The Industrial Hygiene Undergraduate Program at WKU

Dennis K. George[1], John P. Russell[1], and Rodney G. Handy[1]

Abstract

Industrial Hygiene is an engineering-related discipline dedicated to the recognition, evaluation, and control of workplace environmental factors or agents that may pose an unacceptable risk of adverse health effects to employees. As with similar applied fields, the academic preparation for professional industrial hygiene practice includes a firm foundation in basic sciences and mathematics and the application of these fundamental subjects to discipline-specific issues. A critical question elates to whether or not a sufficiently rigorous and thorough curriculum can be provided at the undergraduate level to students preparing for a career in industrial hygiene. This paper attempts to illustrate that such a program can indeed be delivered to career-oriented students provided certain elements are included and various important roles are fulfilled. These roles are discussed with specific examples of implementation in the Western Kentucky University Industrial Hygiene Program.

The Discipline of Industrial Hygiene

Industrial Hygiene (IH) is principally an applied discipline dedicated to the recognition, evaluation, and control of environmental factors or stresses arising in the occupational environment. Such stresses may cause sickness, impaired health and well-being, or significant discomfort in workers or citizens of the community[1]. These factors or stresses may be chemical (e.g. solvents, heavy metals), physical (e.g. noise, heat stress), biological (e.g. bloodborne pathogens, tuberculosis,), or ergonomic (e.g. manual materials handling, repetitive motion) in nature and may arise in virtually any sector of the occupational environment. Practitioners in the field of IH must;

- identify workplace situations that pose a potential threat to employee health and well-being,
- determine the nature and extent of the health risk by qualitatively and quantitatively assessing the environmental stressors involved,
- judge the acceptability/unacceptability of the risk upon observation of all relevant factors, and
- design/implement adequate measures of remediation for those situations posing unacceptable risk.

The purpose of this paper is to demonstrate that properly designed undergraduate IH programs can provide an excellent educational experience for individuals desiring to directly enter the professional practice of this discipline. The significant roles that these curricula can play in the preparation of individuals for important contributions as IH practitioners will be discussed in terms of the various educational and extra-curricular activities in which participating students may be involved. The significance of these activities in the overall learning process will be described in the context of specific examples of implementation in the Western Kentucky University (WKU) IH Program. It must be emphasized at the outset that this article does not necessarily seek to hold up the WKU curriculum as some type of model program. This program was selected as a practical matter since it is obviously the one with which we are most intimately familiar. Other excellent undergraduate programs across the country are accomplishing these or similar goals in a variety of innovative ways.

Academic Preparation for the Field of Industrial Hygiene

In terms of its practice, IH is very much a “professional” discipline. It is represented by at least four prominent national organizations; the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH), the American Academy of Industrial Hygiene (AAIH), and the

[1] Department of Engineering Technology, Western Kentucky University, Bowling Green, KY

American Board of Industrial Hygiene (ABIH). The AIHA, the largest of these technical societies, currently boasts approximately 14,000 members.

The ABIH oversees and administers the professional certification/registration of Industrial Hygienists. This process culminates in the title Certified Industrial Hygienist (CIH) which is analogous to the Professional Engineer (PE) distinction. Attaining the designation of CIH requires a candidate to meet a minimum education requirement (currently a bachelors degree in IH or a cognate discipline), a minimum experience requirement (currently five years for a bachelors-degreed candidate), and a passing score on a two-part examination (a seven-hour core exam and a seven-hour comprehensive practice exam).

In the past, various industrial hygienists have likened the practice of IH to that of a professional discipline such as medicine or law, suggesting that some pre-professional baccalaureate experience (e.g. chemistry, physics, biology, engineering) is an essential entrée into more advanced discipline-specific academic preparation.[2] These individuals conclude that the master's degree should be the minimum educational requirement for the IH profession. The means recommended to enforce this requirement is the certification process, i.e., require an applicant to have the Master's degree as a prerequisite for the CIH exam. Corn states "The desires of senior respected industrial hygienists can only be inferred by younger recruits through deciphering requirements for association membership or certification. Curiously, industrial hygiene has taken the very major accreditation step for professional education while not requiring the education[2]." This opinion prompted the ABIH to begin studying the merits of requiring the master's degree as the minimum educational requirement for professional certification. Clearly, there are those who believe that an undergraduate education alone is not sufficient preparation for the competent professional practice of IH. This position leaves the role of baccalaureate programs in considerable doubt and raises the question of their relevance in the current academic climate.

