Final Progress Report

Occupational Safety and Health Training Project Grant in Industrial Hygiene

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ABSTRACT

The Industrial Hygiene (IH) Program at the University of North Alabama (UNA) was created in the mid 1970's in response to the passage of the Occupational Safety and Health Act of 1970. The UNA IH Program is one of four ABET-accredited programs at a baccalaureate level in the USA. It is one of the first undergraduate programs of IH established in the nation and the only one in the State of Alabama. The program offers the degree of a Bachelor of Science (or Bachelor of Arts) with a major in IH. The IH curriculum is designed to prepare professionals for the comprehensive practice of IH. It is broad in scope and includes complementary education in the allied sciences of safety and environmental health. It also contains a very important component of chemistry courses, and offers, without the need of any extra coursework, the option of a double major in industrial hygiene and general chemistry.

The objectives set for the UNA NIOSH-Training Project Grant (TPG) during the cycle (2012-2017) were threefold: (i) support efforts for continuous academic improvement; (ii) promote the recruitment of qualified students into the OH&S field; and (iii) expand the educational opportunities and services of the IH program. Enrollment in the program is at an all-time high with a trend upward in the last five-year cycle (6% average annual increase). The annual enrollment during the 2015-2016 academic year is the highest on record for the UNA IH Program. With the provision of NIOSH scholarships, a number of high-caliber students have been attracted to the IH field. In the last five years, the average enrollment of the UNA IH Program has been of 52 students per semester with a range of 40 to 63 students. Stable enrollment at the current level is indicative of great success when records that precede the TPG award are taken into account (12 students per semester in 2000; 53 in 2016). The level of enrollment has necessitated the consistent offering of IH courses and yielded viable graduation outputs (average of 11 graduates per year). Among UNA graduates from the TPG cycle (2012-2017), two are members of under-represented minorities.

In relation to program quality and continuous improvement, the level of progress achieved is a result of deliberate effort aimed at meeting goals/objectives and correcting shortcomings. The approach for continuous improvement has been modeled after expectations set by Applied Science Accreditation Commission (ASAC) of ABET for the accreditation of IH undergraduate programs. This model has provided a suitable benchmark with the added value of third-party evaluation and recognition of accomplishments through accreditation. The program completed a new evaluation for re-accreditation in 2014-2015. The program continued its accreditation through September 30, 2021, after submission of an interim report documenting additional assessment of a learning outcome deemed by the evaluation to be incomplete (submitted June 2016). The most relevant changes adopted either as a result of the self-evaluation or as a response to the final statement of accreditation were expansion of capstone project opportunities to include pre-professional internships and improvement of an assessment tool to evaluate ABET Student Outcome (d), "an ability to function on multidisciplinary teams".

In regards to expansion of educational opportunities and services of the IH program, UNA continues to add degree options which require supporting components in OH&S provided by the IH Program. During this grant cycle, UNA introduced three new Bachelor of Science programs which require IH supporting courses as part of the curriculum.

SIGNIFICANT RESULTS

The Industrial Hygiene (IH) Program at the University of North Alabama (UNA) is one of four ABET-accredited programs at a baccalaureate level in the USA. The curriculum contains a central component of industrial hygiene and general chemistry with additional education in allied disciplines of occupational safety and environmental compliance. The program, which offers a double major in IH and general chemistry, has earned a reputation for graduating a pool of qualified industrial hygienists who are providing valuable services to workers and employers in this geographical region and beyond.

The objectives of the UNA IH Program under the renewal cycle of the NIOSH-TPG funding (2012-2017) were threefold: (i) support efforts for continuous academic improvement; (ii) promote the recruitment of qualified students into the OH&S field; and (iii) expand the educational opportunities and services of the IH program. During this five-year cycle of the grant, important advances were made on all three fronts.

(i) Continuous Academic Improvement

Quality assurance through continuous academic improvement requires a sustained effort focused on periodic evaluation of results and timely correction of shortcomings. The NIOSH support of faculty release time devoted to program management has been invaluable in advancing the IH Program to the current level of achievements. The approach for continuous improvement is modeled after expectations set by Applied Science Accreditation Commission (ASAC) of ABET for the accreditation of IH undergraduate programs. This model provides a suitable benchmark with the added value of third-party evaluation and recognition of accomplishments through accreditation.

