Final Performance Report

Industrial Hygiene Program
West Virginia University
Morgantown, WV 26506-6070
Steve.Guffey@mail.wvu.edu

Graduate Training Program

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Program Director: Steven E. Guffey, CIH, Ph.D.

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ABSTRACT

During the 5-year term of this grant, 2005-2010, there were 36 students enrolled in the WVU Industrial Hygiene Masters program. Of those 36, fourteen graduated, 2 dropped out, 1 switched to Safety Management (a program in our department), about 25 have not been in the program long enough to graduate, and the rest have finished coursework but not their theses.

For the same period, 21 students received NIOSH funding. Of those, 6 have graduated, 7 have not had time to graduate, 1 switched to Safety Management, 2 dropped out, 5 are expected to graduate but are in their 3rd or 4th year. Three IH students who were dual majors with Safety Management (SAFM) and IH have graduated from SAFM but not yet from IH. We believe the dual major is substantially delaying graduation in IH for those students.

Of the 6 who graduated in this period, all are employed in safety and health. Indeed, all of our students, except foreign students, are employed either part-time or full time in professional IH positions after completing their first year. Those who move to full-time before completing their theses often thereby delay their ultimate graduation. Nearly all of those who transferred to Safety Management graduated from that program and are currently employed in safety and health positions.

Reducing the time to graduation is a high priority. To do so, we are discouraging students from taking a dual major with SAFM, and we encouraging students to start earlier on their theses. For the latter, first year students in IMSE 660 now write and defend a mini ergonomics-oriented thesis proposal (including a literature review) and complete the research by the end of the course. Each is required to write a truncated "thesis" and defend it in front of their classmates. The entire effort is critiqued and graded by the instructor. However, reducing time to graduation will probably be helped much more by the large increase in NIOSH funding for the next budget period, coupled with WVU's recent decision to waive tuition for students receiving stipends from NIOSH funds. By increasing monthly stipends from $900 to $1280/month and covering all tuition for both in-state and out of state first year students, we believe the reduced financial pressure will allow students to forego early full time work.

The curriculum was strengthened, adding a required graduate level statistics course. More changes to the course requirements are planned for Fall 2010 in response to suggestions made during the Spring 2010 NIOSH site visit. Significant progress was made during the project period in the development of existing courses in the curriculum, including a radically revised course in ergonomics and the addition of modules in other courses on non-ionizing radiation, biohazards, indoor air quality, and other topics. In response to site visit recommendations, further changes to core courses will be

implemented in Fall 2010, including revisions to both IMSE 561 and IH&S 725 to allow greater emphasis on exposure assessment.

The laboratories for industrial hygiene research and student training were greatly improved over this period, with major additions to apparatus for research in ergonomics and in noise measurement and control (i.e., reverberation chamber, custom-built noise data acquisition hardware and custom-written data acquisition software) and with important new apparatus for respiratory protection effectiveness research (e.g., new TSI fit-testing apparatus). For the ergonomics lab, we have acquired or developed a 3D optical motion capture system, a portable full body wireless 3D kinematic system, a 16-channel wireless electromyography system, a full body musculoskeletal modeling system, a lifting strength measurement system, and a 3D static strength prediction software.

At WVU, all Safety Management students (about 40/yr), MPH students in the medical school (2-5 per year), and Occupational Medicine MPH students (2-3 per year) are required to complete our industrial hygiene sampling course (IENG 561). In it they learn not only how to sample airborne contaminants, but also at least the rudiments of noise measurements and ventilation design. Hence, when they enter the workforce as safety managers or occupational physicians, they have a higher than typical working knowledge of industrial hygiene.

Progress in research was also significant. The most important research areas during the project period were: (1) real time determination of noise reduction provided by hearing protectors to coal miners and others during normal work shifts, (2) relationship between fit-testing noise reductions (NR) determined before or after work to values of NR observed continuously during work, (3) effectiveness of enclosing ventilation hoods under typical work conditions, (4) changes in effectiveness due to specific modifications to enclosing hoods, and (5) 10 new ergonomic research programs started by a new faculty member.

The program faced some turnover in faculty. Three ergonomists joined the faculty in this period, but the most senior of them resigned and left in May 2010.

Outcomes/Relevance/Impact

During the 5-year term of this grant, 2005-2010, there were 36 students enrolled in the WVU Industrial Hygiene Masters program. Of those 36, fourteen graduated, 2 dropped out, 1 switched to Safety Management (a program in our department), about 25 have not been in the program long enough to graduate, and the rest have finished coursework but not their theses.

For the same period, 21 students received NIOSH funding. Of those, 6 have graduated, 7 have not had time to graduate, 1 switched to Safety Management, 2 dropped out, 5 are expected to graduate but are in their 3rd or 4th year. Three IH students who were dual majors with Safety Management (SAFM) and IH have graduated from SAFM but not yet from IH. We believe the dual major is substantially delaying graduation in IH for those students.

Of the 6 who graduated in this period, all are employed in safety and health. Indeed, all of our students, except foreign students, are employed either part-time or full time in professional IH positions after completing their first year. Those who move to full-time before completing their theses often thereby delay their ultimate graduation. Nearly all of those who transferred to Safety Management graduated from that program and are currently employed in safety and health positions.

Ironically, we are not too far below our goal of producing 10 IH professionals per year since we are admitting 7-8 per year and nearly all end up working in safety and health whether they graduate from our program or not. Unfortunately, about half are taking so long to complete their theses that we are very concerned whether they will ever complete them. The main problem is their accepting full time positions before graduating due to financial distress. We believe the substantial increase in funding we will have for the next 5 years will do a great deal to reduce that financial stress, hopefully allowing students to avoid full time positions until after they have received their degrees.

At WVU, all Safety Management students (about 40/yr), MPH students in the medical school (2-5 per year), and Occupational Medicine MPH students (2-3 per year) are required to complete our industrial hygiene sampling course (IENG 561). In it they learn not only how to sample airborne contaminants, but also at least the rudiments of noise measurements and ventilation design. Hence, when they enter the workforce as safety managers or occupational physicians, they have a higher than typical working knowledge of industrial hygiene.

It is difficult to produce accurate statistics on this, but we are confident that we train the great majority of industrial hygienists practicing in West Virginia and a significant fraction of those working in Appalachia.

All or nearly all funds were spent each year.

