GSPH was in response to the growing need, particularly in this part of the country, for professionals in several areas of public health. The GSPH consists of five divisions (Epidemiology and Biostatistics, Maternal and Child Health, Health Services Administration, Health Promotion, and Occupational and Environmental Health). The primary objective of all the GSPH programs is to train graduates to assume professional roles in the field of public health and to assist public health workers to improve their knowledge and skills in technical areas of public health. Located in a large metropolitan area of Southern California, and only a few miles north of the Mexican border, the GSPH continues to identify and be responsive to the needs of the region as well as to the national and international communities. Within three years from the date of its establishment, the GSPH received full accreditation from the National Council on Education in Public Health. Since then, accreditation has been renewed by the Council. The review comments from the accreditation board repeatedly stressed the importance of continuing and strengthening training in areas of occupational health.

The Division of Occupational and Environmental Health (OEH) of GSPH is responsible for occupational health training. Currently, the OEH Division offers a two-year Master of Science (M.S.) degree in three areas of industrial hygiene, environmental health science, and toxicology and a two-year Master of Public Health Degree (MPH) in two specializations of occupational health and environmental health.

In 1985, NIOSH awarded the GSPH a long-term training grant for the exclusive training of industrial hygienists. In 1990 and 1995, the training grant was renewed for the second and third 5-year periods, respectively. We have now completed the 15th year of this training program. The NIOSH support included trainee support in terms of stipend, fees and partial tuition, field and laboratory supplies, partial faculty support, and travel support for faculty and trainees. The NIOSH support has, to a great extent, complemented the University's effort in the growth and development of this training program, and has provided vital support particularly in items where University's available budget had shortcomings (i.e., faculty summer salary, supplies, and faculty travel). In addition to such vital support by NIOSH, which has strengthened the program and has greatly enhanced the quality of training, trainee support by NIOSH has enabled us to recruit highly qualified trainees and maintain them as full-time students for the entire two-year period of the program until graduation.

*Critiques Addressed by NIOSH Special Review Team:* The critique provided by the NIOSH site visit team indicates a high degree of satisfaction of the team members about the quality of training, qualification of faculty, and accomplishments of the program. No major weakness was addressed by the NIOSH team that visited the program in 1995

## 2. Training Program Characteristics

*Program Leadership and Faculty:*

**Program Director: Behzad S. Samimi, M.S.P.H., Ph.D., C.I.H.** has a Ph.D. in industrial hygiene from Tulane University and is a certified industrial hygienist in comprehensive practice. Dr. Samimi is a full professor and head of the Occupational and Environmental Health (OEH) Division of the GSPH. As the Program Director, Dr. Samimi will be responsible for implementation and administration of the program and will have the major role in recruiting, selection, and supervision of the NIOSH Trainees. As the principal industrial hygiene faculty, he will teach in areas of principles of industrial hygiene, exposure assessment to chemical and physical agents, air pollution and industrial ventilation. Dr. Samimi will devote 80% time during the academic year and 100% time during the summer to the NIOSH training grant. The OEH Division Faculty Committee advises the Program Director on all matters related to the Training Program.

**Ann dePeyster, Ph.D.,** is a full professor of occupational and environmental health at the OEH Division of the GSPH, and holds a Ph.D. in toxicology from UC Berkeley. Dr. dePeyster has been teaching in the areas of health risk assessment and toxicology for the past 11 years. These courses are required for the M.S. degree. Dr. dePeyster has also been assisting the industrial hygiene students with their master's theses. As program faculty, Dr. dePeyster will devote 40% time during the academic year and 100% time during one month of each summer for teaching, supervision, and assistance to students' thesis research. Dr. dePeyster has an advisory role to the Program Director through the OEH Division faculty committee for recruiting, selection, training, and supervision of NIOSH trainees.

**Rick Gersberg, Ph.D.,** is a full professor of occupational and environmental health at the OEH Division. During the past seven years, Dr. Gersberg has been teaching courses in areas of hazardous waste management and occupational and environmental health policies to the industrial hygiene students. These courses are required for the M.S. degree. As program faculty, Dr. Gersberg will devote 30% time during the academic year and 100% time during one-half month of each summer for teaching, supervision, and assistance to students' thesis research. Dr. Gersberg has an advisory role to the Program Director through the OEH Division faculty committee for recruiting, selection, training and supervision of NIOSH trainees.

**Jenny Quintana, MPH, Ph.D.,** is the new assistant professor of occupational and environmental health who came to SDSU from the University of British Columbia in Vancouver, Canada. Dr. Quintana is currently teaching in areas of occupational and environmental health including ergonomics. She has devoted 50% of her time teaching and advising students related to this training grant.

**David Ingrum, M.D.,** is board-certified occupational physician and a part-time faculty member of occupational medicine at the OEH Division. He has been teaching the occupational medicine course for the past six years. Dr. Ingrum will devote 20 % time during the academic year and 10% during the summer on the training program.

**Susan Glumach, M.S.,** is specialized in ergonomics and is a practicing professional in this field. Ms. Glumack taught the principles of ergonomic course for the industrial hygiene program during the spring 1994 semester.

**Walter Hayhow, B.S.,** is the instructional assistant at the OEH Division. Mr. Hayhow has a major role in industrial hygiene laboratory and computer training and provides continuous guidance and assistance during the laboratory courses. He plays a major role in assisting industrial hygiene students in their laboratory experiments for their thesis work. Mr. Hayhow will devote 40 % time during the academic year and 30% time during the summer to assisting students in the laboratory.

*Adjunct Faculty:*

**Stephen Harris, Ph.D.,** is a consultant in toxicology and teratology and has contributed significantly to the industrial hygiene and toxicology program by teaching, student thesis advising, joint research, and publications with the Program Director and other program faculty.

**Geraldine Stoval, Ph.D., C.I.H.,** is the Manager of Industrial Hygiene at Solar Turbine Inc. Solar remains to be one of several active internship sites for field training of industrial hygiene students, including the NIOSH trainees. Dr. Stoval has been actively involved in field training of our students since 1991.

**William Hughson, M.D., D.Phil., F.R.C.P.(C), F.C.C.P.,** is board certified in pulmonary and occupational medicine, and is the Director of Occupational Health Center of the University of California San Diego. Dr. Hughson served as a part-time faculty member of the OEH Division from 1987 to 1993. He taught the occupational medicine course in the industrial hygiene program during those years and currently remains active in the program by giving lectures in various program courses and advising in student thesis advising. Dr. Hughson has been a member of the OHTAB since 1985.