In reality, no clearly defined educational pathway into IH exists. While pre-law or pre-medicine curricula are widely available at the undergraduate level, a comparable "pre-IH" professional avenue does not exist in academia. Nor is there a "qualifying" examination such as the LSAT or MCAT that one must pass in order to enter the professional school. It is true that at present the majority of the best known and most mature IH curricula are at the master's level. However, this occurrence is likely more a product of happenstance than design. As the practice of IH began taking shape as a profession after the turn of the century, persons entering this fledgling field typically did so after having already completed a baccalaureate program or professional degree. Thus, as IH academic programs began to be developed, the majority of these programs were situated in graduate schools, frequently in Schools of Public Health or Engineering. Until relatively recently, few undergraduate IH programs have existed in the United States. Therefore, the discipline-specific academic preparation for the profession has been primarily at the master's level. Historically, pursuit of a degree in IH necessitated a graduate school experience. However, recent development and advancements in undergraduate IH curricula suggest an alternative.

Currently, persons entering IH graduate schools do so with a variety of academic backgrounds including chemistry, biology, or engineering. While there is much to recommend a bachelor's degree in one these areas as a preparatory to IH practice, the authors contend that a significant portion of the advanced courses comprising such degrees will relate very little to the understanding of IH. The foundational aspects of the basic sciences and mathematics and the application of these principles to the field of IH can be addressed at the undergraduate level with sufficient opportunity remaining to adequately cover advanced principles unique to the discipline.

Important Roles of an Undergraduate Industrial Hygiene Program

Undergraduate IH Programs can provide an overall educational experience that will adequately prepare graduates to begin professional practice without additional, formal academic training. However, in order to accomplish this preparation, attention must be given to the fulfillment of several fundamental roles. This following paragraphs identify and expand upon five such roles.

1. Provide an academic curriculum meeting the needs of entry-level practitioners. A formal academic curriculum is not simply a collection of individual courses and laboratories in a given major area of concentration but is also the manner in which each of these courses is woven together into a cohesive unit to deliver a solid, focused instructional program. In any given discipline, the curriculum may be comprised of a variety of basic components/subject areas and delivered via a host of different mechanisms. Due to differences in faculty interests and expertise, it is unlikely that any two similar academic programs at different institutions will offer the exact

same set of courses or cover precisely the same topics with the same rigor. However, for a field of professional practice such as IH, certain common elements belong in any responsible curriculum which has the graduation of competent practitioners as its goal. A sense of those elements for the field of IH may be obtained by considering Table 1; the rubrics from which questions are drawn for the Comprehensive Practice CIH Examination.[3]

Table 1
Rubrics Covered on the Comprehensive Practice
Certified Industrial Hygienist Examination[3]

Basic Science (Chemistry, Biochemistry, Biology, Anatomy and Physiology, General Physics, Mathematics
Biohazards
Biostatistics and Epidemiology
Controls: Engineering Controls//Non-Engineering Controls
Ergonomics
Ethics and Management
Exposure Measurement: Analytical Chemistry/Sampling, Monitoring and Instrumentation
General Industrial Hygiene Topics (Community Exposure, Hazardous Wastes/Site Remediation, Indoor Environmental Quality, Unit Operations/Process Safety/Confined Space
Noise and Vibration
Radiation/Nonionizing Radiation
Regulations, Standards, Guidelines
Thermal and Pressure Stressors
Toxicology

The critical issue here is whether or not undergraduate IH Programs can do justice to such advanced subjects while at the same time giving sufficient attention to the basic sciences upon which an understanding of these applied topics is built. As noted by other authors, development of genuine problem analysis and problem solving skills is truly impossible apart from a substantial technical background in the sciences and mathematics. Additional IH courses should not be substituted at the expense of basic science courses.[4]

In the opinion of the authors, baccalaureate programs are quite capable of providing adequate coverage of foundational subjects in the delivery of an IH instructional program. The WKU IH Program, as are other undergraduate programs, is committed to developing in its students the scientific foundation, technical background, and applied skills necessary to take on the manifold challenges of IH. In conjunction with the guiding philosophy of the Department of Engineering Technology under which it is administratively housed, the WKU IH Program seeks to produce graduates capable of proactively anticipating/recognizing/controlling a broad spectrum of environmental and occupational health problems in a variety of industrial settings and effectively managing these issues in a manner consistent with sound ethical practice and current regulatory directives.