Research done by faculty and students in this period will likely prove important to the practice of industrial hygiene. Research funded by NIOSH demonstrated that noise reductions (NR) provided during normal coal mining and other work by both ear muffs and earplugs varied with a standard deviation of 5 dBA between workers and roughly 5 dBA for each worker with time during the work shift. Some workers proved to have very low NR values using ear plugs or muffs they had used for many years. For those results we used only periods when we could verify that miners were wearing their protector. This was important since we found that 10-40% of exposure doses occurred when coal miners were not wearing their hearing protector.

Fit-testing both prior to and after work proved to be only modestly predictive of NR values during actual work, especially if a single fit-test was used for the prediction. The poor correlation was due to the high variability of both work experience and fit-testing results. NR values were highly variable, also having a standard deviation of about 5 dBA with multiple tests (12) on the same worker and 5 dBA standard deviation between workers. An intervention study in which a light flashed under a hat brim when the measured noise level exceeded 80 dBA inside the ear canal proved only modestly successful.

To determine the source of variability during work, we completed several series of laboratory studies with human subjects. We could find no combination of body movements that could produce the effects seen universally during work. Talking greatly reduced NR, but we found that miners spent little time talking during work (because of the noise).

A study of the effectiveness of benchtop enclosing hoods produced results that contradicted some common but unproven assumptions (e.g., Industrial Ventilation, 2009) and supported others. It is widely assumed that enclosing hood effectiveness falls sharply with increasing cross draft velocities. We found the effect was moderate and in the opposite direction: exposures were lower at high cross draft velocities than at low ones. As expected, hood effectiveness increased with increasing face velocities, but the effect was far more dramatic at very low velocities (< 100 ft/min) than in the recommended range (100-200 ft/min). The interaction between cross draft and face velocities was highly important, with the highest exposures occurring at combinations of low cross draft and low face velocities. We also determined that commonly suggested "improvements" to hood designs were ineffective, at best, and in most cases dramatically *increased* exposures. The only effective intervention was a sash tilted 45 degrees vertically and in the direction of the face of the hood. It was extremely

effective, reducing concentrations at a breathing, heated, anthropometric manikin posed in a "working" position from 20-200 ppm to undetected (LOD= 0.01 ppm).

Ergonomic studies in the following areas have begun but are not to the reporting stage, yet:

1. Quantification of the cervical spine loading among the surgeons using surgical loupes
2. Evaluation of the cervical spine loading during forceful arm exertions
3. Design and evaluation of cervical spine support mechanism for VDT users
4. Use of Iyengar yoga therapy to reduce low back pain among West Virginia residents
5. Understanding the contribution of physical and psychosocial stress on the loading of neck musculature among healthcare workers
6. Effect of dual monitor display on the electromyography of cervical musculature.
7. Biomechanical evaluation of different techniques used to lift retaining wall blocks by construction workers
8. Understanding the relationship between ingress, egress and reaching tasks volumes and influence of anthropometric dimensions on motions during such tasks
9. Evaluation of an autonomous motion analysis system to quantify biomechanical loading using full body musculoskeletal modeling techniques
10. Evaluation of loaded locomotion on uneven terrains using full body musculoskeletal modeling

Technical Report

Program Focus and Objectives

The objective of the West Virginia University Industrial Hygiene program is to educate students at the masters' level in the field of industrial hygiene, occupational ergonomics, and safety engineering. The IH program is administered through the Industrial and Management Systems Engineering Department (IMSE) in the College of Engineering and Mineral Resources.

The goal of the program is to provide applications-oriented education in the field of industrial hygiene, occupational ergonomics and safety engineering while emphasizing cost-effective and practical solutions to safety and health problems in the workplace. Graduates of the program are prepared to function in both private and public sectors.

1) The I.H. program is structured to meet the needs for a well-trained, broad-based safety and health professionals. The applications-oriented program provides a masters-level education in the fields of industrial hygiene, occupational ergonomics, and safety -- with additional classes in environmental science, toxicology, noise, ventilation, and epidemiology. The goal of the program is to provide applications-oriented education emphasizing cost-effective and practical solutions to safety and health problems in the workplace. Graduates of the program are prepared to function in both the private and public sectors.
2) Our specific goal is to train 10 new industrial hygienists per year and to place them all in professional industrial hygiene or safety positions, with as many as possible in Appalachia. We obviously have no control over where they go when they graduate, but those who were born in this area are far more likely to work here than those who were not.

Secondary goals of the program are:

1) To provide introductory industrial hygiene, safety, and ergonomics education to undergraduate engineering students,
2) to provide similar training to doctoral and masters graduate students in engineering and other parts of the university (e.g. Wood Products, Occupational Medicine, Industrial and Labor Relations, Safety and Environmental Management), and 3) to serve the state of West Virginia by providing limited safety and health services.
3) West Virginia University seeks to provide educational excellence in areas of concern to state and regional residents. The degree in occupational safety and health strongly matches with the institutional goals and objectives of the University and the College of Engineering and Mineral Resources by providing

trained professionals to businesses of the state, region and nation. Our program makes excellent use of the current faculty, curriculum, and laboratory resources of the IMSE Department, as well as the close working relationship the department has with the School of Medicine and the Morgantown laboratories of the National Institute for Safety and Health (NIOSH) and the Department of Energy (FETC).

Regional need for the program:

The population of West Virginia is largely employed in OSHA's "high hazard" industries: mining, railroading, logging and timbering, chemical and steel production. The Appalachian region, including West Virginia, has an unacceptably high level of occupational injuries and disease. Based on the most recent US Department of Labor statistics, West Virginia has a non-fatal injury and illness rate of 5.2%, which is roughly 25% higher than the national average of 4.2%. West Virginia's rate of fatal work injuries is twice the national rate at 7.7 per 100,000 workers. Aside from the much greater losses to injured workers and their families, occupational injuries and illnesses have been extremely costly for the WV's worker compensation fund, which is over $2 billion underfunded, yet disability outlays are more than 8.0% of total payroll costs, the highest rate in the nation. Other nearby areas, such as southwestern Pennsylvania, western Maryland, eastern Kentucky, southwestern Virginia and southern and eastern Ohio, show a similar employment profile. Clearly, there is a tremendous state and regional need for improvements in safety, health and the environment. Just as clearly, it is critical to continue training qualified safety and health professionals if we are to continue improving the occupational safety and health quality of life for workers in West Virginia, the region, and the nation.

Indeed, the training of qualified safety and health professionals is prerequisite for improving the occupational safety and health quality of life for workers in West Virginia and the nation.