**Andrew Bryson, M.S., C.I.H.,** is the Manager of Industrial Hygiene in the San Diego Naval Hospital. He is a highly experienced practicing industrial hygienist. Mr. Bryson has been actively involved in the industrial hygiene program by providing tour and field site presentation to the industrial hygiene classes. Mr. Bryson has been a member of the OHTAB since 1985.

**Michelle Eisenberg, MPH:** Ms. Eisenberg's specialization is in the area of ergonomics and prevention of occupational back injuries. She actively participates in teaching the ergonomics course in OEH Division and is also involved in consulting in ergonomics.

*Faculty Reputation/Strength:*

**Dr. Samimi,** the Program Director, has over 23 years of experience in teaching and research in environmental health science and industrial hygiene at Tulane University, the University of Wisconsin, and SDSU. During his long academic career, he has completed many research projects and is the author of numerous scholarly papers in peer-reviewed industrial and environmental health journals. He has made over 55 peer-reviewed presentations at national and international conferences and symposia. Dr. Samimi has been active in serving on American Industrial Hygiene national committees, i.e., Aerosol Technology and Indoor Environmental Quality. He has served as session arranger and chair of several Technical sessions and round

tables at the American Industrial Hygiene Conference and Exposition. His areas of research are human exposure assessment to toxic chemicals, respiratory protection, and indoor air quality.

**Dr. dePeyster** has taught toxicology and health risk assessment for over 11 years at SDSU. Her recent promotion to the rank of full professor, is an indication of excellent teaching and research accomplishment. In addition to her regular teaching, she has continually assisted the training program director in advising students' thesis research and has been an excellent resource for the industrial hygiene students in important areas of toxicology and health risk assessment.

**Dr. Gersberg** is a highly research-oriented faculty member who, in addition to having excellent teaching records, has been very successful in bringing extramural funding to the OEH Division. Like Dr. dePeyster, he has recently been promoted to full professor rank because of his outstanding academic achievements. Dr. Gersberg is one of the key faculty of the training grant because of (1) being involved in the important area of hazardous wastes handling, disposal and clean-up operations, (2) teaching occupational and environmental health policies, and (3) his valuable assistance in student's thesis research.

Table 1 displays the core and supporting program faculty as well as their specific areas of competence.

**TABLE 1**
**CORE AND SUPPORTING PROGRAM FACULTY**

| NAME | AREA OF COMPETENCY | TEACHING & RESEARCH AREA |
|---|---|---|
| Behzad Samimi | Industrial Hygiene/Ventilation | Exposure Assessment/Air Pollution<br>Prespiratory Protection |
| Ann dePeyster | Toxicology | Risk Assessment/Toxicology |
| Rick Gersberg | Environmental Health | Hazardous Wastes/Occupational Health Policy |
| David Ingrum | Occupational Medicine | Occupational Medicine |
| Louise Hofherr | Epidemiology | Epidemiology |
| Donald Slymen | Epidemiology/biostatistics | Biostatistics |
| Jenny Quintana | Occupational Health/Ergonomics | Ergonomics |
| Michelle Eisenberg | Occupational Health/Ergonomics | Ergonomics |

## 3. Program Plan

The objectives of the training program are to:

- Continue training graduates with M.S. degree in industrial hygiene concentration.
- Continue attracting and recruiting highly qualified graduate students.
- Maintain high quality graduate training in industrial hygiene.

### *A. National/Regional Needs*

The demand for academically trained industrial hygienists has been quite high nationwide and particularly so in California. For example, all of our graduates from the industrial hygiene program, including the NIOSH Trainees, have found immediate employment as industrial

hygienist following graduation. Several students, including NIOSH Trainees currently under the program, have found part-time positions within the San Diego area. The report of the placement of the industrial hygiene program graduates coming up in this report, is a clear indication of the regional and statewide need for academically trained industrial hygienists.

### *B. Unique Core Program Contribution*

*M.S. Degree Program and Curricular Requirements:* The industrial hygiene program M.S. degree consists of 42 units of semester course work plus completion of an original master thesis project.

*Program Content and Course Sequence:*

i) Required Courses: Students in the industrial hygiene M.S. program will complete 26 semester units of required courses in epidemiology, biostatistics, hazardous waste management, ergonomics, toxicology, industrial ventilation, industrial hygiene principles, recognition and evaluation of chemical, physical and biological agents in the workplace.

ii) Prescribed Elective Courses: A minimum of 7 units of course work selected from a total of 9 courses in areas of environmental health, air pollution, risk assessment, occupational medicine, water quality, environmental and occupational health policies, noise assessment and control, occupational health management, and special studies in other topics.

iii) Field Practice Requirement: A minimum of three units of field practice (180 hours) will be required. Students will complete 60 hours of field work per each unit of field practice in a designated internship facility. Each field placement facility is expected to meet the following criteria:

- The internship facility must be involved in a type of work that is directly applicable to or compatible with the trainee's chosen career goals.
- The level of training at the internship facility must be sufficiently challenging and useful for trainee career development as determined by the trainee's faculty advisor. This means that the trainee will be directly involved in significant industrial hygiene activities performed at the facility.
- A qualified member of the internship facility would be named as the field faculty, who will jointly supervise the trainee with the faculty advisor. Frequent contact between the trainee, the field faculty, and the faculty advisor will ensure that satisfactory progress is being made and that the student's time is being properly utilized in field training.
- The internship facility will provide the trainee the opportunity to complete a written exercise. This exercise may vary according to the needs of the facility, but must be reviewed and evaluated by both the field supervisor and faculty advisor. The written exercise will be graded and reviewed with the trainee.

The internship can be completed at any time of the year. During the academic year, students should enroll in PH 650 (3 units). This would mean that the student would be with the internship facility for 180 hours. Students may choose to complete all the (3) units during the same summer or spread the hours over two semesters. Initial contact with the internship

facility will be made by the student's major faculty advisor. An agreement indicating the role of the student, his/her time with the internship facility, and the field site supervisor will be completed prior to the start of the field placement program.