The program curriculum is conformed to serve a set of educational objectives and program outcomes set forth by the IH faculty and members of the IH Program Advisory Board. The Advisory Board, created in 2000, consists of members who hold degrees in Safety, Health and Environmental Science and are affiliated to the manufacturing, service, government and education sectors. The board meets with faculty members at least twice a year to discuss program advancement and opportunities for collaboration. In 2015, the IH Program outcomes were reviewed by the Program Director and Advisory Board along with a focus group of UNA IH graduates who have obtained CIH certification. As a result, the outcomes were reduced from 25 outcomes to 24 outcomes to eliminate redundancy and improve concurrence with current demands of professional practice.

The IH Program received ABET accreditation in 2003 and was re-accredited in 2009. An evaluation for re-accreditation was completed in 2014-2015. The program successfully continued its accreditation through September 30, 2021, after submission of an interim report documenting additional assessment of a learning outcome deemed by the evaluation to be incomplete (submitted June 2016). The main corrective measures adopted either as a result of the self-evaluation or in response to the final statement of accreditation are as follow:

Capstone Project Experience

To expand the capstone project opportunities, it was decided that pre-professional internships would become an acceptable capstone experience. Students choosing this option must submit a proposal with a description of a plan of activities which must be approved by an IH faculty member based on the comprehensiveness of the proposed plan. A curriculum change with this new option was submitted and approved by regular institutional procedures.

Currently, pre-professional internship experience is not mandatory in the IH curriculum; however, participation is strongly encouraged. A recent assessment showed that 91% of students (39 out of 43 graduates since December 2012) completed a pre-professional internship before graduation. Internships and cooperative education opportunities are advertised within the Chemistry and IH Department and via a website managed by the Career Center.

Improvement of Assessment Tool

A final corrective measure involved the improvement of an assessment tool to evaluate ABET Student Outcome (d), "an ability to function on multidisciplinary teams". Formerly, this outcome was assessed by a survey question sent to former students with one to three years of professional practice in OH&S. To further improve this assessment method, student's performance in multidisciplinary teams is now assessed during course activities as well as internship experiences. The IH Program Director in conjunction with the Career Center implemented an evaluation form where supervisors evaluate the intern's performance. The IH Program Director reviews the contents of these evaluation forms to ensure critical assessment components are not missing.

Another major institutional milestone was the grand opening of the Science and Engineering Technology Building in the fall semester of 2015. The Department of Chemistry and Industrial Hygiene, formerly housed in Floyd Science Building (FSB) which served as a teaching facility at UNA for more than 50 years, is now located on the fourth floor of the 163,824-square-foot, four-story, $39.7 million teaching and research facility. A space of 2,700-square-feet for three laboratories, a classroom, equipment storage, and office space is allocated to the UNA IH program. The IH program recently purchased $18,000 of new equipment for teaching and research including: noise dosimeters (3M, The Edge), a six-channel human vibration meter (Svantek), a miniRAE 3000 portable photoionization detector (RAE Systems), and a Ventix MX4 multi-gas detector (Industrial Scientific). All instruments were purchased using department funding and NIOSH TPG contributions.

(ii) Promote the Recruitment of Qualified Students into the OH&S field

Enrollment Results

Enrollment in the program is at an all-time high with a trend upward in the last five-year cycle (6% average annual increase). The annual enrollment during the 2015-2016 academic year is the highest on record for the UNA IH Program. In the last five years, the average enrollment of the UNA IH Program has been of 52 students per semester with a range of 40 to 63 students. An important contributor to IH recruitment is the scholarship program created with funding from the NIOSH TPG. These NIOSH scholarships have proven critical in recruiting and retaining of

high-caliber students, particularly those with good scholastic merits who are competitively recruited by other academic institutions and by other majors. Stable enrollment at the current level is indicative of great success when records that precede the TPG award are taken into account (12 students per semester in 2000; 59 in 2016). Positive trends were also observed in the number of annual applications for NIOSH scholarships.

