EDUCATION PROGRAMS IN OCCUPATIONAL SAFETY AND HEALTH
UNIVERSITY OF PUERTO RICO

FINAL PROGRESS REPORT
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SUBMITTED BY:
JESUS GONZALEZ, PhD, CIH
PROJECT DIRECTOR
UNIVERSITY OF PUERTO RICO TRAINING PROJECT GRANT
Jesus.gonzalez9@upr.edu
DEPARTMENT OF ENVIRONMENTAL HEALTH
UNIVERSITY OF PUERTO RICO
MEDICAL SCIENCES CAMPUS
SCHOOL OF PUBLIC HEALTH
SAN JUAN, PUERTO RICO 00936-5067

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III. Abstract

A five-year (July 1, 2008 to June 30, 2013) performance report for the University of Puerto Rico MS Industrial Hygiene Training Program is presented. The Training Program was developed to contribute to occupational disease and injury prevention, particularly on the Island. The Puerto Rican work force is estimated to be 1,087,000 employees, spread among about 40,000 workplaces of different kinds on the Island. For the past last five years, an average 34,000 new occupational injuries or illnesses are registered each year according to Bureau of Labor Statistics (SOURCE: Bureau of Labor Statistics, U.S. Department of Labor). The goals of the IH Program are to train industrial hygienists for the growing need of this professional, to conduct research, and provide continuing education and outreach activities in this field. The training program consists of 68 credit-hours of coursework and includes: eighteen (18) credit-hours in public health basic areas; ten (10) credit-hours in environmental health and thirty-two (35) credit-hours in industrial hygiene courses. Five (5) additional credit-hours are required in elective courses. Three full-time faculty members are devoted full-time to the Program in addition to other supporting faculty. Major accomplishments during this project period included: enhancement of the curriculum, recruitment of an adequate number of students, high participation of program faculty in curriculum revision, sponsored research and community service projects, and outreach activities. During this time period, 49 students were enrolled full-time of whom 33 already completed the Program. The vast majority of these students were supported by the NIOSH training grant and/or by University assistantships. Of those graduated, 25 are currently employed in OS&H field or enrolled in other OS&H academic programs contributing to the NIOSH national mission of protecting workers' health. Many of these graduates are leaders in their respective management positions in industry. Faculty accomplishments included participation of IH faculty in seven research and service sponsored projects, and maintaining leadership in local and national professional organizations.

IV. Highlights/Significant Results

Major accomplishments of the program during the time covered in this reporting period include:

1. Enrollment of students during the past five years was fairly steady compared with the previous report. A total of 49 new full-time students enrolled during this period. This represents around 10 students per year.
2. During this reporting period the IH Program curriculum was modified to incorporate new content and perspectives in order of providing the students with in-depth knowledge in the principles and practices of the industrial hygiene profession.
3. The IH Program faculty continued its tradition of strong faculty leadership, productivity, and commitment to academic training, scholarly research, and service to the profession. All three full-time IH faculty members were involved numerous in research projects and services activities.
4. Dr. Caporali achieved his ABIH CIH certification and Dr. Gonzalez renewed his CIH certification.
5. The IH faculty continued to provide outreach to community organizations, professional associations, governmental agencies and the general public of this region.

V. Outcomes/Relevance/Impact

During the past five years the Industrial Hygiene Program at the University of Puerto Rico has achieved important goals in: recruiting, graduating and placement of a significant number of students to contribute to occupational disease and injury prevention; contributions of program faculty to the field of occupational health and safety through diverse research fields, outreach and educational activities; revising the curriculum of the Program to advance program performance on providing trainees with appropriate IH competencies.

VI. Technical Report

A. Background

During the last four decades the industrial hygiene academic offerings at The University of Puerto Rico have evolved from teaching courses to general environmental health students, to a concentration in industrial hygiene within the master of science in environmental health in the mid 70's, to an academic program in industrial hygiene (MS in Industrial Hygiene) since 1996. The current program's goal is to train industrial hygienists for the growing need of these professionals, particularly on the Island, or elsewhere where the need for Spanish language practitioners exists. It is expected that this professional will contribute to mitigate the high incidence rate of occupational injuries and illnesses among the Puerto Rican workers.

Many large industries have established operations in Puerto Rico during the last decades. These include among others, pharmaceutical, biotechnology, electronic, chemical and petro-chemical plants. Puerto Rico has one of the highest (if not the highest) densities of pharmaceutical plants in the world. Moreover, we have observed and fostered a trend of new work marked areas for the discipline in hospitals in the Island. The faculty of the IH Program has fostered to provide training in these highly technological areas and will look after for training in emerging areas like nanotechnology.