Evaluation of the trainee will be made in writing by the field faculty. The trainee's final grade will be determined in part by this evaluation and in part by the written exercise by the faculty advisor.

iv) Thesis Requirements: PH 797 Research (3) and PH 799A Thesis (3)

v) Other Degree Requirements: For advancement to candidacy for a M.S. degree, a student must meet the following requirements:

- Have graduate standing and must have completed at least 12 semester units of approved public health course work.
- Have a grade point average of at least 3.0 (B).
- Satisfactorily pass a faculty evaluation of the progress he/she is making in their graduate course of study.
- File an official program of study which is approved by the GSPH Graduate Advisor and the Dean of the Graduate Division.
- Have presented a thesis proposal approved by the his/her academic advisor.

### *C. Course Sequence For a Sample Student*

(i) Sample Student's Qualifications:

| | | | |
|---|---|---|---|
| Bachelor of Science Degree: | *Biology* | Date of Admission: | *Fall 1989* |
| Grade Point Average: | *3.5* | Admission Status: | *Classified* |
| Graduate Record Exam: | *1100 (Verbal & Quantitative)* | | |

(ii) Course Work:

**Fall 1995**
PH 601 Epidemiology (3)
PH 602 Biostatistics (3)
PH 635 Occupational Medicine (3)
PH 732 Principles of Industrial hygiene (4)
*Total Units = 13*

**Spring 1996**
PH 638A Principles of Toxicology (3)
PH 734 Noise in the Workplace (3)
PH 737 Industrial Hygiene Methods (4)
PH 735 Industrial Ventilation (3)
*Total Units = 13*

**Fall 1996**
PH 750C Adv. Field Practice in Occup. Health (3)
PH 632 Air Quality (3)
PH 636 Hazardous Waste Management (3)
PH 797 Research (1) (Preparation for Thesis)
*Total Units = 10*

**Spring 1997**
PH 700 Seminar in Health Risk Assess.(3)
PH 799A Thesis (3)
*Total Units = 6*

### *D. Time Devoted to Lectures, Laboratory, and Field Practice*

The time to be spent in formal, required lecture and laboratory courses in the MS Industrial Hygiene Program is equivalent to a minimum of 26 semester units. PH 732, PH 735, and PH 737 each has a laboratory component, so that nearly one-third of the total of units awarded for these courses (4 of 11 units) are for successful completion of laboratory demonstration exercises. A student must spend three hours of laboratory time per week for each laboratory unit awarded, as compared with one hour of lecture per week for each lecture unit. Therefore, the four-unit Advanced Industrial Hygiene course (PH 737) provides two hours of lecture and eight hours of laboratory work. Over the entire 15-week semester, it becomes apparent that a considerable amount of time in the required industrial hygiene courses is devoted to laboratory work during which time students gain familiarity with the variety of sampling and analytical methods and instrumentation used by industrial hygiene professionals. In some courses such as PH 735 (Industrial Ventilation) and PH 737 (Advanced Industrial Hygiene), some of the laboratory assignments may include demonstration or surveys in an actual industrial facility.

Having completed several of the required industrial hygiene courses (i.e., PH 601, PH 602, PH 732, and PH 737), a student becomes qualified to enroll in Field Practice (PH 650). The majority of students devote considerably more time to field practice, than the minimum requirement of 180 hours.

### *E. Nature and Interrelationship of These Educational Approaches*

The sequence of courses, laboratory work, field practice, and thesis project is carefully designed to develop the industrial hygiene students' expertise in both theoretical and applied areas, resulting in a well-rounded professional who is capable of recognition and identification of the problem as well as solving it. Armed with sufficient theoretical and technical background, the student becomes eligible for the real-world internship experience. Typically, the thesis is completed last and is the most challenging part of the program for most students. Not only does it require that the student be able to make careful, valid measurements in an actual occupational environment, it also requires him/her to identify a significant problem, independently design and execute a sampling program, and effectively communicate results and conclusions, both in written form and orally during the thesis defense. In fact, this experience is excellent practice for the industrial hygiene graduate faced with identifying and solving real-world problems in the workplace. The high quality and originality of thesis research work by our students has resulted in acceptance of 3-4 papers per year for presentation at the American Industrial Hygiene Conference and Exposition (AIHC&E), several of which have been published in refereed industrial hygiene journals. These achievements distinguish our graduates in the eyes of potential employers.

## 4. Qualification of Graduates

Graduates of the current M.S. industrial hygiene program have demonstrated their knowledge and skill to recognize and evaluate the potential hazardous elements in the workplace and recommend corrective measures. Graduates without prior work experience who received adequate field training, have been capable of assuming responsibilities as entry-level industrial

hygienists in a variety of industrial settings, insurance companies, governmental institutions, consulting firms, etc., but managed to master the job to the level of working independently within a short period of time. Those graduates having prior work experience, particularly those with excellent academic performance, have been able to assume higher responsibilities with increased competency and knowledge earned through the program. (See Progress Report for Placement of Graduates.)

**5. Integration and Coordination of Departmental Components in the Program**

The academic concentration of industrial hygiene for which NIOSH support has been obtained, constitutes a major component of the OEH training activities. Other concentrations offered in the Division are toxicology, environmental health and occupational health. The toxicology and environmental health concentrations also offer a M.S. degree whereas the occupational health concentration is offered in the format of a MPH degree. The MPH in occupational health is a highly flexible program and has been designed for occupational health workers (i.e., physicians, nurses, and administrators who intend to work in occupational health settings). These students with different backgrounds such as medicine, nursing, business management, health science, etc., will be advised to select appropriate courses to lead them to the desired track.

Although these four programs within the OEH Division are governed by the Division Faculty Committee chaired by the Division Head, each academic program has a faculty coordinator who is responsible for most of the training and research activities in that program.