Pedagogically, the curriculum in IH at WKU addresses these necessary skills through a combination of classroom instruction and laboratory training. Please note the curriculum layout as illustrated in table 2. All IH students graduate with a solid foundation in the basic sciences and mathematics (e.g. chemistry, physics, biology, anatomy/physiology, and calculus). Specifically, the foundation courses include 14 semester credit hours in mathematics (through calculus II and statistics), 15 hours of chemistry (through organic), 8 hours of physics, 8 hours of biology, and 6 hours of earth sciences. These courses are intended to provide groundwork such that the breadth and depth of concepts defining the field of IH may be approached with confidence.

Building upon this foundation, the application of the sciences and mathematics can be applied to the understanding of the more advanced topics important to the discipline. WKU courses and laboratories in the IH specialty area emphasize fundamental observational techniques and basic survey skills necessary for identifying potential health hazards associated with specific occupational situations. In addition, significant portions of the IH curriculum are spent in discussion and demonstration of the principles involved in the accurate measurement of these contaminants and in the proper assessment and interpretation of the results. Similarly, the elements of basic control strategies and their applications to specific situations are discussed in the classroom along with

opportunities for students to design simple control systems (e.g. local exhaust ventilation) for various unit processes. In this manner, the instructional program delivers the basic IH principles of recognition, evaluation, and control. Note from table 2 that 23 semester credit hours are devoted specifically to IH courses and the application of the basic sciences to the understanding of IH-related issues and their resolution.

Table 2
Industrial Hygiene Curriculum - Western Kentucky University

Mathematics		**Industrial Hygiene Core**	
Algebra and Trigonometry	5*	Elem. of Industrial Hygiene	3
Calculus I	3	Chemical Hazard Assessment	3
Calculus II	3	Chemical Hazard Assess. Lab	1
Statistics	3	Physical Hazard Assess.	3
		Physical Hazard Assess. Lab	1
Basic Science		Toxicology	3
		IH Risk Assessment	3
College Chemisty I	3	Industrial Ventilation	3
College Chemistry I Lab	2		
College Chemistry II	3	**Environmental Science Core**	
College Chemistry II Lab	2		
Intro to Organic Chemistry	5	Freshman Environmental Seminar	1
Biology Concepts	3	Intro to Environmental Science	3
Biology Concepts Lab	1	Hazardous Materials Mangement	3
Anatomy and Physiology	4	Air Pollution	3
College Physics I	1	Environmental Sampling and Meas.	3
College Physics II	3	Hazardous Waste Management	3
College Physics II Lab	1	Water Treatment Processes	3
Physical Geography	3	Industrial Environmental Mangmnt.	3
Environmental Geology	3	Senior Environmental Sem.	1

***Semester credit hours**

An important question is whether or not the delivery of this course work is sufficient in the context of a baccalaureate program. A significant step towards an affirmative answer to this question occurred in 1995 with the publication of the Related Accreditation Commission of the Accreditation Board for Engineering and Technology (RAC ABET) Accreditation Criteria for Undergraduate Industrial Hygiene Programs[5]. Prior to that time, RAC ABET accreditation of IH programs occurred only at the masters level. However, development of these criteria is a clear indication that in the judgment of RAC ABET and the AAIH (the cognizant technical society responsible for criteria development in cooperation with AIHA and ABIH), undergraduate IH Programs are in fact capable of delivering a curriculum that ensures a sufficient coverage of mathematics and basic sciences while at the same time incorporating the subject matter essential for professional IH Practice.

