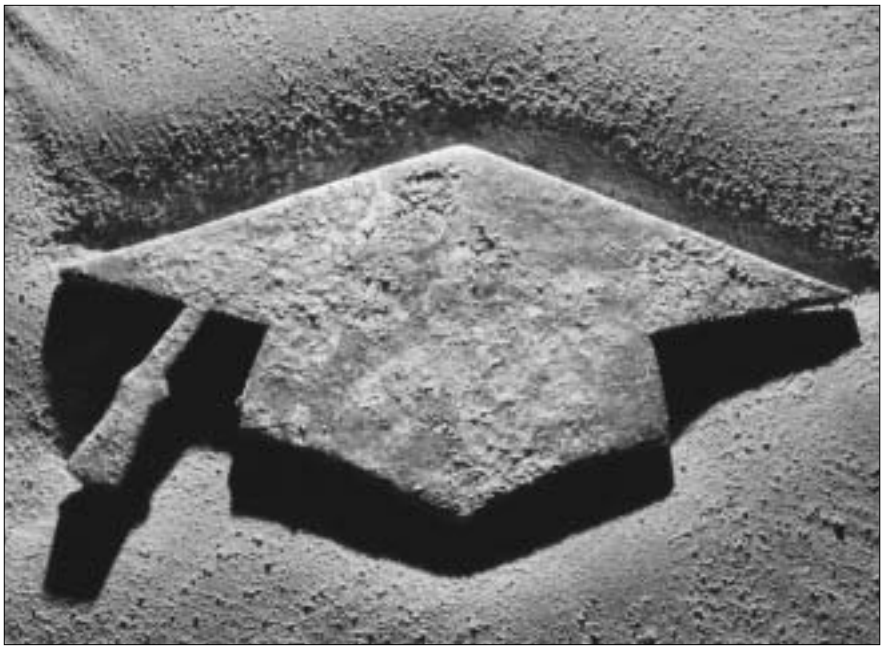

A DOCTORAL PROGRAM FOR THE NEXT GENERATION

By WARREN R. MYERS and GARY L. WINN

Coinciding with a national call for advanced academic training in occupational safety and health, the Industrial and Management Systems Engineering Dept. at West Virginia University has developed a doctoral program to train research-based scholars for industry, government and academic settings. In establishing guidelines for this new terminal degree, the university has created a unique blend of technical and management-based competencies. This new academic program seeks to establish research foundations in emerging safety and health concerns, and to prepare individuals to replace retiring academic personnel. The program accepted its first students in the 2000-2001 academic year.

Three key events during summer 2000 signaled the need for a significant expansion of doctoral-level preparation for the safety and health profession. While not exactly a "cause and effect" relationship, the West Virginia University Board of Trustees approved a doctoral program in occupational safety and health (to be administered by the College of Engineering and Mineral Resources), coinciding with a national call for such a program by ASSE and the National Academy of Sciences' Institute of Medicine (IOM).

The July 2000 issue of *Professional Safety* included a news item on an IOM report, "Safe Work in the 21st Century: Training Needs for the Next Decade's Occupational Safety and Health Professionals." The report called for development of graduate-level safety and health training at academic institutions, noting that many academic faculty members will be retiring soon and will need to be replaced. The report warned that the current replacement level falls below actual needs.

TABLE 1
West Virginia University Faculty Average Ages, Full-Time & Part-Time

Year	Full-Time		Part-Time	
	Number	Avg. Age	Number	Avg. Age
1988	812	45	257	32
1989	Not available		Not available	
1990	849	46	357	32
1991	903	46	113	43
1992	907	47	444	32
1993	822	47	399	33
1994	881	47	421	35
1995	853	48	418	35
1996	838	48	434	35
1997	773	48	464	36
1998	777	49	531	34
1999	788	49	589	34

Note: Faculty from the Schools of Medicine and Dentistry are excluded.
Source: Statistical Profile of Higher Education in West Virginia.

Graduate-level safety and health training at academic institutions is threatened by a "graying trend" among faculty and the fact that the current replacement level falls below needs.