**6. Occupational Health Training Advisory Board (OHTAB)**

OHTAB is composed of a group of established public health professionals in Southern California with expertise in the practice or administration of industrial hygiene and occupational health. During the past nine years, OHTAB has assisted and/or advised the Program Director in various aspects of the training program such as student recruitment, thesis research, field training of students, etc. One of the primary objectives of consultation with OHTAB is to ensure that the training program activities are consistent with the needs of the industrial hygiene and occupational health community. The members of OHTAB during the reported period were as follows:

- *Andrew L. Bryson, M.S., CIH,* Director, Industrial Hygiene U.S. Naval Hospital, San Diego, California
- *Brian Heramb, M.S., CIH,* Manager, Industrial Hygiene San Diego Gas and Electric, San Diego, California
- *William Hughson, M.D.,* Director, Occupational Health Center, University of California San Diego, California
- Rachel Morishige, Industrial Hygiene Student and NIOSH Trainee
- *Gary Stephany,* Director Environmental Health Services, San Diego County Department of Health Services
- *Behzad Samimi, MSPH, Ph.D., CIH,* Professor and Training Program Director (Chair)

### *A. Guidance, Monitoring, and Evaluation of Trainee's Progress*

*Advising*: Upon entry into the program, students are assigned a faculty advisor from tenured/tenured track faculty within the OEH Division of the GSPH according to interests expressed in the trainee's admissions application. Students are free to change faculty program advisors and also may consult with any of the faculty for assistance with a particular program, even though at any given time a single faculty member is viewed as a trainee's primary resource person and is ultimately responsible for guiding the trainee's progress toward completion of the academy program. The University Graduate Bulletin, which details all university policies pertaining to students and the requirements for all SDSU programs, serves as the primary written guide for both the student and the faculty advisor. This document is updated and issued annually.

Whether or not a student claims to be familiar with SDSU policies and requirements, frequent meetings between the student and faculty advisor are encouraged. Throughout the first year of a student's program, the faculty advisor can help him or her by making certain that school-wide and divisional course requirements for the degree program are being satisfactorily met; recommending a coherent, sensible overall program of study, including planning for course electives and for the field placement experience; and suggesting possible areas for thesis research and encouraging the student to explore potential research topics compatible with his/her own interests.

After the student has completed a minimum of 12 units of graduate level requirements, the student and faculty advisor finalize the student's Official Program, which is the official accounting of courses completed, grades achieved, and units the student intends to complete to fulfill the minimum of 42 units required for the M.S. degree. At this time, the student must have a minimum average GPA in all graduate level courses of 3.0 (A = 4.0, B = 3.0, etc.). The Official Program is signed by the faculty advisor and the GSPH Graduate Advisor and submitted to the SDSU Graduate Division for approval. The Official Program becomes a contract between the student and the University. Although changes in the Official Program can be authorized, this document does serve to guide the student throughout the remainder of his/her program.

The student is advanced to candidacy once the student has solidified the research idea for his/her thesis with the help of the faculty advisor and has submitted a thesis proposal. Other responsibilities of the faculty advisor in this regard are: (1) suggesting other appropriate thesis committee members, and (2) facilitating the completion of the thesis project by arranging for the necessary laboratory space, equipment, and supplies and helping with problem solving throughout the time the thesis research is taking place.

*Monitoring and Evaluation of Trainees:* As described in the Advising section, the student's progress and performance are primarily facilitated by his/her own individual faculty advisor and by the Graduate Advisor. At the end of each semester in which a student is enrolled, a report of courses taken showing units and grades earned is sent to the student. Grades and points per unit used in reporting at SDSU are as follows:

(i) Grade Courses:

| | | | |
|---|---|---|---|
| A | Outstanding achievement, 4 points | D | Minimally passing, 1 point |
| B | Praiseworthy performance, definitely above average, 3 points | F | Failing, 0 points |
| | | I | Incomplete, authorized incomplete |
| C | Average, awarded for satisfactory performance, 2 points | U | Unauthorized incomplete, a "F" in GPA calculation |

A plus/minus grading system is also used at the discretion of individual instructors. In these cases, decimal values of plus and/or minus grades for grade courses are used in the calculation of GPA. A University review board exists to arbitrate any grade-related matters that cannot be worked out between a student and the course instructor.

(ii) Credit/Non Credit Courses: At the GSPH only field practice, research, thesis, and special study courses are credit/non-credit.

| | |
|---|---|
| SP | Satisfactory progress, not counted in GPA |
| W | Withdrawal, not counted in GPA |
| Cr | Credit, signifying units earned, but not counted in GPA |
| NC | No credit, no credit earned and not counted in GPA |

All activities for which the student receives academic unit credit toward the degree are evaluated on the basis of the above grading system.

### *B. Evaluation of Training Faculty by the Students*

At the end of each semester, trainees are given the opportunity to submit their own evaluations of course content and instruction in the GSPH. Course evaluations are designed to preserve anonymity so that candid opinions are obtained. The course evaluation form solicits information about the following specific aspects of a course and its instructor:

- ❒ How many hours per week were spent on class outside formal class periods?
- ❒ Were course objectives made clear?
- ❒ Were procedures for evaluation made clear?
- ❒ Were teaching methods appropriate to content and objectives?
- ❒ Was course content up-to-date?
- ❒ Were resources provided useful?
- ❒ Were tests congruent with course content and objectives?
- ❒ Were objectives met; and was course worthwhile?
- ❒ Was instructor knowledgeable and prepared to lead class activities?
- ❒ Was instructor professional and understanding?
- ❒ Did instructor encourage interaction and display a manner that facilitated student learning?

The student's possible score for each question is 1 (hardly agree) to 5 (very strongly agree). Course evaluations are compiled by GSPH clerical staff and additional written comments offered by a student are transcribed to preserve anonymity. This information is passed on to the instructor, and copies of student evaluations are placed in the instructor's personnel file for review by others responsible for judging faculty performance.

The GSPH also has developed an alumni questionnaire which evaluates the usefulness of the education and training received. This questionnaire solicits specific comments primarily on the usefulness of coursework to the graduate's present job and asks for a more general evaluation of how successful the GSPH was in meeting the needs of its students.

### *C. Interdisciplinary Interactions*

The structure of the industrial hygiene graduate program requires the NIOSH Trainees, as well as the other graduate students, to experience interdisciplinary interactions in the areas of environmental toxicology, environmental health (including hazardous wastes management, environmental risk assessment and water quality investigations), epidemiology biostatistics and computer applications. The focus of the student's Masters thesis determines the extent of his/her interdisciplinary interactions.

## 7. Trainee Candidates

### *A. Admission Criteria and Procedures*

Potential candidates applying to the GSPH for a MPH degree or for the M.S. in Public Health must meet several admission requirements. There are actually three sets of requirements: those for the University Graduate Division; those for the GSPH; and those for the Division of Occupational and Environmental Health.

(i) University Requirements: All applicants for any type of post baccalaureate study at SDSU must:

- Hold an acceptable baccalaureate degree from an institution accredited by a regional accrediting association or have completed equivalent academic preparation as determined by the Dean of the Graduate Division (proof of previous work must be submitted in the form of official transcripts for all undergraduate work attempted).
- Have attained a grade point average of at least 2.75 (when A equals 4) in the last 60 semester (90 quarter) units attempted.
- Have been in good standing at the last college attended.