History of the Program:

1) The I.H. program is administered through the Industrial and Management Systems Engineering (IMSE) Department in the College of Engineering and Mineral Resources (CEMR). The I.H. Program is ABET accredited in Industrial Hygiene as an Applied Science. Note that our PhD program is a separate entity (Occupational Health and Safety) whose faculty consists of both I.H. and Safety Management faculty. We are not authorized to support doctoral students with TPG funds.
2) Since its inception in 1980, the I.H. program has graduated more than 222 students. Our students have gone on to extremely successful careers in

occupational safety and health. The program has enjoyed the benefits of a Training Grant for 30 years.

Training Status

In five year period of 2005-2010, 21 students received NIOSH training grants. Their current status is detailed in Table 3. Of the 21 students, 7 have not had time to graduate, 1 switched to Safety Management, 2 dropped out, 5 are expected to graduate but are in their 3rd or 4th year.

Table 3: IH Masters Students Receiving NIOSH Traineeships in 2005-2010

Year Funded	*Student*	Level	Working PT or FT	Graduation
2005-2006	Ηιλλ, Ναταλιε	Masters	FT with WVU OS & H	Expected Dec. '10
2005-2006	Ενγλε, Θοην	Masters	U.S. Navy OS & H	Graduate in Safety Management in May 2009. Grad in IH is doubtful
2005-2006	Λεωιν, Θονατηαν	Masters	FT at Mylan Pharmaceutical	Expected Dec. '10
2005-2006	Σαϖαγε, Κριστεν	Masters	FT with WVU OH&S Extension	Graduate in Safety Management in Dec 2009. Expected Dec. '10
2006-2007	Σηερμαν, Βενφαμιν	Masters	Trainee	Graduated May '09
2006-2007	Θυινν, Αλεξα	Masters	FT with ICU Environmental Health & Safety	Graduated May '09
2006-2007	Λεωισ, Χηριστιαν	Masters	FT with Dept of Veterans Affairs, Asheville, NC, IH	Graduated May '09
2006-2007	Σανγυινεττι, Μαρια	Masters	FT with USGS/Eastern Region, IH	Graduated May '08
2006-2007	Πιεγολ, Αδαμ	Masters	FT with Marathon Oil	Graduated May '09

2007-2008	Εδρισ, Τερεσα	Masters	PT/ Research Assistant	Graduated from SAFM Dec. 09. Expected IH in May '10
2007-2008	Σηερμαν, Βενφαμιν	Masters	FT with Sargent Safety Services	Graduated May '09
2007-2008	Νιχηολσ, θαμιε	Masters	Dropped out	
2008-2009	Βυρνσ, Δρυ	Masters	Trainee	Expected Dec '10
2008-2009	Ηαρπ, Χηριστοπηερ	Masters	Trainee	Expected Dec '10
2008-2009	ΜχΚιββιν, Ραλπη	Masters	Trainee	Expected Dec '10
2008-2009	Πυστολσκι, Ελιζαβετη	Masters	Dropped out to teach HS biology	
2008-2009	Μιλαμ, Αντηονψ	Masters	PT with WVU OH*S	Expected Dec '11
2009-2010	Μεαδορ, θυστιν	Masters	FT, Trainee	Expected Dec '12
2009-2010	Μοορε, Χηριστοπηερ	Masters	FT, Trainee	Expected Dec '12
2009-2010	Τυφουρ, Αντηονψ	Masters	FT, Trainee	Expected Dec '12

Notes: All graduates have permanent, full-time jobs as IH&S professionals

During the period covered, 3 to 5 students each year received a 12-month appointment as a trainee. When 5 or 6 students received awards, it was because one or more of the trainees accepted a safety and health part-time job on campus and relinquished their award after the first semester, freeing up funding for another student. In two cases a funded trainee dropped out after one semester. In addition to the scholarship, these students also received partial support for travel to the AIHA conference each year. None of the recent graduates have publications or inventions, yet.

Traineeships are awarded for one year, only. Almost all trainees obtain safety and health part-time jobs with campus OS&H, NIOSH, or EG&G for their second and later years. Many work full-time after completing their coursework, leading sometimes to long delays before completing their theses.

Note that the students who are 3rd year or later are all living in Morgantown and working either part time or full time as industrial hygienists. All except those noted maintain that they will complete their theses and problem reports by December 2010. However, some have delayed completion for 3 years or more.

Note that 2 trainees dropped out, in both cases to return to their original goal of teaching high school biology.

We also had two students who transferred to SAFM within weeks of starting the program and are not listed for that reason. One had been granted a traineeship and another was given tuition support, but those funds were withdrawn from student financial accounts when they transferred out of IH.

Enrollment and graduation rates

As can be seen in the table below, the program has had a total of students in the program that has fluctuated between 4 and 9. Likewise, the number graduating each year has fluctuated between 2 to 5. Note that Table 4 lists numbers of new students each year, not the total number enrolled.

Table 2: Recent History of Enrollment in the Program (First Year Students and Graduates)*

Year	New full-Time	New Part-Time	Total New	Total Graduated
2005-2006	4	0	4	2
2006-2007	7	0	7	2
2007-2008	7	0	7	3
2008-2009	9	0	9	5
2009-2010	9	0	9	2
Total	36	0	36	14

*Nearly all students are part-time after their first year

In Table 2 the 2009-2010 graduation rate is a bit better than it appears since 2 more defended successfully in July 2010. Nevertheless, Table 2 shows a low graduation rate over this period. We admit roughly 7 students per year, for a total of 37 over the 5 year period. During the same period, 14 graduated. Of course, those who graduated in 2004-2006 were admitted before the 5-year period started, and those who entered 2007-2010 have not had time to graduate. Our best estimate is that roughly half who are admitted graduate within 4 years. Those who delay more than 4 years sometimes never graduate, but some do.

Hence, we are not graduating as high a fraction as we would expect or want. We have identified 3 problems that keep students from graduation:

1) struggle academically (about 1 per year): almost all of these transfer to Safety Management (SAFM) and ultimately graduate from it.

(2) double majors in IH and SAFM (1-2 per year): almost all graduate from SAFM, which has no thesis or problem report requirement, and almost all complete their

IH coursework, but fewer than half complete their thesis and graduate from IH. Four of those who are 4th year students are double-majors.

(3) complete all coursework, take a full-time IH job, and drag on for years (2 per year): these students all state that the intend to complete their thesis or problem report, but find it difficult to do while working full time.