According to the *PS* report, IOM also concluded that doctoral candidates need more support (e.g., research and tuition) and suggested that institutions should strive to better accommodate the needs of today's professionals through distance education. Furthermore, although the report found the current level of preparation in technical areas is effective, it concluded that educational institutions must improve training in non-technical areas such as "behavioral health, work organization and team learning" (1).

Around the same time, ASSE contacted several colleges and universities to gauge their interest in developing a terminal degree in occupational safety. The Society noted that many academicians were reaching retirement age and added that some universities had phased out their degree-granting programs. ASSE stated that "a significant opportunity now exists for a university to take a leadership role in offering a doctoral program once more."

Although it would be nice to claim that WVU's program was created on the heels of these national calls, that really is not the case. The university actually began work on the program in 1997. Faculty believed that both technical and non-technical M.S. graduates could offer more to their respective fields as a whole if they 1) had training and exposure to a broad variety of coursework; and 2) could plan and conduct experimental research in safety and health. At the most-basic level, that is what this program offers: Graduates will have expertise in both occupational safety and occupational health.

A CHANGING PROFESSION

Although the need for an advanced terminal degree is well-known throughout the field, limited empirical evidence is available to support this notion, a fact underscored by the IOM report. However, the "graying" of the field can be illustrated in several ways.

Consider these data from three actual (but anonymous) ABET-accredited master's-level faculties. Program "A" has seven safety and health faculty, one of whom is now retired and one more who may retire. Program "B" has only 2.5 safety and health faculty remaining—one member retired in 2000 and one is scheduled to retire in 2002. Program "C" has seven faculty members, with two eligible for retirement.

For these three programs, out of 16.5 full-time equivalent faculty, six either have retired or could retire at any time. By the year 2002, the faculty could be reduced by 36.4 percent. Assuming that academic professionals have an average professional career of 35 years and that they began teaching near enactment of the OSH Act in 1970, one can postulate that the full effect of the "graying" phenomenon will be felt by about the year 2005, at least at these three institutions. This conclusion is supported by WVU's faculty data for all colleges and departments (Table 1).

The IOM report also summarizes data on the nation's aging workforce, coupled with a comparative declining number of doctoral students graduating.

> *Perhaps the most worrisome aspect of all these data is the small number of Ph.D.s being awarded. In only one year [between 1990 and 1999] did the Ph.D. recipients number exceed eight. Furthermore, analysis of limited data provided to the committee by NIOSH grantees showed only one dissertation in the previous five years that focused on the traditional safety domain of acute traumatic injury prevention. Although few, if any, industries require safety professionals with doctorates, a critical mass of such individuals is necessary for both the conduct of critical research in injury prevention and for the continued viability of the academic programs that produce practicing safety professionals at the associate, bachelor's and master's level* (IOM 156).

THE PROGRAM ITSELF

The WVU program is designed to prepare professionals who will make research contributions; find new ways to reduce injuries and illnesses across industry, government and private settings; and develop ways to implement the initiatives and measure their success. The program goes beyond merely learning the application of safety management and/or industrial hygiene principles; it teaches research from beginning to end. Students will be asked to draft research proposal(s) for external funding; engage in lab rotations; assist with lab or field research; report (in

writing) research findings; and publish research results in peer-reviewed publications. As the program proposal states:

The principal objective of the proposed [program] is to educate and train men and women so that they [can make] significant technical and teaching contributions to the occupational safety and health profession through their efforts in academia, government and industry.

The course of study will make students competent to perform independent research in the application of scientific principles to anticipate, recognize, evaluate, control and manage occupational and environmental hazards to the working populations of West Virginia, the nation and the world.

In the authors' opinion, the IMSE department and its two supporting programs are well-positioned to offer this doctorate. The university's safety management master's degree program (SEM) is accredited by the Accreditation Board for Engineering and Technology/Related Accreditation Commission (ABET/RAC), as is its master's degree program in occupational hygiene/occupational safety (OH/OS). This latter program covers exposure assessment, noise and ventilation. To graduate, students must submit "problem report"; this entails conducting quantitative assessments of noise, air handling or air pollutants. (Until 1997, SEM trained safety managers and OH/OS trained industrial hygienists as separate entities. The departments' administrative functions have since been merged, but course content and program activities remain separate.)