Recruitment

During this grant cycle, a new plan for recruitment of underserved and underrepresented racial and ethnic groups targeted high school students in the surrounding region. The Department of Chemistry and Industrial Hygiene administers an annual chemistry competition to high school students. The competition, which involves completion of a proctored exam, has been organized by the Department of Chemistry and Industrial Hygiene for 60 years. Although this recruitment effort was not designed to reach exclusively underserved and underrepresented groups, it provides an opportunity for all students enrolled in high school chemistry courses, regardless of ethnic background, to learn about the programs offered by the department. Participants include students enrolled in chemistry courses (first- and second-year) from private and public high schools of the Wilson Dam Section of the American Chemical Society (five counties in Alabama, four counties in Tennessee and one county in Mississippi). In the spring of 2012, the registration form to enter this annual competition was modified to include information on ethnic background.

Students from underserved and underrepresented groups who participated in the chemistry competition and obtained a score at the 60^{th} percentile or better were provided with information about the program (letter and brochure) and invited to the UNA campus for a session activity that included demonstrations of IH practice and presentations of career opportunities in occupational health and safety (November 2, 2012). The first year, forty-five (45) students from underserved and underrepresented groups were contacted. Unfortunately, response was mediocre. Only five students accepted our invitation, and only three students actually attended. Of the three that attended, one student chose this major and is currently matriculating through the program with a projected graduation date of spring 2018.

The following two years, thirty-six (36) and fourteen (14) students from underserved and underrepresented groups who participated in the chemistry competition and obtained a minimum acceptable score were provided with information about the program (letter and brochure) and encouraged to contact faculty of the IH Program if they have interest in the field and wished to tour of the facilities. Response to this effort was also minimal.

The IH Program Director also participated annually in the Presidential Mentor Academic (PMA) Program which its objective is supporting “opportunities for students whose racial group is underrepresented at the UNA campus.” Dr. Crescente Figueroa, the program director at the time, attended the event annually from 2012 to 2015. During the event, he delivered a presentation on the professional field of industrial hygiene and the educational and working opportunities available for the graduates of the IH Program. Students also received information of institutional and national scholarships offered for undergraduate and graduate studies in

occupational health. Unfortunately, no students are currently matriculating through the program as a result of these efforts.

Concerning overall recruitment of new students in the IH program, a consistently successful feeder has been our own campus. The IH program has been effective at attracting college students who are in search of an academic major that better suits their career interests. Consequently, a sustained effort has been placed on creating awareness of the academic programs offered by the Department of Chemistry and Industrial Hygiene among promising, undecided college students enrolled in lower-level chemistry courses. Awareness of the program among the campus student community is also promoted by the activities of the UNA IH Student Association (UNA-IHSA) which meets monthly.

(iii) Expand the Educational Opportunities and Services of the IH Program

UNA continues to add degree options which require supporting components in OH&S provided by the IH Program. During this grant cycle, UNA introduced three new Bachelor of Science programs.

The Bachelor of Science in Interdisciplinary Studies has an option which requires students to earn 42 hours of coursework in an area of emphasis. Areas of emphasis with a potential connection to OH&S are Business and Applied Entrepreneurship, Health, and Technology. To date, at least five students have completed IH/Safety courses as part of this program.

UNA most recently introduced the Earth Systems Sustainability and Engineering Technology degree programs. The four-year Earth Systems Sustainability degree within the Department of Physics and Earth Science will require students to complete Occupational Safety and Health (IH 301) and Environmental Regulations (CH 465), as supporting courses for this degree.

The four-year Engineering Technology degree will be focused on Electro-Mechanical Engineering and prepare students for a multitude of career choices such as design engineering, robotics, engineering management, automated manufacturing, entrepreneurship and further advanced education. Occupational Safety and Health (IH 301) is a required supporting course for this degree as well.