Foreign students whose first language is not English, must also submit proof of passing the Test of English as a Foreign Language (TOEFL) with a score of 550 or more.

The University has several Admission Categories and all students applying to the Graduate School of Public Health must be in either (1) Graduate Standing (Classified) or (2) Conditional Graduate Standing (Classified). Applicants admitted to Graduate Standing (Classified) must meet all of the above requirements, and:

- Achieve a satisfactory score (it is understood that a combined verbal and quantitative score must not be less than 1000) on the GRE General (Aptitude) Test. (Students holding an advanced degree from an institution that is a member of the Council of Graduate Schools are exempted from this requirement.)
- Have completed an undergraduate major appropriate to the field in which the student desires to earn an advanced degree.

- Satisfy the special school or college requirements detailed below.
- Meet the professional, personal, and scholastic standards for graduate study established by the Department and the Graduate Council.

Students admitted with Graduate Standing (Classified) are admitted to authorized advanced degree curricula and may enroll in 600- and 700-numbered courses. Such admission does not imply that a student will be advanced to candidacy for an advanced degree.

Students admitted to Conditional Graduate Standing (Classified) have deficiencies in the criteria required for Graduate Standing (Classified), but meet the general University admission requirements described above. It is assumed that these deficiencies can be met by specific additional preparation, including qualifying examinations. Not more than 15 semester units may be assigned to satisfy undergraduate deficiencies in the major and all course conditions must be met within five semesters for the time of initial enrollment. Students admitted with Conditional Graduate Standing (Classified) are admitted to authorized advanced degree curricula and may enroll in 600- and 700-numbered courses. Once the conditions established by the school or college have been met, the student will be accorded full Graduate Standing (Classified).

(ii) GSPH Requirements: In addition to satisfying the requirements for admission to the University for either Graduate Standing (Classified) or Conditional Graduate Standing (Classified) described above, the student seeking admission to the GSPH must:

- Fill out a GSPH application form (two pages).
- Submit a narrative statement as described in the instructions for applicants (variable length).
- Submit three letters of recommendation.
- Present additional evidence of promise of success in academic and professional activities.
- Document competence or prior academic preparation in the biological sciences, social sciences, and quantitative methods.

The competence in quantitative methods must be documented in one of two ways or the student will be required to take an appropriate undergraduate course in statistics before he/she can enroll in PH 602 (Biostatistics). One way to document competence is to pass a qualifying examination given before the start of each semester in general statistical knowledge (student must score 70% or better). Another way to demonstrate competence is to show proof (official transcript) of courses in the three years prior to the student's application to the GSPH. If the course was taken more than three years ago, the student may be required to take and pass the qualifying examination.

(iii) Division of Occupational and Environmental Health Requirements: Students applying for graduate training in the concentration in Industrial Hygiene must meet all of the above university and school requirements and, in addition:

- Have strong undergraduate training in the sciences or engineering.
- Have substantially better GRE score than the minimum required by the University (prefer a minimum combined score between 1100 and 1200).

- Pass a comprehensive credential review by all full-time faculty members in the division and be recommended for admission.

A personal interview is also desired when feasible.

### *B. Recruitment of Students*

Recruitment for qualified students regularly consists of the following activities:

- ❒ Preparation of posters announcing the availability of the M.S. program in industrial hygiene and availability of federal assistance (NIOSH traineeship) to qualified trainees.
- ❒ Mailing information packages to safety and health professionals in industries and professional organizations in California.
- ❒ Inclusion of curriculum description in the NIOSH Catalog of Higher Education.
- ❒ Personal contact by faculty and "word of mouth" by satisfied students.
- ❒ Posters on all SDSU bulletin boards, particularly undergraduate natural science, engineering, health science, and nursing schools.
- ❒ Advertising in occupational health and safety professional journals such as American Industrial Hygiene Association Journal, Occupation Health and Safety Journal, etc.

The Program Director will be responsible for responding to inquiries about the program, provide sufficient information to potential trainees, and review the applicants' qualifications for admission purpose.

### *C. Selection of NIOSH Trainees*

NIOSH Trainees are selected from the most highly qualified applicants admitted to "classified" standing and applying for traineeship. Applicants for NIOSH Traineeship must fill out a two-page application form. The criteria used in selection of NIOSH trainees from a pool of applicants are:

- ❒ Admission to GSPH and M.S. degree in Industrial Hygiene with Classified Standing.
- ❒ Undergraduate background (i.e., B.S. in biology, chemistry, physics, chemical or mechanical engineering, etc.).
- ❒ Grade point average of 3.0 or better in overall courses as well as in basic science courses of undergraduate study.
- ❒ GRE scores in quantitative and verbal aspects.
- ❒ Other evidence of success and motivation in the graduate program by personal interview with faculty.
- ❒ Promise of remaining as full-time student until graduation.

The NIOSH Trainees are selected by the Special OEH Division Committee consisting of four faculty members. The selected trainees should sign a contract agreement with the GSPH to comply with specific rules regarding NIOSH Trainees.

### *D. Sources of Students*

Enrollment data from the past 15 years indicate that the majority of students entering the OEH Division programs come from jobs in government, industry, and local private health care facilities (i.e., hospitals and clinical or biomedical research laboratories). Many of these individuals need an advanced degree for career development, but must continue to work at least part-time to support themselves and their graduate studies. Another very promising source of highly qualified, potential OEH trainees is the recent graduates from basic sciences, engineering, and nursing programs in Southern California and elsewhere. This source has remained relatively untapped so far, due to the lack of financial resources of this particular group coupled with our inability to offer significant financial aid. Clearly, the ability to offer traineeship stipends and improved training programs will result in attracting even more of these academically qualified, yet financially needy, students to our program. The more financial aid that becomes available through traineeship support, the more part-time students able to change to full-time status.

The sources described above would be expected to provide us with the majority of our most qualified NIOSH trainees in the future. In addition, two other sources of students help to strengthen and diversify OEH program enrollment, even though these students would generally be less likely to need traineeship assistance since they often already have outside support. The U.S. Navy has been a strong advocate of the OEH Division and the source of a significant number of students, particularly in areas of industrial hygiene.