The Puerto Rican work force is estimated to be 1,087,000 employees, spread among about 40,000 workplaces of different kinds on the Island. Therefore, there are also a significant number of small and medium size firms in the island, which in most cases can't afford but need assistance on the OHOS area.

For the last five years, an average 34,000 new occupational injuries or illnesses have been reported annually as recordable cases by the BLS. Accordingly, 4.6 out of every one hundred Puerto Rican workers (4.6% of the workforce) will suffer an occupational injury or illness every year. In addition, it is well known that there are many occupational cases that end up being treated by private physicians and therefore are not officially reported. This high injury and illness incidence rate among Puerto Rican workers demonstrates the urgent need for training and research in occupational health and safety in Puerto Rico.

The mission of the Program is to produce top quality general IH practitioner for industry or government agencies. Students are required to complete a 480-hour internship under supervision of an industrial or public agency partner. In addition, through the field studies course, students visit a wide variety of industrial sites where they are exposed to OHS issues in each particular case.

The Industrial Hygiene Program within the Department of Environmental Health is a graduate program that offers a Master of Sciences degree in Industrial Hygiene. The Program has three full-time faculty members: Lida Orta-Anes, PHD, Jesus Gonzalez, PhD, CIH and Sergio Caporali, PhD, CIH; and several supporting faculty members from others School departments. The training program consists of 68 credit-hours of coursework and includes: eighteen (18) credit-hours in public health basic areas; ten (10) credit-hours in environmental health and thirty-two (35) credit-hours in industrial hygiene courses. Five (5) additional credit-hours are required in elective courses. The basic curriculum includes, toxicology, occupational health, environmental health, ergonomics, noise and other physical agents, biostatistics, epidemiology, principles of industrial hygiene, principles of industrial safety, environmental health and safety law, ventilation, respiratory protection, industrial hygiene laboratory, an internship and a field studies course.

In addition, trainees have opportunities to integrate and apply acquired knowledge through specific culminating and other practical experiences. The field studies course

and the required field internship provide the students with important field and hands-on experience, the opportunity to integrate their occupational health and safety knowledge, as well as interdisciplinary interaction with a wide range of occupational health and safety professionals. The duration of the training program is two (2) years and is conducted by means of lectures, seminars, laboratory practices, field practices and research experiences. A thesis is not required, but students, if interested, do have the opportunity to complete research with the IH faculty. This program is the only industrial hygiene program in the Island. The program will also offer courses to other academic and continuing education programs within the School of Public Health.

The vast majority of these graduates are employed by local industry and government; and they are employed professionally in the occupational safety and health field. Due to their highly qualifications and bilingual skills, a group of students have been hired by federal OSHA in several of its state offices. This group of graduates constitutes an important network of occupational health and safety professionals that contribute in protecting workers' health.

Trainees are recruited at the predoctoral level with a bachelor degree in natural sciences (e.g., chemistry, biology, physics, general science or engineering). An admission index is used to select these candidates. The index is calculated based on the GPA, the GRE or equivalent (PAEG), work experience, and an interview. The GRE and the PAEG scores are normalized to the same value. According to the School's criteria, students are expected to have a minimum score of 70% in order to be admitted.

B. Training Goals and Objectives

The goal of the Industrial Hygiene Program is to prepare industrial hygienists to supply the growing need of these professionals, particularly in Puerto Rico, or elsewhere where the need for Spanish language practitioners exists. Additional goals pursued by the program include: serve as a local resource, especially in the Spanish language, for information dissemination; provide continuing education and outreach activities; to conduct applied and basic research in this field to contribute to the development of this discipline; and to develop a leadership role in this discipline on the Island.

Key objectives for the program for the last 5-year period focused on the following:

1. Recruit a sufficient number of trainees of the highest quality each year and provide these trainees with adequate financial support to enable them to graduate.
2. Continue the curriculum revisions of the IH Program to advance program performance on providing trainee with appropriate IH competencies for professional practice and certification.
3. Maintain a strong IH core faculty participation, including securing external research and service projects and activities in areas of critical need.
4. For Dr. Caporali to achieve ABIH CIH certification.

5. To maintain a strong participation of the faculty in the local section of the AIHA, and other local and national related professional organizations.