Briefly, the RAC ABET Criteria for Baccalaureate Programs include:[5]

- Mathematics. A minimum of six semester credit-hours including college algebra or courses more advanced, introductory level calculus through integrals, and statistics.
- Basic Sciences. A minimum of twelve semester credit-hours of chemistry courses with laboratories including organic chemistry, six semester credit hours of physics with laboratories, and six semester credit-hours of biology.
- Communications, Humanities, and Social Sciences. A minimum of twenty-one semester credit-hours in the areas of communications, humanities, and social sciences.
- Industrial Hygiene Science. An Industrial Hygiene Science course is one that is designed to expand and apply the basic sciences and mathematics toward professional practice including the solution of

closed-form problems and quantitative expression. This segment of the curriculum provides the core Industrial Hygiene Program and includes at least fifteen semester credit-hours in the following: Fundamentals or Principles of Industrial Hygiene, Industrial Hygiene Measurements, including laboratory, Industrial Hygiene Controls, and Toxicology.

- Industrial Hygiene Practice. Industrial Hygiene Practice courses apply the Industrial Hygiene Sciences to solve needs of workers and identified clients. This may require written or computed solutions, cost and ethical considerations, or the application of independent judgment. A minimum of fifteen semester credit-hours must be in Industrial Hygiene Practice. The published criteria includes a list of topics similar to those listed in table 1 above.
- Additional Technical Subjects. A minimum of fifteen additional semester credit-hours must be taken in additional technical subjects. This may include additional Industrial Hygiene Science or Practice or additional mathematics or science beyond the basic requirement.

An IH curriculum accredited by RAC ABET enjoys the credibility associated with this distinction. A specific objective of the accreditation effort as identified in the published criteria is "to identify for prospective students, student counselors, parents, potential employers, public bodies, and officials, engineering-related programs which meet the minimum ABET criteria in engineering-related specialties[5]". Thus, in addition to the development and delivery of the solid academic program needed by entry-level practitioners, the alignment of the curriculum with RAC ABET criteria is an important step for a baccalaureate program. In achieving accreditation, an undergraduate program makes significant advancement toward fulfilling its role of providing graduates with the most credible and marketable baccalaureate degree possible.

The WKU IH Program received RAC ABET accreditation in 1997. As of this writing, the WKU program and the similar program at Purdue University, are the only two undergraduate IH programs that have obtained this distinction. However, curricula at other institutions are under consideration in the 1997-98 accreditation cycle.

2. Furnish a broad-based educational experience. Another important preparatory function of baccalaureate IH curricula is the inclusion of course work and laboratory exercises that expose students to important specialty areas outside of but related to their major course of study. For example, a discipline closely related to IH is that of Industrial Environmental Management. Industrial Environmental Management is also concerned with hazardous agents or pollutants generated from industrial processes. However, whereas IH focuses on the health and well-being of workers *inside* the plant, industrial environmental management is concerned with the impact of these agents on the health of the surrounding community and the fate of these pollutants in the neighboring environment. Thus, an industrial environmental manager focuses on the behavior of the contaminant *outside* the plant and the assessment and control of hazardous materials escaping from the plant and into surrounding air, water, or land. As with the industrial hygienist, the types of industrially-generated hazardous agents of concern to the industrial environmental manager are as many and varied as the industrial processes from which they originate. Managing the environmental issues of an industrial concern is, indeed, a highly complex challenge requiring a strong technical background coupled with a very diverse set of applied skills.

The recent "downsizing" trend in American industry has resulted in the functions of IH and Industrial Environmental Management being combined in a number of industries, particularly the small to medium-sized companies. Frequently, the safety manager function is also included, creating a job title called the "Environmental, Health, and Safety (EHS) Manager". In fact, a recent survey of industrial hygienists showed that 33% of facilities surveyed operate consolidated EHS departments at the highest level of the organization with only about 25% having separate safety, IH, health and environmental departments[6]. Obviously, a broad range of expertise is demanded of today's industrial EHS manager. Increasingly, the plant-level professional is required to possess a varied background that includes a combination of IH, environmental management, and industrial safety. The day of the narrowly-focused technical specialist is rapidly giving way to the era of the broad-based generalist whose duties encompass the entire gamut of EHS issues. In addition to the ethical concerns over the health and well being of employees and surrounding communities, companies are constrained to control employee exposures and environmental releases of contaminants by a plethora of governmental occupational health and environmental regulations (e.g. OSHA and EPA. Obviously, the necessity of applying a broad base of technical skills and problem solving abilities within such a complicated regulatory framework makes the field of EHS management one of the most complex and challenging of the current scientific disciplines. Recognizing this, it is imperative that students experience a comprehensive range of IH/Industrial Environmental Management course work, projects,

and problem solving situations to adequately prepare them for the complex issues they will be expected face upon employment. A vital role for undergraduate IH Programs is to provide students with a broad spectrum of these meaningful educational experiences, including those from the environmental sciences.