(4) drop out entirely before completing coursework (<1/yr): these students generally were either struggling academically or became disenchanted with IH or, in most cases, had personal problems or issues that required them to leave Morgantown (e.g., husband transferred).

We have tried things that did not seem to work, such as strongly advising students not to take full time work until their thesis is completed. They did not take that advice because they felt financial distress or fatigue with student poverty and found that they could compete for decently paying IH jobs without the degree. They were competitive because almost all had significant professional experience since they worked part time as IHs for a year or two before taking the full time position.

Their financial distress was not relieved by our first year NIOSH stipends because they were very low. With the $60,000/yr funding for the last 10 years, we could pay only in-state tuition levels and $800-$900 stipend per month. Part-time positions in IH (especially working for WVU) also generally pay only $800-$1000 per month. Working in a lab pays $1260 or more per month, but we generally reserve most of those positions for foreign students since their visas do not allow work off campus. Students with graduate positions are not generally eligible for student loans, and in any case most were deeply concerned about their total debt from their undergraduate schooling.

Hence, although many of our strategies seemed reasonable, they were not addressing the central problem: finances. We believe this problem will be markedly reduced beginning this year for two reasons:

(1) WVU has finally agreed that students receiving the stipends will be given waivers of tuition, increasing the amount we can allocate to stipends.

(1) A increase in NIOSH funding from $60,000 to $100,000 further increases the amount we can provide as monthly stipends to $1,280/month

Hence, both in-state and out of state students will have their tuition covered and will receive roughly $400 more per month. This is a Godsend for our program. Instead of going into debt their first year and being compelled to work part or full time thereafter, it will be feasible for them to work only part-time or not at all their second year and only part-time their 3rd year, if a 3rd year is necessary.

To improve retention and reduce delays in graduating, we have undertaken steps in addition to increasing stipends:

(1) We now actively discourage students from doing the second degree in SAFM (we cannot forbid it). That has apparently been successful with recent students.

(2) After first trying to improve progress towards a thesis by instituting a voluntary seminar on research in Fall '09, we dropped that in favor of a modification to a Spring 2010 course, IMSE 660 (Human Factors). As a major course assignment, students are required to write and orally defend a realistic thesis proposal on an ergonomics topic, including an extensive literature review. They then do the research, write up the results and defend their written reports in class. The response of the students has been enthusiastic. We intend to extend this to a second course this Fall (Industrial Ventilation Design).

Employment of graduates

To date, we have had far more employers eager to hire our students then we have students. Our graduates have accepted employment in industry, government, and labor. They have accepted employment as industrial hygienists, researchers, safety engineers, ergonomists, and as general health, safety, and environmental professionals utilizing their broad-based education.

Program enhancement achieved through the availability of the Training

Trainee grant funds paid for trainee stipends and tuition, as well as for trips by the Program Coordinator and most of the trainees to the national American Industrial Hygiene Conference and Exhibition for all 5 years. In addition, it paid for one-half month of the Program Coordinator's salary, enabling the Coordinator to spend the time necessary to administer and improve the program.

Faculty

The Industrial Hygiene faculty has had three changes in this period: Dr. Wiker has resigned and left (May 2010), Dr. Ashish Nimbarte joined the faculty (Fall 2009), and Dr. Kevin Rider joined the faculty (Fall 2006). The core I.H. faculty currently includes Drs. Warren Myers, Kevin Rider, Nimbarte, and Steve Guffey.

Dr. Guffey is the program coordinator for the Industrial Hygiene and the PI for the TPG grant.

Table 3a: Areas of Core Faculty Competence and Involvement

Core Faculty	% Effort	% Funding	Areas of Competence and Involvement
Guffey, Steve PhD, CIH	75	19	Training Grant Director, I.H. Program Coordinator, advising, teaching, mentoring, and liaison with supporting departments; areas of competence: ventilation, industrial hygiene, air sampling, noise control, ergonomics, statistics
Myers, Warren, PhD, CIH	40	0	Associate Dean for Academic Affairs, teaching, advising, mentoring, liaison with Dean's office and university; areas of competence: industrial hygiene, air sampling, ventilation, statistics, noise control
Nimbarte, Ashish PhD	75	0	Teaching, mentoring; areas of competence: ergonomics, safety
Rider, Kevin PhD, CPE	25	0	Teaching, mentoring; areas of competence: ergonomics, safety

Core Faculty

All core faculty are members of the Industrial and Management Systems Engineering Department. All four are involved in teaching required courses taken by I.H. students, advising students on academic and professional issues, mentoring and supervising students through their program reports and theses, and maintaining program quality.

Note that any faculty member in IMSE who is a member of the graduate faculty (which is all of them) can serve as a chair or member at the discretion of the program coordinator and the IMSE Chair. For example, Drs. Wafik Iskander and Robert Creese have served on IH thesis committees many times as members. In addition, supporting

faculty (see Table 3b) often serve as members of examination committees. Adjunct faculty (see Table 3c) often serve as an "outside" member of examination committees.

Table 3b: Areas of Supporting Faculty Competence and Involvement

Non-Core Faculty	% Effort	% Funding	Areas of Competence and Involvement
Mike Reasor, PhD	10	0	Teaching and point of contact in toxicology; areas of competence: toxicology and pharmacology
Priscah Majuru, PhD	8	0	Teaches epidemiology
Kevin Rider, PhD, CSP	10	0	Teaches ergonomics and safety courses and serves on committees as Chair and Member; areas of competence are safety and epidemiology
McCawley, M. PhD, CIH	5	0	Teaching and mentoring in engineering controls; areas of competence are aerosols physics, industrial hygiene, and engineering controls for pollution control
Brandon Takacs, M.S.	5	0	Teaches sampling course lab; areas of competence are industrial hygiene practice and coal mining
Michael Klishis, PhD	5	0	Teaches safety electives; serves on committees as Member; areas of competence are training and coal mining
Gerry Hobbs, PhD	5	0	Teaches statistics; area of competence is statistics
Gary Winn, PhD	5	0	Teaches safety electives; serves on committees as Member
Wafik Iskander, PhD	3	0	Consults on statistical issues; serves on committees as Member; areas of competence are statistics and engineering

Supporting Faculty

The program also includes a number of supporting faculty (see Table 3b), including: (1) Drs. Mark Reasor and Mary Davis, who teach Toxicology, (2) Dr. Majuru Priscah, who teaches epidemiology, (3) Dr. Gerry Hobbs, who teaches STAT 511 and serves on student research committees, (4) Dr. Michael McCawley, who teaches a popular elective on air pollution controls and serves on student research committees, (5) Brandon

Takacs, a clinical faculty assistant professor in our Safety and Health Extension program who teaches the lab portion of the first sampling course (IENG 561), (6) Klishis and Winn, Safety Management Faculty who teach popular safety electives and serve on student research committees. Other supporting faculty include those who so not teach courses our students take but do serve on student research committees and provide expertise on request. Among those are Dr. Iskander, the IMSE Chair and an expert on experimental design and statistics.