C. Results and Discussion

C.1 Trainees. During the period covered by this report (five years), 49 full-time and 16 part-time new students enrolled in the IH program, or about 9.8 full-time students per year. This enrollment is on the range of Program expectations of ten new students each year. Thirty-four (34) of these students graduated during this period, an average of 6.8 graduates per year. Ten (10) of the new students are still enrolled; and two (2) left the program. Of those graduated, 25 are currently employed in OS&H field or enrolled in other OS&H academic programs. Of those enrolled in the program (49), 46 were supported in some way by NIOSH traineeships. The University also provided assistantships as work-study, teaching assistantships and research assistantships for the trainees. In the last five years, placement of graduates in professional positions, both in industry and government have been inspiring. Also the vast majority of these graduates are employed in Puerto Rico, helping meet the program's goal of training its graduates to meet the urgent need for these professionals on the Island. Moreover, during previous academic year, graduates from the IH program have received academic awards from the School of Public Health, for the highest grade point average of all master candidates.

C.2 Curriculum. The curriculum of the Program is intended to provide the students with integrated training in industrial hygiene, environmental health and a broad understanding of the basic areas of public health. In addition, trainees will have opportunities to integrate and apply acquired knowledge through specific culminating and other practical experiences.

During this reporting period the IH Program curriculum was modified to incorporate the critiques from previous NIOSH review panels and the requirements from the Council on Education for Public Health (CEPH). In addition to regular course content update, several additions to SAAM 6565 and SAAM 6548 were made. SAAM 6565 was offered for the first time in a hybrid mode with 2 modules (6 contact-hours) offered online together with all but one evaluation. This modification allowed for the in-class delivery of a more comprehensive module on Fan selection and additional time for ventilation exercises done in-class. SAAM 6548 had the addition of 2 laboratory practices, one in Metal Fumes Air Sampling and Laboratory Analysis (NIOSH 7030-NMAM), and the other on Quantitative and Qualitative Respiratory Protection Fit Tests. The IH Program has no thesis requirement, but all students are required to complete a 480-hour field internship and take the Seminar on Industrial Hygiene Topics.

In addition, an elective course was added to increase student's skill set on Risk Management in Industrial Hygiene. This course has been taught by Fernando Cordero, an Adjunct Professor with CIH credentials and extensive experience as an IH consulting as well as in the private industry. The course covers tools such Six Sigma, Root Cause

among others.

An area on which the program did not accomplish its goal during the previous project period was to increase the interdisciplinary activity of the industrial hygiene students. During the present project period the Program achieved a significant progress toward this objective. Some of the new approaches developed to increase interdisciplinary interactions in the Program were: (1) the involvement of students from other graduate programs in the IH courses. Students come from the Audiology program, the Occupational Therapy program, the DrPh in environmental as well as from the Evaluation program. Areas of interest of these students include noise measurement and controls, and (2) the development of a research poster as part of SAAM 6529-Seminar on Industrial Hygiene Topics. Students from the Seminar present their poster in an annual research activity hosted by the Sunshine ERC based on the University of South Florida in Tampa. For two days, students and professors from disciplines such as Industrial Hygiene, Nursing and Psychology from several universities get together and share their research in multiple areas. Thirty (30) students from our program have participated during this reporting period with their respective posters. Dr. Orta-Anés led this effort. Furthermore, cooperative research was established with the Industrial Engineering department of the University of Cincinnati. Dr Orta-Anes and Dr. Kermit Davis engaged in a research project that involved students from both universities. Industrial Hygiene, Occupational Therapy and Engineering students shared responsibilities measuring subjects in patient handling and merchandising tasks. Data collected was published in the Applied Ergonomics Journal 2013.

***C**.3 Faculty participation and development.*

All core IH faculties continued its participation with100% commitment to the IH Program. Jesus Gonzalez, PhD, CIH and tenure Full Professor is the director of the NIOSH Training Project Grant. He teaches SAAM 6543 (Industrial Hygiene), the Field Studies (SAAM 6556) and the Internship in Industrial Hygiene (SAAM 6596). Doctor Gonzalez also advises students. During this period he served as member of the Board of Director of the AIHA Puerto Rico Local Section. He continued as the Co-Principal Investigator of the RED de Asma Infantil de Puerto Rico project Face II. This project is sponsored by the Merk Foundation under the Merk Child Asthma Network (MCAN) program and its goal is to develop a program for in-home education and management to reduce the impact of asthma triggers in home; and to provide education in the clinic to improve the health of these low-income children with asthma in Puerto Rico. He led the home environment component of this project. He completed Face I (2006-2010) of the MCAN project during this period. Face I project was devoted to the development of a model health service program to improve the quality of life of children with asthma and their families. Dr. Gonzalez co-authored several publications as a result of these projects.