The WKU IH Program is actively seeking to fulfill this role for its students. Building upon the science foundation described previously, each student receives a fundamental preparation in the Environmental Sciences with courses such as Air Pollution, Solid and Hazardous Waste Management, Water Treatment Processes, Industrial Environmental Management, etc. In all, a total of 15 semester credit hours of the curriculum are devoted to environmental science and industrial environmental management (note table 2). As a result, these students possess an understanding of the behavior of pollutants in air, water, and land, and they have a firm basis from which to understand the control techniques required to solve problems associated with the release of pollutants into these media. Through theses courses students are also introduced to the regulatory background governing the management of important environmental issues in the industrial setting. The information presented rounds out the IH student's overall educational experience.

3. Introduce Significant Extra-Curricular Educational Activities. Preparing students for the ambitious roles described above requires creativity in the delivery of the instructional program. Providing formal academic course work in each important area of IH/Industrial Environmental Management is clearly impossible in an undergraduate (or even graduate) program. Additionally, limitations in existing faculty expertise may prevent a knowledgeable presentation of certain sub-specialties of the field. Thus, many important and interesting areas may be mentioned only briefly or covered at some cursory level during the regular curricular offerings. A vital role of undergraduate programs is to develop innovative ways to integrate this important material into the curriculum so that these important topics may be amplified and detailed coverage may be provided of information that may only be introduced by existing courses.

To meet this need, undergraduate IH programs must engage students in unique educational experiences outside the normal classroom setting in addition to providing a solid, broad-based formal curriculum. It is essential that students be afforded opportunities to expand their knowledge base in a broad spectrum of IH and industrial environmental management subject areas via participation in a variety of professional development and continuing education programs while still in school. Examples of the implementation at WKU include:

- Students are permitted and encouraged to attend the University of North Carolina/Duke University National Institute for Occupational Safety and Health (NIOSH) Educational Resource Center (ERC) Summer and Winter Institutes. These institutes are week-long (35 to 40 contact-hour) sessions held twice each year; in the summer in Norfolk, VA, and in the winter in St. Petersburg Beach, FL. A wide variety of in-depth continuing education/ professional development courses on specific EHS topics are presented at the institutes by recognized experts from across the country. Students may choose from a broad selection of these courses. This effort provides students with a unique opportunity to extend their baccalaureate educational experience beyond the typical classroom setting through their participation in in-depth professional development courses directly related to their chosen major.
- Students are encouraged to attend 40 hours of focused training on occupational safety and health topics taught by the Kentucky Occupational Safety and Health Administration (KOSHA). Courses include noise and hearing conservation, permit-required confined spaces, lockout/tagout, hazard communication, injury and illness recordkeeping requirements, and air contaminants and respiratory protection. These sessions allow students to focus on the regulatory aspects of the various topics in the health and safety field.
- During spring break of each year, students participate in a 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) course conducted by the Bowling Green Regional Technology Center. This course is accredited by the state EPA and provides a very important credential for students entering the job market.
- Students are encouraged to attend the various seminars on environmental, health, and safety matters sponsored by the department. The seminars, covering some of the most current issues in the field, are conducted at the rate of approximately once per month and range from one half to a full day in length.

In all, this collection of valuable external training experiences allows students to:

- obtain focused, in-depth instruction in vitally important and highly specialized areas of their field (such as ergonomics or indoor air quality) that may not be covered in great detail through the regular curriculum,

- interact with occupational safety and health professionals in business, industry, government, and education from all across the United States and several foreign countries, and
- attain credentials and certifications that will significantly improve their job competitiveness.