Table 3c: Areas of Adjunct Faculty Competence and Involvement

Adjunct Faculty	% Effort	% Funding	Areas of Competence and Involvement
John Etherton PhD, CSP, CPE	20	0	Teaching: safety; areas of competence are safety and ergonomics
Wells, Carol MS, CSP	10	0	Teaching and mentoring; areas of competence are industrial hygiene and safety practice
Kevin Michael, PhD	5	0	Serves on student research committees; areas of competence are noise measurements, audiometry, and research on the effectiveness of hearing protective devices
Chris Coffey, PhD	2	0	Guest lectures and mentoring; areas of competence: industrial hygiene, air sampling, respiratory protection, analytical instruments
Martin Harper, PhD, CIH	2	0	Guest lectures and mentoring; areas of competence: industrial hygiene, air sampling, analytical instruments
Hongwei Hsiao, PhD	2	0	Guest lectures: areas of competence: ergonomics and safety
Yulia Iossifova PhD, M.D.	2	0	Guest lectures; areas of competence molds and other biological agents
M. Abbas Virgi ScD, CIH	2	0	Serves on student research committees
Ziqing Zhuang, PhD	2	0	Serves on student research committees; areas of competence: ergonomics, respirators

Adjunct Faculty

We are blessed with many active adjuncts (see Table 3c) who have substantial expertise, including: (1) Dr. John Etherton, a retired NIOSH researcher who teaches both required safety courses, (2) Carol Wells, an industrial hygienist from the WVU Safety and Health Office, who teaches our IH sampling course (IENG 561) in the spring semester for Safety Management students and mentors IH students, (3) Dr. Kevin Michael, an expert on hearing loss and effectiveness of HPDs, who serves on nearly all of the several student committees involving HPD effectiveness, and (4) several researchers at NIOSH in Morgantown who provide quest lectures, serve on committees, and mentor students. NIOSH professionals active within the program include Drs. Chris Coffey, Martin Harper, Hongwei Hsiao, Yulia Iossifova, Christopher Pan, and Ziqing Zhuang. The first three are Branch Chiefs at NIOSH in Morgantown. Dr. Iossifova, an MD researcher on IAQ, does guest lectures on molds in the ventilation course. Drs. Coffey, Harper, Hsiao, and Pan do guest lectures in the two sampling courses. Dr. Ziqing Zhuang, an ergonomist researcher, serves on student research committees. Note that adjunct faculty can serve on student research committees (AEC) as the "outside" member.

Faculty Commitment and Breadth

Not only are the Core faculty committed to the success of the trainees in the field of safety and health, but they also are supported by numerous other faculty within and without the IMSE Department and by professionals in the area, as was discussed in the previous section (see Tables 3b and 3c).

The faculty's breadth is unusual for this type of program. Dr. Guffey, a CIH, has worked for OSHA and has consulted widely among Fortune 500 firms and with much smaller companies, giving him great practical experience. In addition, he has a Masters degree in ergonomics/safety and an undergraduate degree in engineering mechanics. He has designed engineering controls for hundreds of companies over many years and has done extensive research on ventilation design, exposure assessment, and noise controls. Dr. Myers is a CIH with considerable research experience in protective equipment with NIOSH. He has been commended for his work with respiratory protection. Dr. Wiker (now resigned) is a prominent ergonomist with a strong background in industrial engineering and safety, as are Drs. Rider and Nimbarte (incoming faculty member). Dr. Nimbarte comes to us with 7 previous ergonomics research publications and several grant proposals already submitted for review. Dr. Nimbarte's research efforts include joint mechanics and lifting.

The support faculty and adjuncts also have highly distinguished careers in safety and health. Dr. Rider is developing a research program in vehicular safety. Dr. Iskander and Hobbs are both well-regarded statisticians. Dr. Harper is a well-known expert on sampling who previously headed research at SKC. Dr. Coffey is an expert on ventilation filtration, both for ventilation and for respirators, and in sampling and evaluating volatile organic compounds. Dr. Kevin Michael is a PhD audiologist with a world-wide

reputation in hearing protector effectiveness research and hearing conservation. Carol Wells is an IH practitioner with a comprehensive practical experience in IH and safety. Dr. Hongwei Hsiao is a highly published researcher on trips and falls from heights and many other safety issues. Dr. Virgi has strong research credentials in respiratory protection, nano-materials, and noise measurement and control. Dr. Iossifova is an epidemiologist and physician with a great deal of practical experience and a strong research program in measuring, identifying, and evaluating the toxicology effects of exposures to molds and other biological agents. Dr. Gary Winn has substantial expertise in construction safety and Dr. Michael Klishis has substantial expertise in coal mining hazards.

In addition, while they are not listed here as supporting faculty, the expertise of the faculty of the entire College of Engineering and Mineral Resources is available to the IH program. Dr. Guffey actively collaborates with Drs. Ismail Celik and Nigel Clark in research and serves on their students' committees and they serve on his. Dr. Celik is an expert on computer fluid dynamics simulations, and Dr. Clark is an expert on air contaminants due to vehicular emissions, including diesel. Students doing ventilation research regularly consult with Drs. Celik, Morris, and other fluids experts in Mechanical and Aerospace engineering (MAE).

Likewise, the Medical School provides another vast source of current and potential support, but we have not listed as Supporting Faculty only the three who teach our students: Drs. McCawley, Majuru, and Reasor. Stephen Wetmore, M.D. serves as a medical consultant to our noise research studies for 3 years, and Edward Doyle, MD has served as medical consultant to our ventilation and exposure assessment research for the last 9 years.

Drs. Guffey, Myers, Virgi, and Harper are certified for the comprehensive practice of IH (CIH) by the ABIH. Drs. Rider and Etherton are Certified Professional Ergonomists. Carol Wells and Dr. Etherton are Certified Safety Professionals.

