

INDUSTRIAL HYGIENE



Masters (MS and MPH) and Doctoral (PhD) Programs

STUDENT HANDBOOK

2014-2015

UNIVERSITY
OF MINNESOTA
**School of
Public Health**

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GENERAL DESCRIPTION

Students in the Industrial Hygiene masters programs may be enrolled in either the Master of Public Health (MPH) or Master of Science (MS) degree in Environmental Health. The MPH, offered through the School of Public Health, is often thought to be a terminal degree for practitioners, although it is possible to proceed to the doctoral program after obtaining this degree. The MS, offered through the Graduate School, is meant for both practitioners and those contemplating careers in research or academic institutions. It can lead to further study toward the PhD.

There are very few differences between the two degrees as offered in the Industrial Hygiene Program. Coursework, field experience, culminating experience, and other requirements are almost the same for the MPH and MS degrees. The specific differences between the MPH and MS degree options are as follows:

- Students taking the MS degree must register for PubH 6742 Ethics in Public Health: Research and Policy, while those in the MPH degree must register for PubH 6741 Ethics in Public Health: Professional Practice and Policy.
- Students pursuing the MS degree must prepare a Research Paper for their Culminating Experience (PubH 7194). Students pursuing an MPH degree may prepare either a Research Paper or a Literature Review for their Culminating Experience.

During the past 30 years, the Industrial Hygiene Program has been funded in part by the National Institute for Occupational Safety and Health (NIOSH) under its Education and Research Center (ERC) training scheme. That support provides financial assistance for qualified applicants. **The Industrial Hygiene Master's (MPH and MS) programs are accredited by the Applied Science Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), <http://www.abet.org>.** A master's degree from an ABET-accredited program will count for one year of work experience when applying for the certification (CIH) exam.

It is expected that the full program of study for the masters (MS or MPH) degrees in these two programs will be of two years duration, including courses, field experience, and culminating experience. **Students are expected to take a minimum of 46 semester credits of coursework (excluding the field experience and culminating experience). With the Field Experience (PubH 7196, 3 cr) and the Culminating Experience (PubH 7194, 3 cr), the total number of required credits is 52.**

MASTER'S PROGRAM CURRICULUM

The following courses are required of MS and MPH students entering the Industrial Hygiene (IH) Program during the 2014-2015 academic year. These courses will meet the requirements of the School of Public Health (SPH), Division of Environmental Health Sciences (EnHS), Occupational Health and Safety (OH&S), and the IH Program.

School of Public Health Core Requirements:

(Note: These courses can be taken on-line during Fall, Spring & Summer semesters)

PubH 6020	Fundamentals of Social and Behavioral Science	3 cr
PubH 6320	Fundamentals of Epidemiology	3 cr
PubH 6450	Biostatistics I	4 cr
PubH 6741	Ethics in Public Health: Professional Practice and Policy	1 cr (MPH)
PubH 6742	Ethics in Public Health: Research and Policy	1 cr (MS)
PubH 6751	Principles of Management in Health Services Organizations	2 cr

Division of Environmental Health Sciences Core Requirements:

PubH 6103	Exposure to Environmental Hazards	2 cr
PubH 6104	Environmental Health Effects: Introduction to Toxicology	2 cr
PubH 6105	Environmental and Occupational Health Policy	2 cr
PubH 7194	Culminating Experience: Environmental Health (Lit. Review/Research Paper)	3 cr (MPH)
PubH 7194	Culminating Experience: Environmental Health (Research Paper)	3 cr (MS)
PubH 7196	Field Experience: Environmental Health	3 cr

Occupational Health and Safety Core Requirements:

PubH 6130	Occupational Medicine: Principles and Practice	2 cr
PubH 6150	Interdisciplinary Evaluation of Occupational Health & Safety Field Problems	3 cr
PubH 6170	Introduction to Occupational Health and Safety	3 cr

Industrial Hygiene Program Requirements:

(Note: Most of these courses are offered in alternating years)

PubH 6172	Industrial Hygiene Applications	2 cr
PubH 6173	Exposure to Physical Agents	2 cr
PubH 6174	Control of Workplace Exposures	3 cr
PubH 6175	Environmental Measurements Laboratory	2 cr
PubH 6192	Measurement and Properties of Air Contaminants	2 cr
PubH 6193	Advanced Topics in Human Exposure Science	2 cr
INDUSTRIAL HYGIENE ELECTIVES		at least 6 cr

Industrial Hygiene Electives:

PubH 6100	Topics: Environmental Health (Complex Systems Modeling for Population Health)	2 cr
PubH 6112	Environmental Health Risk Assessment	2 cr
PubH 6115	Worker Protection Law	1 cr
PubH 6116	Environmental Law	1 cr
PubH 6120	Injury Prevention in the Workplace, Community, and Home	2 cr
PubH 6131	Working in Global Health	2 cr
PubH 6132	Air, Water, and Health	2 cr
PubH 6140	Occupational and Environmental Epidemiology	2 cr
PubH 6161	Regulatory Toxicology	2 cr
PubH 6162	Biomarkers	2 cr
PubH 6182	Emerging Infectious Disease	3 cr
PubH 6190	Environmental Chemistry	3 cr
PubH 6451	Biostatistics II	4 cr
CE 4561	Solid Hazardous Wastes	3 cr
CE 5551	Environmental Microbiology	3 cr
IE 5511	Human Factors and Work Analysis	4 cr
IE 5513	Engineering Safety	4 cr
Kin 5001	Foundations of Human Factors/Ergonomics	3 cr
ME 5113	Aerosol/Particle Engineering	4 cr
PA 5721	Energy and Environmental Policy	3 cr
Other courses approved by your academic advisor		

MINIMUM TOTAL CREDITS:**52 cr**

EXAMPLE INDUSTRIAL HYGIENE STUDENT COURSE PLAN

PLEASE NOTE: This course plan is an example; individual course plans may vary depending on the needs and interests of each student

Fall 1

PubH 6103	Exposure to Environmental Hazards	2 cr	TuTh 5:45 – 7:40 (first 7 weeks)
PubH 6104	Environmental Health Effects	2 cr	TuTh 5:45 – 7:40 (last 7 weeks)
PubH 6170	Introduction to Occupational Health and Safety	3 cr	W 2:30 – 5:30
PubH 6192	<i>Mgmt. and Props. of Air Contaminants (odd years)</i>	2 cr	WF 12:20 – 2:15 (first 7 weeks)
PubH 6193	<i>Adv. Topics in Human Exposure Science (odd years)</i>	2 cr	WF 12:20 – 2:15 (last 7 weeks)
PubH 6450	Biostatistics I	4 cr	TuTh 1:25 – 3:20 + lab
INDUSTRIAL HYGIENE ELECTIVES (even years)		2-4 cr	
		13-15 cr	

Spring 1

PubH 6105	Environmental and Occupational Health Policy	2 cr	Tu 6:00 – 7:55
PubH 6150	Interdisciplinary Evaluation of OH&S Field Problems	3 cr	Tu 10:10 – 1:10
PubH 6172	<i>IH Applications (odd years)</i>	2 cr	F 9:05 – 11:00
PubH 6173	<i>Exposure to Physical Agents (even years)</i>	2 cr	M 4:40 – 6:40
PubH 6174	<i>Control of Workplace Exposures (odd years)</i>	3 cr	M 4:40 – 7:40
PubH 6175	<i>Environmental Measurements Laboratory (even years)</i>	2 cr	W 12:20 – 4:25
INDUSTRIAL HYGIENE ELECTIVES		2-4 cr	
		11-14 cr	

Summer

PubH 7196	Field Experience	3 cr	
		3 cr	

Fall 2

PubH 6020	Fundamentals of Social and Behavioral Science	3 cr	TuTh 11:15 – 12:30
PubH 6192	<i>Mgmt. and Props. of Air Contaminants (odd years)</i>	2 cr	WF 12:20 – 2:15 (first 7 weeks)
PubH 6193	<i>Adv. Topics in Human Exposure Science (odd years)</i>	2 cr	WF 12:20 – 2:15 (last 7 weeks)
PubH 6320	Fundamentals of Epidemiology	3 cr	Tu 3:35 – 5:30 + lab
PubH 6741/2	Ethics in Public Health	1 cr	M 12:20 – 2:15 (half semester)
INDUSTRIAL HYGIENE ELECTIVES (even years)		2-4 cr	
		9-11 cr	

Spring 2

PubH 6130	Occupational Medicine	2 cr	W 5:00 – 7:00
PubH 6172	<i>IH Applications (odd years)</i>	2 cr	F 9:05 – 11:00
PubH 6173	<i>Exposure to Physical Agents (even years)</i>	2 cr	M 4:40 – 6:40
PubH 6174	<i>Control of Workplace Exposures (odd years)</i>	3 cr	M 4:40 – 7:40
PubH 6175	<i>Environmental Measurements Laboratory (even years)</i>	2 cr	W 12:20 – 4:25
PubH 6751	Principles of Mgmt. in Health Services Organizations	2 cr	on-line
PubH 7194	Culminating Experience	3 cr	
		11-12 cr	

TOTAL CREDITS (assuming 6 elective credits)

52 cr

FIELD EXPERIENCE

The requirement for field experience in environmental health (PubH 7196) is described in the 2014-2015 Student Guidebook for the Environmental Health MS and MPH degree programs. Please read this description carefully. The field experience is an important component of the Industrial Hygiene Program; it is usually pursued during the summer between first and second year.