4. Extend Classroom and Laboratory Experiences into the Real World. Each of these classroom/laboratory experiences and extracurricular activities described above is an integral part of a student's preparation for a career in IH/Industrial Environmental Management. The importance of these experiences should not be minimized. However, in view of the increasing level of expectations and broad range of capabilities required of entry level EHS managers, it is clear that a vital role of undergraduate IH Programs is to provide its graduates with "real world" experiences that they can take with them to their initial employment. Today, many companies are hiring inexperienced people, saddling them with heavy responsibilities, and are expecting them to step in and perform immediately. Unfortunately, individuals who have had little or no real-world experience or opportunity to work under the supervision of competent professionals in the field are at an extreme disadvantage in this situation. In view of this trend, it is obvious that providing these opportunities as an integral part of the baccalaureate degree experience becomes even more critical. Adequate academic preparation of these individuals is no accident but is rather the result of a carefully planned curriculum supplemented by real-world activities and experiences.

Undergraduate IH Programs must actively seek to fill this role and create even more unique and effective learning environments for their students. Faculty must strive to extend educational opportunities for students beyond routine classroom/laboratory exercises and into problem solving experiences in "real-world" industrial settings. The practice of this philosophy allows students to interact with actual workers, supervisors, and management personnel in genuine industrial workplaces and gives them the excitement and satisfaction of applying problem solving skills in a setting in which their contributions will make a material difference. In the opinion of the authors, combining a solid academic foundation with these real-world experiences is the best method of producing technically competent and marketable practitioners in the field of IH.

The need for EHS management assistance within industries in close proximity to the typical university provides a natural mechanism for these student projects. Many of the individuals with EHS responsibility in local industry are pleased to have students work with them to measure and document the exposure of their workers to a variety of occupational and environmental hazards. This provides a service to these companies that is very difficult for them to obtain otherwise. They are very interested at the prospect of having our students assist them in carrying out the basic facets of occupational and environmental health for their respective companies. Working with these industries, students can help identify specific areas in which they may be of assistance. The depth and complexity of these experiences may be highly variable. The more straightforward projects may be accomplished within the context of a regular semester course. Other, more complex issues may require more intensive effort and thus may the subject of a directed research project for a student or a group of students receiving academic credit. As students demonstrate their capabilities to local EHS managers, ties between the university and the industrial community are strengthened. The benefits reaped by the students and the eagerness with which they approach these industrial experiences cannot be overemphasized. They encounter first hand the reality of interacting with both workers and management personnel in a "real" workplace. They also experience the reality of practicing their profession in an environment where their proposed solutions must not only be effective from a worker protection perspective but they must also be cost effective from a business point of view. Perhaps the most satisfying aspect of these projects is the fact that through conscientious data collection, thoughtful problem analysis, and workable solution development, these students actually make a substantial contribution to the Environmental Health & Safety program of a particular company.

In a similar vein, the WKU IH Program has developed a viable co-operative education/internship program in which students go out into industries for extended periods. During these experiences, the students have an opportunity to spend several weeks working hand in hand with a company's EHS manager. During this time the student can participate in long-term projects of greater depth and complexity that may require significantly more effort and expertise to manage. The students benefit from the practical experience of the EHS professional while the company benefits from the technical abilities of the student. In addition to valuable experience in the fundamental practice of IH, the student has opportunities to do such things as; practice verbal and written communication skills, sharpen and further develop computer skills, observe how major programs such as Hazard Communication, Hearing Conservation, etc. are implemented in practice, and conduct safety and health training sessions for workers.

Also, since internship positions are competitive, students gain valuable experience in the process of preparing a resume`, searching for open positions, and planning for and participating in a job interview. Students are required to complete at least one 3 credit-hour internship (minimum of 450 clock hours).

5. Foster Development of Strong Student Organizations. The final function of an undergraduate IH Program to be discussed in this paper is to provide an environment that encourages students to interact with other students. The formation of social/professional associations is critical to the field of IH. As mentioned previously, in many industrial facilities, the industrial hygienist (or EHS manager) comprises a department of one and may have few opportunities for professional interaction within his/her company. These individuals must depend upon and work through an external network of colleagues. Thus, it is critical that students planning to enter this profession be taught the many benefits associated with participation in professional societies and be made aware of the great networking opportunities afforded by such organizations. Students can be initiated to this practice through participation in an organized student group such as one sponsored by a cognizant national society or local section of a national organization.