### *E. Student Enrollment:*

The enrollment data for the Industrial hygiene specialization during the reported period are given in Table 2. Crossovers between the various specializations in OEH can and do occur after a student enters the OEH division and has had an opportunity to become acquainted with the faculty and program offerings. As can be seen in Table 2, the number of applicants, as well as student enrollment, has been quite steady since 1995. The number of selected NIOSH Trainees has been dependent upon the budget availability. There is no doubt that support provided by NIOSH during the past 15 years has not only directly supported the NIOSH Trainees, but has also indirectly benefited the other students in the program in several ways; i.e., enhancement of laboratory and field training, conducting thesis research projects, and advising and field training possible during the summer months.

**TABLE 2**
**ENROLLMENT DATA FOR INDUSTRIAL HYGIENE**

| ACADEMIC YEAR | NUMBER OF APPLICANTS | | NUMBER OF STUDENTS ADMITTED | | TOTAL STUDENTS IN THE PROGRAM | | |
|---|---|---|---|---|---|---|---|
| | Total | NIOSH Trainees | Total | NIOSH Trainees | Total | NIOSH Trainees | FT/PT Ratio |
| 1995-1996 | 17 | 14 | 10 | 3 | 36 | 6 | 1.40 |
| 1996-1997 | 18 | 11 | 11 | 3 | 39 | 6 | 1.50 |
| 1997-1998 | 19 | 7 | 12 | 3 | 40 | 6 | 1.48 |
| 1998-1999 | 16 | 10 | 9 | 3 | 38 | 6 | 1.31 |
| 1999-2000 | 15 | 5 | 10 | 3 | 37 | 6 | 1.30 |

**TOTAL NUMBER OF STUDENTS ADMITED: 52**

Total No. of Students Admitted = 52

Total No. of Recruited NIOSH Trainees: 15

Equivalent NIOSH Trainees x Year = 30

## D. TRAINING FACILITIES AND RESOURCES

### 1. Office and Classroom Space

The GSPH occupies 3,375 $ft^2$ of office space in the Hardy Memorial Tower building on the SDSU campus. At the present time, faculty have individual offices so that students can receive personalized attention from faculty with minimal distraction during the advising sessions. Classroom space allotted to the GSPH totals approximately 3,950 $ft^2$ in addition to the office space stated above.

### 2. Laboratory Facilities

There is over 3,000 $ft^2$ of GSPH laboratory space located on the first and second and third floors above the main group of faculty offices in Hardy Tower. These labs can be used by all students and faculty in the GSPH; however, the laboratories are used essentially only by the Divisions of Occupational and Environmental Health. These laboratories are primarily student laboratories, used for teaching and student thesis research. Faculty research is a secondary use, with some faculty also conducting research in-field laboratories off campus. Another 400 $ft^2$ of wet lab is under construction on the Mezzanine Floor of Hardy Tower building. This lab will be ready for use in the next academic year

Current laboratory space consists of three large, teaching and research laboratories, each with associated smaller prep rooms. Completely renovated in 1984 and in also 1992, these labs contain safety hoods, equipment, and instruments that enable graduate students to complete thesis research in industrial hygiene and related areas of toxicology, environmental pollution, and

hazardous waste remediation. Through the University's generous budget for new and replaced equipment, we have been able to equip the new teaching laboratory HT-10) in Hardy Tower building with several major analytical equipment (two gas chromatographs, GC/MS, Graphite Furnace AA Spectrophotometer, 2nd. Cahn Electrobalance, scintillation counter, etc., and no longer need to use the other university departments laboratories.

In addition to the main GSPH laboratories, there is a computer laboratory in Hardy Tower equipped with personal computers, printers, and remote terminals that can be used by students to connect to the Internet. These terminals can also access the University Computer Center, the Love Library and the other major libraries to the area for availability of research articles and inter-library loan.

The GSPH also has a small animal room and a separate room that houses an inhalation chamber frequently used by the industrial hygiene students. A conference room is also available in Hardy Tower, which is shared with the School of Nursing.

### 3. Library Holdings and Services

SDSU's Love Library holds a large collection of primary journals, reference collections, basic monograph, and book collections to support the industrial hygiene program and related specialty areas. The SDSU library currently holds over 900 different serial titles and over 40,000 books in these relevant areas.

Another important library resource for the public health program is the SDSU Government Publications Library, particularly since the library is a repository for state and federal government publications. In addition to an extensive microfilm collection, the SDSU Government Publications Library has a total of over 12,000 linear feet of government documents. Publications issued by the EPA, NIOSH, OSHA, the FDA, and the Department of Health and Human Services are part of this large collection. Many of these publications are also available for downloading through the Internet, a readily available and free service to the students. Cooperative efforts among San Diego area libraries provide additional support in medical sciences literature. SDSU faculty members have borrowing privileges at the University of California, San Diego Biomedical Library and SDSU students may also use materials within that library. The Southern California Occupational Health Center Library at the University of California, Irvine is available also to SDSU faculty and students.

A librarian specializing in public health is available at SDSU to acquaint students with research literature and the use of specialized reference tools. Students may request computer searches of the National Library of Medicine MEDLARS, Excerpta Medica, Medline, Toxline, and other data bases. The Interlibrary Loan Department can obtain virtually any article or monograph published from other cooperating libraries throughout the country, often free of charge.

### 4. Access to Occupational Settings

All industrial hygiene graduate students in the M.S. program must complete a field practice experience as a degree requirement. As predicted, while enrollment in the industrial hygiene

program grew over the first 5 years of the program and has remained steady since then, opportunities for students to complete internships locally in suitable occupational settings have increased dramatically as the San Diego area has grown tremendously and attracted numerous new industries. These industries provide great potential for exposure to a variety of industrial operations and problems. Off-campus facilities that have been used by the OEH Division/Training Program for field training of industrial hygiene students are:

a) San Diego County Department of Health Services--Hazardous Waste Section of Environmental Health Protection.
b) Various U.S. Navy facilities including Naval Ocean Systems Center (NOSC), Naval Training Center, Naval Hospital and North Island facilities in San Diego.
c) Science Applications International Corporation, San Diego.
d) Public Health Service--COSTEP Program (NIOSH).
e) National Steel and Shipbuilding Company, San Diego.
f) ROHR Industries Incorporated, Chula Vista.
g) ISIS Pharmaceuticals, San Diego.
h) U.S. Air, San Diego
i) General Dynamics, Convair Division, San Diego.
j) General Dynamics, Space Division, San Diego.
k) Solar Turbines Incorporated, San Diego.
l) Hughes Aircraft, Carlsbad (San Diego County).
m) Chemtronics, San Diego.
n) Hewlett Packard, San Diego.
o) Hyberitech, San Diego
p) CAL OSHA, San Diego.
q) Hartford Insurance Company, San Diego.
r) Industrial Indemnity Insurance Company, San Diego.
s) Med Tox Company
t) San Diego Zoo, San Diego.
u) Unocal, Los Angeles
v) Several industries in Los Angeles area (i.e., Rockwell International, etc.).