Faculty reputation and strength

The IMSE Department has 15 tenured or tenure-track faculty members who are engaged in teaching, research, and service. Of the 15, eight teach partially or exclusively in industrial hygiene, ergonomics, and safety. Of those eight, 5 are tenured and the other 3 are tenure-track.

Of the IH program faculty, Drs. Guffey and Myers are tenured full professors. Drs. Rider and Nimbarte are tenure-track Assistant Professors. Dr. Wiker has resigned effective May 2010.

The IH Program faculty are well known in the occupational safety and health community. Dr. Guffey serves on the JOEH Editorial Board and the ACGIH Ventilation Committee, and he is a member of the AIHA Engineering Committee and the AIHA Noise Committee. He has written ventilation design software that is sold all over the world, and is the sole author of 3 chapters of the latest version of the ACGIH Industrial

Ventilation manual, including two of the most important: ventilation measurements and hood design (next edition). He was awarded the "Best Paper of the Year" by the AIHA Engineering Committee three times in 7 years.

Dr. Myers has been editor of an international occupational safety and health journal, has chaired one AIHA technical committee and was an officer on another. Due to his established reputation in protective equipment technology, he was invited to write the respiratory protection chapter in Patty's. Dr. Myers is the Associate Dean for Academic Affairs, giving the program additional security, visibility within the college and university, as well as visibility with other engineering programs. Dr. Myers has received the John M. White award given by the American Industrial Hygiene Association three times in the last 14 years. He is the only researcher in the US to be so honored.

Dr. Nimbarte, has been on the faculty for one year but already has 7 accepted or published research articles and has already submitted extramural research proposals.

Faculty members continue to improve their methods of instruction, conduct research, and render public service to the community, state, and region. Indicative of the quality and the reputation of the program are the wealth of publications and externally funded research projects. For the 4-year year since the last competitive renewal, Dr. Guffey alone has had over $1.8M extramural funding. For the core faculty members, the total grant funding for the 4-year period ending May '09 was well over three million dollars, a respectable productivity considering that Dr. Nimbarte is new, Dr. Rider has been here less than 3 years, and Dr. Myers is Associate Dean of engineering. The areas of expertise for core, supporting, and adjunct faculty are also discussed in the previous section (see Tables 3a-3c).

The four core faculty members involved with teaching occupational safety and health also have distinguished publication and professional records, especially considering that one is an associate dean and another just started. In the period of 2005-2009 they published 35 papers in archival, refereed journals plus 2 book chapters. Also, their research achievements have been recognized in their profession. For example, Dr. Guffey has received the "Best Paper" award from the AIHA Engineering Committee for 1994, 1995, and 2000. The faculty hold professional certifications appropriate for their professions. Two are Certified Industrial Hygienists (C.I.H.), two are Certified Safety Professionals (C.S.P.), two are Certified Professional Ergonomists (C.P.E.), one is a Certified Safety Manager (C.S.M.), and one is a registered professional engineer (P.E.).

The faculty members listed in the Table 3b below are involved in teaching the I.H. course work, program administration, advising, and health and safety research. Their areas of competence are listed as well. The percent effort number reflects their involvement with these duties as it relates to the program. The requested NIOSH funding number is a small percentage of the faculty's time commitment to the program; the balance of faculty support is provided by the university and by research grants. This funding primarily supports administrative activities which go on throughout the year, including counseling students, advising program reports and theses, modifying and updating course materials, recruiting students, job placement of students, coordinating

seminar speakers, organizing industrial field trips, and managing student research dollars.

Education

Degrees offered

The Industrial Hygiene (I.H.) program offers a Masters of Science degree. The doctoral degree is offered through a different program within the Department and is not funded through this TPG.

Fields in which trainees will be qualified upon completion of training

Graduates of the I.H. program are qualified to take the ABIH certification for industrial hygiene (C.I.H.) and the ASSE certification for safety (C.S.P). In addition, with two or three courses in ergonomics, graduates should be competent to resolve most ergonomics issues. In addition, the elective course in environmental management is invaluable in dealing with hazardous wastes and pollution control, another "hat" often worn by industrial hygiene and safety professionals.

Duration of the training program

The program can be completed in 4 full semesters (see Table 2: IH Curriculum). However, the great majority of students work part-time or even full-time after their first year. As a result, most students now require more than 2 years to complete the program, with a substantial fraction taking 3-7 years. About half who do not receiving funding from the TPG work part-time during their first year, also. Most who work part or full time obtain positions at NIOSH, DOE, or campus safety or health during their second and third year. The work experience is invaluable to them but does delay their graduation.

A minimum of 44 semester hours with a GPA of 3.0 (not including research credits) are required for the I.H. masters degree. Only courses that are required or are approved electives are counted when computing the GPA. Required pre-requisites are not considered in GPA calculations. In addition to the course work, the students must meet a university-stipulated writing requirement, which can be satisfied by completing a three-hour problem report or a six-hour thesis. Following completion of the problem report or thesis, the students must pass a formal defense and oral examination. Trainees are expected to do a Masters thesis but we do accept Problem Reports, if necessary. The latter are typically done by students who are working full time.

Current Curriculum

Our curriculum is intended to impart an unusually strong competence in recommending and evaluating engineering controls (see Table 4), as befits our engineering school home base. We require a full semester each on ventilation design (IH&S 528) and on noise measurement and control (IH&S 527), as well as two semesters each on ergonomics and safety.

We will also continue to require an environmental elective and a safety and health elective, not to mention either a thesis or a Problem Report (see Table 4)

Table 4: Required Courses in the Industrial Hygiene Curriculum

Prog.	No.	Title	Credit	Required	Instructor
IENG	461	Systems Safety Engineering I, Fall	3	yes	Dr. Etherton
IENG	662	Systems Safety Engineering II, Spring	3	yes	Dr. Etherton
IENG	561	Industrial Hygiene Engineering (includes lab), Fall	4	yes	Dr. Myers
	561 lab	IH Engineering Lab, Fall (see above)		yes	Mr. Takacs
IH&S	725	Industrial Hygiene Sampling and Analyses, Spring	4	yes	Dr. Myers
IENG	564	Industrial Ergonomics, Fall	3	yes	Drs. Rider or Nimbarte
IENG	660	Human Factors System Design, Spring	3	yes	Drs. Rider or Nimbarte
IH&S	527	Industrial Hygiene Noise Assessment and Control, Fall	3	yes	Dr. Guffey
IH&S	528	Ventilation Control Technology, Fall	3	yes	Dr. Guffey
PCOL	562	Occupational Toxicology, Spring	3	yes	Dr. Reasor
PUBH	660	Public Health Epidemiology, Spring recommended	3	yes	Dr. Majuru
STAT	511	Graduate level statistics course, Fall	3	yes	Dr. Hobbs
Various		Environmental Elective	3	yes	
Various		Safety and Health Elective	3	yes	
IH&S 697		Masters thesis (6 credits) or a Problem Report (3 credits).	3 or 6	yes	Faculty