An ergonomics master's degree, under the auspices of industrial engineering in IMSE, will also support the new Ph.D. via instructors and coursework. Combined faculty is 11—well above the "critical mass" normally expected.

Two types of master's-level programs will likely feed the new WVU program: 1) the university's own accredited master's degree programs and 2) similar accredited programs at other universities. Why is ABET/RAC accreditation such an important distinction?

Established in 1932, ABET is a federation of 31 professional engineering and technical societies representing millions of engineers, computer scientists, technologists and technicians. With input from these professional societies, ABET develops the criteria used to evaluate educational programs. ABET accredits over 2,500 engineering, computing, engineering technology and engineering-related programs at some 500 colleges and universities in the U.S. (ABET 2001).

Admission to the WVU doctoral program requires either an ABET/RAC-accredited master's degree or the equivalent. Table 2 lists accredited programs at other universities.

TABLE 2
U.S. Universities with Relevant ABET-Accredited Master's Degrees

University or College	Type ABET MS*	Title or Degree Offered
University of Alabama, Birmingham	IH	MPH
University of California, Berkeley	IH	MPH
University of California, Los Angeles	IH	MSPH and MSEHS
Central Missouri State University	IH	MIH
University of Cincinnati	IH	MEIH
Colorado State University	IH	MOH
Harvard School of Public Health	IH	MIH
University of Illinois at Chicago	IH	MPH and MSIH
Indiana University of Pennsylvania	SM	MSS
University of Iowa	IH	MIH
The Johns Hopkins University	IH	MIH
University of Massachusetts at Lowell	IH	MIH
Medical College of Ohio	IH	MOH
University of Michigan	IH	MIH and MPH
University of Minnesota at Minneapolis	IH	MSIH and MPH
Montana Tech of the University of Montana	IH	MIH
Murray State University	IH	MOSH
University of North Carolina at Chapel Hill	IH	MSIH and MSPH
University of Oklahoma, HSC	IH	MPH, MSIH and MSIH
Purdue University at West Lafayette	IH	MIH
San Diego State University	IH	MIH
University of South Carolina	IH	MPH and MSPH
University of South Florida	IH	MIH
University of Texas at Houston	IH	MPH and MSIH
Tulane University	IH	MIH
University of Utah	IH	MIH
University of Washington	IH	MIH
Wayne State University	IH	MOEHS
West Virginia University	IH and SM	MSM and MIH

**IH* includes industrial hygiene, public health and related degrees; *SM* includes safety management, safety science and related degrees.
Source: Accreditation Board for Engineering and Technology/Related Engineering Accreditation (www.abet.org, 2001).

Two types of master's-level programs will likely feed the new WVU program: 1) the university's own accredited master's degree programs and 2) similar accredited programs at other universities.

DIFFERENTIATING THE TERMINAL DEGREE

Today, industry offers many new job titles and positions—ergonomists and ventilation experts, specialists in bloodborne pathogens, management information systems, construction safety, environmental management—which demand new skills. In the authors' opinion, master's degrees in safety management or occupational safety and health will continue to prepare professionals for these roles.

Doctoral graduates will be able to propose, conduct or manage safety-related industry and government research programs as well as enter the academic community and begin to replace retiring professors.

But a doctoral program is different. First, it will train graduates in quantitative aspects of industrial hygiene and comprehensive safety management. Second, the degree will enable graduates to propose, conduct or manage safety-related industry and government research programs. Third, successful doctoral students can enter the academic community and begin to replace retiring professors.

At most academic institutions, the Ph.D. is required for an entry-level professorship. In addition, many institutions now expect entry-level assistant professors to have at least a few articles published when they start. The WVU doctorate is designed to meet these requirements. It offers training in a complementary field, and will help students develop the skills needed to propose, conduct and evaluate experimental research, enter the academic community and publish in professional journals.

Following is an outline of the program's main elements. (*Authors' note: This is an abbreviated list; for example, it does not include university requirements such as tuition fees or residency requirements.*) Undergraduate- and master's-level preparation includes:

1) **Industrial Hygiene or Ergonomics.** *Undergraduate:* A minimum of 120 semester hours or the equivalent that shall include 63 or more semester-hour credits in undergraduate- or graduate-level courses in science, mathematics, engineering and technology, with at least 15 of those at the upper (junior, senior or graduate) level. A minimum of 21-semester hour credits, or equivalent, must also be completed in communications, humanities and social sciences.