Many students have received offers of full-time employment where they completed their internships. In fact, a good majority of students find employment at the internship site where they received field training as a student intern. Examples of these places are U.S. Navy facilities, San Diego County Department of Health Services, UCSD, ISIS, Hewlett Packard, General Dynamics, LaJolla Pharmaceuticals, San Diego Water Utilities and many other places. There continues to be excellent opportunities both for student internship and future employment in San Diego County, as well as other parts of Southern California, for our students and future graduates.

## 5. Training Record and Graduate Placement

The training activities within the OEH Division during the past 5 years included training graduates in the areas of environmental health, industrial hygiene, toxicology, and occupational

health. The NIOSH training grant has partially supported a significant part of the activities related to the training of industrial hygienists. Table 3 shows placement of graduates from industrial hygiene program during the past five years.

**TABLE 3.**
**PLACEMENT OF GRADUATES**

| | GRADUATE | EMPLOYER | CITY/STATE | NIOSH TRAINEE? |
|---|---|---|---|---|
| 1 | Lee Wilmon | La Jolla Pharmaceuticals | San Diego, CA | Yes |
| 2 | Alec Wong | US Navy, China Lake | San Diego/CA | Yes |
| 3 | Robert Spretter | Veterans Hospital | San Diego, CA | No |
| 4 | Jim Breay | Us Navy | San Diego/CA | No |
| 5 | Vilmarie Rodriguez | Ligand Pharmaceuticals | San Diego, CA | No |
| 6 | Linda Brenner | Dura Pharmaceuticals | San Diego/CA | Yes |
| 7 | David Burcin | Occupational Services | San Diego/CA | Yes |
| 8 | Erica Organ | Romic Environmental | Palo Alto, CA | Yes |
| 9 | Jyotika Muni | Applied Materials | San Francisco, CA | Yes |
| 10 | Jennifer Kelly | Sony Electronics | San Diego, CA | No |
| 11 | David Ferguson | Signet Armolite, Inc. | San Marcos, CA | No |
| 12 | Melody Dias | General Atomic | San Diego, CA | Yes |
| 13 | Debra Colarusso | ISIS Pharmaceuticals | Carlsbad, CA | Yes |
| 14 | Joshua Bliss | Occupational Services | San Diego/CA | Yes |
| 15 | Michelle Eisenberg | Ergonomics Evaluations | San Diego, CA | No |
| 16 | Susan Otten | SD Department of Health | San Diego/CA | No |
| 17 | Gary Cheeley | US Navy | San Diego, CA | No |
| 18 | Withney Fae Long | US Navy | Groton, CT | No |
| 19 | Kyle Hopf | San Diego Union/Tribune | San Diego/CA | No |
| 20 | Paul Carter | U.S. Navy | San Diego/CA | No |
| 21 | Mark Katz | San Diego Gas and Electric | San Diego, CA | Yes |
| 22 | Fredrich Berger | CAL OSHA | San Diego, CA | No |
| 23 | Bruce Hanna | NASSCO | National City, CA | No |
| 24 | Efrem Neuwirth | Admitted to Ph.D. Program | UC Irvine, CA | No |
| 25 | Raymond Welch | Hawaii Dept. of Health | Honolulu, HW | Yes |
| 26 | Todd Nguyen | US Filters | Phoenix, AZ | No |
| 27 | Ronald Teagarden | University of Arizona | Phoenix, AZ | Yes |
| 28 | Zulfiguar Chaudhry | NIOSH | Cincinatti, OH | Yes |
| 29 | Mark Fitzmaurice | County Health Department | San Diego/CA | No |
| 30 | Kirk Meeken | Los Alamos National Lab. | Los Alamos, NM | No |
| 31 | Mimi Thaung | ISIS Pharmaceuticals | Carlsbad, CA | Yes |
| 32 | Mark Thompson | Johnson and Johnson | San Diego/CA | No |
| 33 | Deborah Wolfe-Lopez | San Diego Gas and Electric | San Diego/CA | No |

**Total No. of IH Program Graduates (1996-2000): 33**

**Total number of NIOSH Trainees Graduates (1996-2000): 14**

It should be emphasized that due to the continuous demand for industrial hygienists in the San Diego area, most of our students have been able to find part-time, entry level jobs after completion of the first year of academic program.

During the past 15 years of the training grant, as reflected in the past and the current progress reports, program faculty and trainees have regularly presented 2 to 4 papers per year at AIHC&E conferences. Such research and scholarly activities are vital to the program for enhancement of the training of students as well as professional development of the faculty.

## E. Advancement of the Industrial Hygiene Graduate Program Through NIOSH Support

### 1. Personnel

The GSPH faculty, including the Division Heads, have academic year (9 month) appointments with no summer salary except for those who hold substantial university administrative responsibilities. This training grant has provided partial summer and academic year salary for the program faculty. This support has made the following activities possible throughout the summer, as well as extended hours during the academic year:

- ❒ Supervision of students at the field training sites.
- ❒ Advising and supervision of students' research work including master thesis projects.
- ❒ Review of incoming applications and interview with applicants for student/trainee recruitment.
- ❒ Student and trainee attendance in local professional activities.

Achievements of the training objectives, i.e., extra effort placed on the field and laboratory training of the students, student recruitment, assisting students in their special studies, research and thesis projects, and advancement to graduation would not have been possible without NIOSH support.

### 2. Equipment and Supplies

During this reporting project (1996-2000), due to reduction in the amount of NIOSH award, no budget was available for purchase of field sampling equipment; however, several portable field monitoring instruments that were purchased through the NIOSH grant award in the previous years, are still in use both in the field and laboratory training of the students.

NIOSH funding was used to provide additional laboratory and field supplies needed for training of students. Some NIOSH trainees also received support for purchase of sampling materials and chemicals needed for their thesis projects. In summary, NIOSH support has been instrumental in enhancing the training of industrial hygiene students during the past period of the training grant.