We believe that our students are thoroughly trained in sampling and analyses, ergonomics and human factors, noise, ventilation, and safety. In addition, they are given background training typical of IH programs nationwide in toxicology and epidemiology. Students who do not enter with substantial field experience or gain it from work experience while a student are strongly encouraged to take CMED 791A, an elective course which involves student IH inspection and recommendations to at least 3 industrial operations. However, nearly all students gain experience from a full-time, paying job in IH and safety during the summer. All students must complete a Project or Thesis (IH&S 697). Furthermore, hands-on laboratory experience is provided in courses, such as Industrial Hygiene Engineering (IENG 561), Ventilation (IH&S 528), Noise Control (IH&S 627), and Ergonomics (IENG 660 and 564). Statistical analyses are stressed in IENG 561 (industrial hygiene engineering), IH&S 725 (sampling and analyses), and IH&S 627 (noise). Report-writing is stressed in Industrial Hygiene (IENG 561, IH&S 725), Ventilation (IH&S 528), and Noise Control (IH&S 627).

Changes in the curriculum

During the 5-year period we began requiring a graduate course in statistics (STAT 511) in the first fall semester of attendance. IH&S 725 (advanced sampling) has always been strongly oriented to statistical analyses of realistic data sets. In the noise course we have increased the amount of statistical lectures and assignments for noise sampling data.

We have added a biohazard module to IENG 561 (sampling) and increased the time allotted to IAQ in the ventilation course. We have also added a module on non-ionizing radiation to the vent course.

In response to suggestions made by site visitors during the TPG site visit in Spring 2010, we plan to make several changes to the curriculum, including:

(1) Combining the two safety courses into a single course by removing redundancies between the two courses and within the two courses,

(2) Add a course with a strong risk assessment and management component

(3) Continue changes to the second ergonomics course to make it a research training course. As discussed earlier, as a course requirement, all students develop and defend a thesis proposal, do the research, and write a "thesis" and defend it before the class.

(4) Increase the emphasis on exposure assessment in the two sampling courses by removing topics redundant with other courses and redundant between the two courses.

Field experience – practicum

Internships (a paid position as an IH during the summer) are arranged so that students have a directed field experience if they have not gained it from either prior experience

or from working while in school. Nearly all students both work fulltime as IHs in the summer and part time as IHs during the school year. The IH program assists students with placement. To date, there have been far more opportunities for internships than we have students.

Years ago we required students to register for a specific internship course and to report on their activities for a grade when they returned. We discontinued that practice for these reasons: (1) we decided that the report was redundant since all were required to write reports as part of their work tasks, (2) their work mentors held them to high standards, (3) it was an extra expense for students, and (4) there were concerns about the University's legal liabilities. For those reasons, students continue to accept internships but their reports to the Program Coordinator are informal and not part of a course.

Our experience is that companies provide internships primarily to evaluate the student for permanent employment, but also to have special projects done. In every case, our students have been supervised by highly qualified industrial hygienists or safety professionals. All report being given challenging tasks that greatly enhanced their appreciation and understanding of IH methods.

Competencies enhanced in internships are varied but often include:

Practicum: Some students do a Masters Project instead of a thesis to meet graduation requirements. The Project must be approved by the student's Committee, which is chaired by a member of the graduate school, generally Drs. Guffey, or Myers. Professionals in the community (especially NIOSH) often serve on both thesis and project committees, but not as Chairs. Projects generally are intensive applications of industrial hygiene, safety and ergonomics knowledge to a particular company's array of problems and issues. They are excellent preparation for professional practice.

However, a Masters thesis is also good preparation for a practitioner because it challenges the student to do what professionals do when taking on a substantial problem (whether research or "practical"): (1) formulate the problem, (2) gather and describe background information, (3) organize and execute a plan of action, (4) solve problems along the way, (5) analyze the results of the investigation, (6) draw conclusions and justify them, (6) make and defend recommendations, and (7) accurately and succinctly describe it all in a report.

Interdisciplinary experiences

WVU is in a particularly opportune location in Morgantown to integrate the course work of IH Masters students with students from other disciplines both within the University as well as in town. WVU and the CEMR are uniquely located next to three Divisions of the National Institute for Occupational Safety and Health, the Morgantown office of EG&G which has the occupational and environmental safety and health responsibilities for the Federal Energy Technology Center in Morgantown and Pittsburgh and the

Institute for Occupational and Environmental Health at the WVU School of medicine. As a result, they provide many research opportunities in the areas of:

Safety Research
Exposure Assessment
Toxicology
Engineering Control Technology
Ergonomics
Respirator Research
Industrial Hygiene

In addition, WVU is located near the National Research Center for Coal and Energy, which has funding in excess of $80M on coal and energy related research, with particular emphasis is:

Acid mine drainage remediation
|Small watershed improvement
Fossil fuel efficiency and improvement
Small mine safety and health

In the College, integrative research opportunities exist in many places including:

Civil engineering: construction safety for engineers
Civil Engineering: environmental site preparation, EIS surveys
Chemical Engineering: process safety for safety managers
Engineering of Mines: coal mine safety and health
Petroleum and Natural Gas Engineering: environmental site study
|Electrical and Computer Engineering: behavioral safety (expert systems)
Mechanical and Aerospace Engineering: regulatory climate and compliance

Training Program Evaluation

We are ABET accredited as an industrial hygiene Masters program. The assessment requirements completely overlap necessary assessments of the TPG other than financial ones.

To meet TPG/ABET requirements, we do extensive assessments of our program goals and how well we meet them. We review of goals and objectives with our Advisory Group, and we report our assessment results to them and discuss ideas to better meet our goals and objectives. The Advisory Group is comprised of alumni and others from all parts of the country who have achieved success in the fields of industrial hygiene, safety, and ergonomics. We meet at least once per year.