Graduate (M.S.): 30 hours of ABET-accredited or equivalent coursework in industrial hygiene, with a thesis or problem report.

2) **Safety Management.** *Undergraduate:* A minimum of 120 semester-hours or the equivalent that shall include a minimum of 40 semester-hour credits, or equivalent, in undergraduate- or graduate-level safety-related courses in engineering, technology, communications, humanities and social sciences. A minimum of 23 semester-hour credits in undergraduate- or graduate-level courses in science, mathematics, engineering and technology must also be completed, with at least 15 of those at the upper (junior, senior or graduate) level.

Graduate (M.S.): 36 hours of ABET-accredited or equivalent coursework in safety management, with a thesis or problem report.

3) **Doctorate.** Normally, a minimum of 30 hours of coursework (excluding research, directed studies, etc.) will be required after the M.S. Some 21 of those hours will be completed in the IMSE Dept. in complementary areas (e.g., safety manager enrolls in hygiene courses, and vice versa). Remaining nine hours will be in one or two minor areas. Nine hours of statistics and experimental design are required, as are 24 hours of research. The minimum hour total will be 54, but more may be added to successfully pass the qualifying exams.

What the WVU doctorate is *not* bears mention as well. It is not a computer-based distance learning program in which the student rarely sees the instructor. While a small selection of such courses may eventually be available, the faculty believes that students at this level must be imbued with the fabric and the culture (the paradigm) of the profession. Students and faculty will be attending conferences, writing and presenting research papers and interacting with contacts at National Institute of Occupational Safety and Health; these activities require local interaction. WVU is also fortunate to be located near the National Energy Technology Laboratory, an FBI center and a large NASA facility. The WVU campus also features several research centers—the Robert C. Byrd Health Sciences Center and the National Research Center for Coal and Energy—where IMSE faculty conduct ongoing research projects.

WHAT'S HAPPENED TO DATE

In operation for one semester, the doctoral program has two students. Both have industrial hygiene backgrounds, yet are seeking professional careers in safety management. These students will likely undergo coursework exams in spring 2002 and begin work toward their research and dissertations. A third student, also with an industrial hygiene background as well as five years' work experience in industry, began his coursework in fall 2001. Two other students are under consideration by the Admissions Committee.

Early in the academic year (Oct./Nov. 2000), faculty noted a wave of interest from international students. WVU has a large population of international students; however, as a general rule, these students need guarantees of full-time research support. While this situation changes each semester, faculty supporting the doctorate had no openings at that time. About half of the inquiries to date have arrived via the Internet.

In summary, WVU's new doctoral program answers the call of ASSE, the Institute of Medicine, and the many safety and health professionals who have recently noted the need for advanced scholarly preparation in the U.S. The profession has grown tremendously and offers challenges not anticipated 30 years ago. The WVU program attempts to balance the technical and management needs of professionals and enables candidates to analyze, conduct and execute findings from the highest possible levels of research. ■

REFERENCES

Accreditation Board for Engineering and Technology. Related Accreditation Commission. New York: ABET. <http://www.abet.org>.

Institute of Medicine. "Safe Work in the 21st Century: Education and Training Needs for the Next Decade's Occupational Safety and Health Personnel." Washington, DC: National Academy Press, 2000.

"Too Few Ph.D.s in Safety, IOM Finds." *Professional Safety.* July 2000: 1.

Warren R. Myers, *Ph.D., CIH, is a professor in and chair of the Industrial and Management Systems Engineering Dept. at West Virginia University (WVU), Morgantown. Myers teaches industrial hygiene and statistics in the university's occupational hygiene/occupational safety master's degree program.*

Gary L. Winn, *Ph.D., CHST, is a professor of safety and environmental management at WVU, where he is also coordinator of the occupational safety and health doctorate program. He teaches safety management principles, safety compliance and engineering. Winn is a professional member of ASSE's Northern West Virginia Chapter.*