### 3. Faculty Travel

The School has limited budget for faculty travel which is primarily given to the faculty attending the Annual American Public Health Association Conference. As a result, during the reporting period, no travel support was available for attending other professional conferences. The NIOSH training grant has been the only support for program faculty to participate in professional conferences and deliver papers. During the reported period, six faculty trips to professional conferences and nine presentations have been made possible through NIOSH support.

### 4. NIOSH Trainee Travel and Paper Presentation

During the reporting period, the following NIOSH trainees attended the American Industrial Hygiene Conference and Exhposition from 1996 through 2000.

| | | |
|---|---|---|
| *Alec Wong** | *Brian Boynten* | *Alvin Viray* |
| *Zulfigar Chaudhry* | *Jyotika Muni** | *Mark Katz* |
| *Raymond Welch** | *Cristina Kwong* | *Kristen Konar* |
| *Rachel Morishige* | *Linda Brenner** | |

* NIOSH Trainees who have had accepted papers at AIHC&E

The titles of these papers have been stated in the programs reports submitted each year.

## 5.0 Publications/Presentation/Abstracts by the Program Faculty and the Students

### 5.1 Presentations/Abstracts

- Samimi, B. and G. Hom* (1995). A comparison of the Andersen N-6 bio-aerosol sampler with the gravity settling plate for sampling airborne fungi under field and chamber conditions. AIHC&E, Kansas City, MO, May 20-26, 1995.

- Samimi, B. and C. Wing** (1995). A comparison of Assay Technology Organic Vapor Diffuser Monitor, #546 with NIOSH method #1500 for sampling N-octane under controlled laboratory conditions. AIHC&E, Kansas City, MO, May 20-26, 1995.

- Samimi, B. Comparison of Assay Technology Organic Monitor "546" With NIOSH Method 1500 for Sampling Octane Under Controlled Laboratory Conditions. Proceedings of the American Industrial Hygiene Conference & Exposition. Kansas City Kansas. May 1995.

- Samimi, B. M. Dias**: "Assessment of Rate of Formaldehyde Emission from Wood Products Used in California Homes Under Normal and Extreme (High End) Environmental Conditions. The Proceedings of the American Industrial Hygiene Conference & Exposition, Washington, DC, May 1996.

- Samimi, B. :"Prevalence of *Aspergillus versicolor* in Commercial and Residential Buildings With a History of Water Intrusion". Proceedings of the American Industrial Hygiene Conference and Exposition, Dallas, Texas, May 1997.

- Samimi, B. , R. Teagarden** and W. Hayhow: "Evaluation of Abrasive Blasting Helmets Under Simulated Under Simulated Work Conditions". Proceedings of the Ninth International Conference on Occupational Respiratory Diseases, Kyoto, Japan, September 1997.

- Samimi, B. and E. Organ**: "Comparison of Collection Efficiency of Anderson Single-Stage Viable Sampler (N-6) and Two-Stage Viable Sampler for Sampling Airborne *Aspergillus niger* Under Controlled Chamber Conditions". Proceedings of the American Industrial Hygiene Conference and Exposition, Atlanta, Georgia, May 1998.

- Samimi, B. and T. Nguyen*: "Indoor Air Quality in Sweatshops : Assessment of Human Exposure to Formaldehyde Resulting from the Use of Cross-Linking Agents in Textiles". Proceedings of the American Industrial Hygiene Conference and Exposition, Atlanta, Georgia, May 1998.

- Samimi, B. and J. Kelly*: "Temporary Threshold Shift (TTS) in Divers Resulting from the Use of Noisy Underwater Tools". Proceedings of the American Industrial Hygiene Conference and Exposition, Atlanta, Georgia, May 1998.

- Samimi, B. and A Wong**: "Work Protection Factor of Clemco Appolo 60 Abrasive Blasting Helmet Under Actual Abrasive Blasting Conditions. Proceedings of the American Industrial Hygiene Conference and Exposition, Toronto, Canada, June 1999.

- Samimi, B. , Quintana, J., Kleinman, M. and Delfino, R.: "Performance of Personal Data RAM in Passive and Active Modes with and without Inlet Heater Under High Relative Humidity." Proceedings of the American Industrial Hygiene Conference and Exposition, Orlando, Florida. May 2000.

- Samimi, B. and Welch**, R.: "Assigned Protection Factors of Single-Use Dust Masks Under Simulated Work Conditions". Proceedings of the American Industrial Hygiene Conference and Exposition, Orlando, Florida. May 2000

- Breay*, J, Samimi, B. and Quintana, J.: " Comparison of the DORR Oliver 10-mm Nylon Cyclone with the SKC Aluminum Cyclone for Collecting Silica-Containing Dust." Proceedings of the American Industrial Hygiene Conference and Exposition, Orlando, Florida. May 2000.

**** NIOSH Trainees; * Other IH Students**

### 5.2 Book Chapter

- Samimi, B. (1995). The environmental evaluation: Commercial and home. Occupational medicine: State-of-the-art reviews (pp 95-118). Hanley & Belfus, Inc.

## F. CONCLUSION

By the end of the reported period (6/31/2000), the number of NIOSH-supported graduates of the industrial hygiene program, since the beginning of the training program in 1985, reached a total of 52. For the reporting period from 7/1/96 – 6/31/2000, the Industrial hygiene MS degree program admitted 52 students and had 36 graduates (Graduates/Admitted = 0.7). Th number of graduated NIOSH Trainees for this period was 14 versus a total of 15 admitted (Gradates/Admitted =0.93). The reason for the difference in the ratio of "graduates/admitted" between the total students and the NIOSH Trainees is that all NIOSH Trainees are full time so they would graduate in shorter period (mostly within 4 -5 semesters) whereas almost 50% of the other students are part-time and take longer time to graduate.

In addition to the NIOSH Trainees, the other students in the industrial hygiene program, who constituted the majority, have also indirectly benefited form the NIOSH support because of enhancement of curriculum, laboratory and field training, and the availability of faculty during the summer period and winter break. The NIOSH support assisted us in achieving our projected objectives of training highly qualified industrial hygienists for the demanding job market. As is evident from this report, the demand for industrial hygiene professionals in Southern California has been so high that almost all students, who completed the major portion of the class and laboratory training, have obtained part-time or full-time job as an entry level industrial hygienist. Our goals for the future remain the same and with continued NIOSH support, we will continue to pursue excellence in teaching and research in this highly demanding area of public health practice.