Our meeting with the IH Advisory Group each year is the culmination of nearly constant assessments. Those assessments, which are all discussed with the Advisory Group, including:

Quality and number of applicants and enrolled students

Review of admissions requirements

Review of the program goals and objectives

Review of the curriculum and how it matches the goals and objectives

Assessments of each required course based on the goals and objectives met by that course

Surveys of alumni and alumni employers (every 6 years)

Exit interviews with graduating students

Formal and informal discussions with the Student Local AIHA Section and with individual students

Measures taken to "close the loop" (i.e., improvements) based on all of the assessments

With the Advisory Group, we also discuss recruiting strategies, measures to further improve interactions with NIOSH-Morgantown scientists, and problems encountered by students in progressing through the program.

We assess success in meeting graduation goals by counting the number of graduates. We assess individual courses using individual ABET course assessments, which are based on evaluations of student competencies on competencies associated with each course. We assess our goals and methods not only by feedback from the Advisory Group but also by interviews with graduating students, alumni, and alumni employers.

In addition, the Program Coordinator frequently meets with individual students to elicit information about students' issues with individual courses and about the student's personal academic problems. If the student becomes part-time or full-time, these meetings are much more difficult to arrange.

Finally, faculty productivity and teaching effectiveness are evaluated in the normal academic manner, including annual review by a departmental promotion and tenure committee (P&T), IMSE Chair, College P&T Committee, and the Dean. Results of all of these evaluations are reviewed with the faculty member by the Chair of IMSE and the Chair of the IMSE P&T Committee. If necessary, a plan of action is agreed upon to improve productivity.

Tenure and promotion include the same review levels plus outside reviewers and review by the WVU Provost and President. Reviews consider productivity in teaching, research, and service to their professions, the University, and West Virginia. Teaching productivity is assessed mostly based on course loads and student evaluations.

Core faculty responsibilities for selected coursework

As shown in Table 4, almost all core coursework is taught by I.H. faculty. The core I.H. faculty includes Drs. Warren Myers (CIH), Kevin Rider, Ashish Nimbarte, and Steve Guffey (CIH), all from the IMSE Department. The two safety courses are taught by Dr. Etherton, an IMSE adjunct who is a retired NIOSH safety and ergonomics researcher. The other 3 required courses are taught in the School of Medicine.

Training Candidates

Qualifications

All students accepted into the I.H. program as regular students must meet ABET standards. Drs. Guffey, Myers, and Wiker evaluate the full application package of each candidate after Dr. Guffey reviews all applications initially to determine if the requirements have been met:

Bachelor's degree with a 3.0 GPA, preferably in engineering, a physical science, or a related field
Minimum of 63 hours of acceptable, college-level mathematics, science, engineering and technology
2 semesters of physics
2 semesters of chemistry
1 semester of statistics
1 semester of computer science
Organic chemistry is considered highly desirable but is not required of most students.
Biology or human physiology is considered highly desirable but is not required of most students..

The admission process involves initial screening of past academic performance, a review of the resume and letters of reference, and ranking of applicants based on previous field of study, previous institution, grade point average, previous work experience within and outside the field of safety and health. To be accepted as a regular student, a 3.0/4.0 GPA is required. Those applying with less than a 3.0 or with deficiencies in prerequisites may be accepted on a provisional status but are not considered for trainee grants, except perhaps for unusual cases. Provisional students can become regular students if they maintain a 3.0 and make up all course deficiencies in their 18 credit hours.

Letters of reference are accepted but rarely affect admissions decisions except in marginal cases since referees rarely criticize applicants. They do occasionally support applicant explanations of relatively low grades (i.e., personal hardship). Likewise, personal statements are accepted and read. Since the program director communicates with nearly all applicants, the same information is obtained in conversations.

Likewise, GRE scores are considered but affect only marginal cases during the selection process. We have found that some students with mediocre GRE scores have done well in the program and have done well as professionals, as evidenced by glowing, unsolicited testimonials from their employers. Personal characteristics are clearly very important to success.

Students from outside the program are admitted to IH classes with instructor approval. Their participation is encouraged since it provides a wider range of backgrounds and

viewpoints in the classes. The greatest number attend the 4 ergonomics courses provided to undergraduate and graduate students by Drs. Wiker and Nimbarte, and to a lesser degree by Dr. Rider. The IH sampling courses are required for the occupational medical and some MPH programs in the School of Medicine. The noise and ventilation courses are electives for graduate students in most CEMR engineering graduate programs.

Recruiting

Students are recruited nationally, but most applicants are West Virginia residents. The great majority are from West Virginia, with a substantial minority from Pennsylvania, Maryland, Ohio, and Virginia. Their undergraduate backgrounds are varied, with biology, chemistry, engineering, and environmental health and safety predominating. Many are referred to us by faculty in undergraduate safety and health programs at other institutions. WVU students know of us from two emails sent to all graduating seniors with GPAs above 3.0 in appropriate departments and from notices posted by faculty at universities in surrounding states. A significant fraction know of us from surfing the web and finding our web site or the Program Coordinator's personal website. Others were referred to us by members of the IH Advisory Committee and alumni.

To be funded by the TPG, trainees must have full-time status. In general, students accepted on a provisional basis will not be eligible for traineeships until the deficiencies are corrected (and rarely then). "Non-degree" and part time students are not eligible for traineeships or partial tuition support.

We have accepted 6 full time students at the time of this writing for Fall 2010; all indicate they will attend. We generally have 2-3 new students each spring, also. The great majority of our students each year are U.S. citizens or permanent residents. International students usually remain in the U.S. after graduating and become IH&S professionals. When all applications are completed and reviewed, we expect to have at least 7 students who are accepted for the academic year. Of that number, at least 6 will be eligible for traineeships.

Given today's economy, it is difficult to predict how applications will change in the future. Since we easily place every graduate in professional IH&S positions and all students who need them in paying internships during summers, we believe that applications are limited by knowledge of the existence and desirability of IH positions.

Monitoring Trainee Progress

Trainee progress in the program is monitored through a combination of individual advising sessions with Drs. Myers, Rider, Nimbarte, and Guffey for students taking their courses, and individual counseling and advising sessions by the Program Coordinator with each student at every opportunity. The instructors for the toxicology and epidemiology classes have been very good about contacting the Program Coordinator

when IH students have difficulty in their classes, leading to counseling with the Program Coordinator.

In the case where academic progress is not adequate, the College has the option of placing the student on probation or suspension. This rarely happens, but we do have occasional students who transfer to SAFM, usually within weeks of starting, reportedly because they believe that they cannot compete with other IH students. Undergraduate grades and GRE scores have not proven to be adequate predictors for these individuals.

List of publications

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