A significant plus for the WKU IH students is the departmental support of a very active student organization; the Western Kentucky University IH Student Association (WKUIHSA). This organization, sponsored by the Kentuckiana Local Section of the AIHA, provides an excellent forum in which students have the opportunity to work together on various projects related to the field of IH and industrial environmental management and to contribute to the profession and the community in a variety of ways. The Student Association is the focal point for virtually all organized student activities and service projects within the program. It brings together students from the freshman through the senior level and is an excellent vehicle for communication as well as an effective recruiting tool. Student interaction with the sponsoring AIHA local section lays the groundwork for their future professional organization activities at both the local section and national association levels.

Conclusion

The WKU undergraduate IH program is committed to expanding the horizons of each and every one of its graduates and rendering them capable of handling entry-level positions in IH and EHS Management. It offers a strong academic/instructional program supplemented by a variety of extracurricular activities. The program is also exploring the tremendous learning and public service opportunities available through IH/industrial environmental projects with local and regional industries. WKU IH students recognize that the opportunity to prevent occupational disease, protect public health and natural resources, and improve the overall quality of life for a number of individuals in society make this career one of the most rewarding.

References

1. Plog, Barbara A., **Fundamentals of Industrial Hygiene**, fourth edition, Barbara A. Plog and Jill Niland, editors, Chapter 1, *Overview of Industrial Hygiene*, National Safety Council, Itasca, Illinois, 1996.

2. Corn, Morton, "Professions, Professionals, and Professionalism", *American Industrial Hygiene Association Journal*, (58), 590-596, July 1994.

3. The American Board of Industrial Hygiene, 4600 W. Saginaw, Lancing, MI 48917-2737, 1996.

4. Perkins, Jimmy L., **Modern Industrial Hygiene**, Vol. 1, Chapter 3, *Principles and Focus of Industrial Hygiene*, Van Nostrand Reinhold, 1997.

5. *Criteria for Accrediting Engineering-Related Programs*, Effective for Evaluations During the 1997-98 Accreditation Cycle, Related Accreditation Commission Accreditation Board for Engineering and Technology, Inc., Baltimore, MD.

6. "13th Annual Environmental Health and Safety White Paper", *Industrial Safety and Hygiene News*, Radnor, PA, 1997.

Dennis K. George, Ph.D., CIH

Dennis holds both a M.S.P.H. and a Ph.D. in Industrial Hygiene from the University of North Carolina at Chapel Hill. He has seven years of field experience in both government and industrial settings and has been a full-time faculty member in the Western Kentucky University Environmental Science Program since 1992. Dennis has research experience in the areas of industrial ventilation and occupational exposure assessment and has been published in both areas in major industrial hygiene journals. He also has extensive experience in the development and presentation of a wide variety of courses in the field of industrial hygiene, having presented courses to virtually all levels of participants from shop floor personnel to practicing occupational safety and health professionals. Dennis has delivered professional development courses for academic institutions, private corporations, and government organizations. He is certified by the American Board of Industrial Hygiene in the Comprehensive Practice of Industrial Hygiene.

John P. Russell, Ph.D.

The second author's biodata.
John, currently the Chairman of Western Kentucky University's Department of Engineering Technology, holds a Ph.D. in Environmental Engineering Sciences and an M.S. in Nuclear Physics from the University of Florida. He has authored and co-authored numerous publications and technical reports on a variety of environmental topics. In recent years he has conducted several environmentally-related projects that have benefited many local industries and municipalities and has served as an expert witness locally and nationally. Additionally, John has served as project director for a number of grant projects with funding totaling $500,000. He currently serves as project director for the Industrial Hygiene Curriculum at Western Kentucky University which has amounted to over $250,000 in funding from CDC/NIOSH.

Rodney G. Handy, Ph.D.

Dr. Handy is currently an Assistant Professor of Environmental Science at Western Kentucky University. Rod holds a Ph.D. in Environmental Engineering from the University of Florida and an MBA from Ball State University. His professional experience includes six years of university teaching and seven years of industrial experience. He has also worked on several environmental field projects, and has several professional publications related to environmental field assessments. In addition, Rod has taught both credit and non-credit environmental courses in Florida, Ohio, Kentucky, Indiana, and Virginia.