IMPACT

Since December 2012, the Program has graduated 55 students. Placement records show that 89% of these students are employed in the field of occupational health and safety (OH&S) or pursuing graduate degrees in OH&S. Among these graduates, two are members of under-represented minorities (4%). The employment of graduates in recent years has been very successful. The success is reflected by the importance of the hiring companies and the satisfaction expressed by these companies with the performance of our graduates. It is not uncommon for UNA IH graduates to acquire managerial responsibilities in occupational health

and safety after only a few years of employment. Employers' satisfaction is indicated by recurrent recruitment. A number of companies have offered employment to more than one graduate of the UNA IH program. 3M has employed six; Alcoa and Bridgestone Firestone have both employed five; Constellium has employed four, BP Amoco, United Launch Alliance, and Tennessee Valley Authority (TVA) have each employed three; and NASA, Georgia Pacific, Navistar, and Wyle Laboratories have each employed two. In addition, these companies continue to recruit our students for summer internships in IH.

Six UNA IH students continued in graduate studies during this grant cycle. One graduate completed a Master's in Public Health in Environmental Health Sciences/Industrial Hygiene at the University of Alabama at Birmingham (UAB). One graduate is pursuing a M.S. in chemistry at the University of Alabama. Four students are pursuing a Master's in Public Health in Environmental Health Sciences/Industrial Hygiene: one student is enrolled at the UAB School of Public Health, one student is enrolled at the University of Michigan School of Public Health, one student is enrolled at The University of Texas School of Public Health (UTHealth), and one student is enrolled at the University of Miami (UHealth).

PUBLICATIONS

UNA is primarily a teaching institution. Research productivity is obviously limited by teaching loads assigned to IH full-time faculty. However, research is important and carried out to foster better education and students' participation in this area of learning. Research production in the last five years includes multiple conference presentations, one grant-supported study (Entech), and four undergraduate students' projects.

Student, Morgan Camp, collaborated with Dr. Kimbrough in a study titled, "Evaluation of Airborne Hazards in the Ammonia Making Process". Ms. Camp presented her findings at UNA Research Days on April 10, 2017.

Student, Trevor Beasley, collaborated with Dr. Olive in a study titled, "The Recognition and Control of Hazards in the Volunteer Fire Service". Mr. Beasley presented his findings at the 4th Annual Future of the Profession Event of the Alabama Section of the AIHA in Florence, AL on March 11, 2016.

Student, Jacob Shedd, collaborated with Dr. Figueroa in a study titled, "Exposure Assessment and Control of Ultra Violet Radiation in Photo-Reactive Curing Processes." Mr. Shedd's study was selected for presentation at the Fall Conference of the Tennessee Valley Section (TVS) of the AIHA in Knoxville, TN in October 2015 and at the 4th Annual Future of the Profession Event of the Alabama Section of the AIHA in Florence, AL on March 11, 2016.

Dr. Brent Olive collaborated as principal and co-investigator in two studies accepted for presentations at the National Environmental Monitoring Conference in Chicago, IL from July 13 – 15, 2015. The title of the studies were "Designing a Fence Line Monitoring Program to Detect Volatile Organic Compounds (VOCs) on a Real-time Basis" by Olive, B.; Gamiles, D.; and Crampton, R. and "Using Spectral Averaging and Signal Processing to

Leverage Existing Short-term Fence Line UV Spectroscopic Data to Retrieve Accurate, Long-term Gas Concentrations to Meet New Monitoring Goals" by Crampton, R.; Gamiles D.; and Olive, B.

Dr. Brent Olive presented the results of the study "Gravimetric Evaluation of HDS (Helium Diffusive Sampling) Personal Air Sampling Devices" to the Committee D22 on Air Quality at the ASTM's Biannual Meeting held on April 7, 2014 in Toronto, Canada. This study had previously obtained funding through two internal research grants from the UNA College of Arts and Science and support from the manufacturing company (Entech) through equipment loans. A summary of the gravimetric results was also presented at the Alabama Section AIHA meeting on February 28, 2014 in Birmingham, AL by the student, Trevor Beasley.

Student, Elizabeth Reid, collaborated with Dr. Figueroa in a study aimed at comparing noise reductions based on published noise reduction rates (NRR) and values measured by commercial fit-testing systems (E-A-RFit^{TM}). Ms. Reid's paper was one of the winners of the student competition organized by the Middle Tennessee Section of the AIHA (December 2013).

Dr. Crescente Figueroa presented the results of his research "Evaluation of Slot Loss Factors" at the 10th International Conference in Ventilation in Paris, France (September 17-19, 2012). The paper was published in the proceedings of this conference.