Lida Orta-Anes, PhD and tenured Full Professor is the coordinator of the academic IH Program since fall 2007. She teaches SAAM 6526 (Industrial Ergonomics) and, SAAM

6547 (Fundamentals of Occupational Safety), and SAAM 6529 (Environmental Health Seminar). She also collaborates teaching in, SAAM 6595 (Internship in Industrial Hygiene) and in Field Practice in Industrial Hygiene (SAAM 6566). She advises students at the master and doctoral levels. During this period Dr. Orta-Anés mentored two doctoral dissertations of the DrPh Environmental Health Program. Both students successfully obtained their doctoral degrees and are working on publishing their works. In addition, she served in two NIOSH ERC review boards, for the University of Michigan and the University of South Florida. She is an appointed member by OSHA to the National Advisory Committee on Safety and Health (NACOSH) and also of the Occupational Health Fund Committee appointed by the Governor of Puerto Rico to manage funds directed to the prevention of occupational injuries. Moreover, she had two projects with the Puerto Rico State Workers Compensation Insurance Fund Corporation to evaluate return to work programs and to identify physical and psychosocial risk factors that trigger MSD's. Dr. Orta-Anes is a longstanding member of the AIHA's Ergonomics committee and the HFES Occupational Health.

Sergio Caporali, PhD, CIH and tenured Associate professor. He teaches SAAM 6548 (Industrial Hygiene Laboratory), SAAM 6565 (Control of Occupational Health Hazards, our ventilation and respiratory protection course), and SAAM 6537, the physical hazards control course covering noise, ionizing radiation and heat stress course. During this project period he has successfully obtained funding as PI on several grants: an OSHA Susan Harwood Training Grant program to train construction workers on the focus four hazards in construction; a pilot study research grant from the Center for Construction Research and Training, CPWR, to evaluated the effectiveness and economical feasibility of different engineering control and personal protective equipment to mitigate welding fume exposure; and in the past 2 years a 4-year training research grant from CPWR to develop, pilot test and validate training materials on local exhaust ventilation for welding fume control to be delivered to welding apprentices across the nation. In addition to the research grants, Dr. Caporali has also secured the donation of IH equipment from TSI and SKC, and of a Wind Tunnel and several power tools to the Industrial Hygiene Program, from NIOSH laboratories in Cincinnati. Dr. Caporali successfully coordinated and secured a collaborative agreement between UPR-RCM and UPR at Cayey and today this wind tunnel is fully operational and will be inaugurated at the end of September 2012. Dr. Caporali has already started a project on wind noise with the Latin American Motorcyclists Association, Puerto Rico Chapter, L.A.M.A, where he and our graduate students will be using the Wind Tunnel and other noise monitoring technology developed in collaboration with NIOSH in Cincinnati. Dr. Caporali taught a 2-day PDC course on Economical Justification of OEHS alternatives for the Brazilian Association of Occupational Hygiene, in 2008, 2010, and 2011 as well as an IAQ PDC in 2008 and now during the third week of August 2012 an Industrial Hygiene Statistics and AIHA Exposure Assessment Model PDC. In 2008 and 2009 Dr. Caporali coordinated and implemented two 40-hr workshops in Noise Control and Chemical Hazard Control and Assessment respectively, bringing international specialists from Canada, England, and Brazil. All graduate students active in those

years could attend these workshops for free, where they could interact with EHS management people from Puerto Rico and the U.S. Virgin Islands.
In addition, other faculty members from the Department of Environmental Health contributed to the Program by teaching courses and advising students. During this period, adjunct IH faculty taught specialized IH courses or lectured in core faculty courses. These included several experienced OHS professionals, namely Ricardo Vega an experienced occupational medicine consultant who teaches the Occupational Health course; Fernando Cordero has taught the Risk Management in Industrial Hygiene course, and Cesar Noble lectures in the Industrial Hygiene course. They have proven to be a valuable resource to the program.

D. Conclusions

During this reporting period the Industrial Hygiene Program at the University of Puerto Rico has met important regional needs. Program faculty and students have contributed to the field of occupational health and safety through training, research and outreach activities. The Program was successful in recruiting and graduating a substantial number of students and in the placement of them in occupational health and safety positions in local industry and organizations. A total of 49 new full-time students enrolled during this period. Twenty-five (25) graduates are currently employed in OS&H field or enrolled in other OS&H academic programs. Ten (10) of the new students are still enrolled. Some of our graduates have pursued doctoral degrees in universities such as University of South Florida and Iowa State. Other areas of achievement included the implementation of changes needed to strengthen the curriculum; for one of its faculty member to achieve ABIH; and the increased participation of the industrial hygiene adjunct faculty. The NIOSH training grant continued to make possible financial support to a significant number of our trainees, and provided support to other program key activities.

E. Publications

No publication resulted directly from the training grant support.