Other options are available for fulfilling the field experience requirement, including part-time arrangements during the academic year. This should be arranged in consultation with your academic advisor. If you have previous relevant work experience and wish to be exempted from this requirement, you should first consult with your advisor. Generally, even those with previous experience are encouraged to consider doing additional field work, as another work experience in a different setting can broaden one's perspectives and skills.

Generally, announcements for field experience opportunities are received by the faculty or Division and communicated directly to students. You are then expected to contact the location directly. It is recommended that students begin searching for an appropriate field experience during early spring semester. Faculty do not generally become personally involved in screening students or arranging internships. However, if you are seeking some particular type of experience, your advisor may be able assist in identifying specific contacts or locations.

You must discuss your field experience plans with your academic advisor to assure that it meets expectations for an experience relevant to industrial hygiene. In general, faculty expect that these experiences should offer some variety in activities (a mixture of office and in-plant work) which encompass the full range of typical industrial hygiene principles (anticipating, recognizing, evaluating, and controlling hazards).

Field experiences should not consist of singular, office-related activities, such as reviewing material safety data sheets. An example of an appropriate field experience is one which offers a student an opportunity to:

- participate in exposure assessment
- measure or design ventilation systems or other controls
- write reports in which they describe results and make recommendations
- participate in decision-making and other opportunities which help them understand the role of an industrial hygienist in the organization
- observe and evaluate a variety of hazards
- interact with a broad range of people, including employees, engineers, management and health and safety professionals
- think creatively and apply their learning to specific problems and situations
- practice and learn new skills appropriate to the field

Students are expected to complete the on-line learning agreement for field experiences (<http://sph.umn.edu/students/current/fe/>) and ensure it is been approved by the preceptor, academic advisor and major coordinator before beginning the field experience. It is highly recommended that the student discuss these expectations and the planned field experience with both the preceptor and the advisor prior to completion of the on-line form.

If expectations are not met or the job description changes during the field experience, this should be communicated to the advisor. A revised form may be necessary in some circumstances. Students who fail to complete this form within the first two weeks of beginning the field experience may risk receiving a failing grade in this course upon completion of the field experience.

Upon completion of the field experience, students must complete an on-line report and evaluation about their experience and have the preceptor evaluate their participation. The academic advisor will then certify completion of the field experience by completing the final section of the on-line form and submitting a grade (satisfactory/non-satisfactory). A student will receive an incomplete until the field experience form has been completed.

Students may combine their field experience and culminating experience. This requires careful consultation with your academic advisor (who oversees the field experience), your culminating experience advisor (if different from the academic advisor) and your field experience preceptor. It is strongly recommended that a face-to-face meeting with all of the involved individuals be arranged during the early part of the field experience, in which the specific project is discussed and arranged. The field experience preceptor should receive copies of the expectations for Research Projects from both the Environmental Health Student Guidebook and the Industrial Hygiene Student Handbook. Your advisors will ensure that the supervisor clearly understands these expectations and the nature of their written and oral presentation. An organization may have trade secret and confidentiality issues with the written publication or oral reporting of sampling or other data. The culminating experience advisor, with the student, should ensure that such issues are discussed and resolved prior to the start of the project work. The advisor or the preceptor may request a written agreement. If this is the case, it may be appropriate to ask the Division Head to review such an agreement.

See the section on Culminating Experience for more details. Keep in mind the requirements for human subjects approval. These requirements apply to the data from exposure sampling in which you are involved or that has been previously performed.

CULMINATING EXPERIENCE

General requirements and guidelines for the Culminating Experience (PubH 7194) are described in the Environmental Health Major Student Handbook and should be carefully reviewed. Specific requirements and expectations for Culminating Experiences in the Industrial Hygiene Program are described here.

Students pursuing an MS degree are required to produce a research paper, which results from a single, data-based research project. Students pursuing a MPH degree may choose to complete either a research paper or a literature review. The literature review is in the nature of a critical review and typically involves some amount of data analysis and drawing inferences from the literature and the data analysis.

You should select a topic area with a project advisor who has relevant experience. Your project advisor may be your academic advisor, another faculty member in the IH program, another faculty member in Environmental Health, or a faculty member external to the Division (but with the appropriate affiliation status). Additional faculty may be consulted, if necessary, for advice and input on your project's design, implementation and presentation.

You should complete a Proposal Form once you have determined your topic. This should be submitted to your project advisor near the start of work on the project. Students are also encouraged to develop an outline (an example is included in this handbook) early in the project and submit this to the project advisor for review and comment.

Students should submit a written paper to the culminating experience advisor as soon as possible after completion of the research project. The advisor may return the paper for changes; several drafts may be required before the paper is considered acceptable. With the help of your culminating experience advisor, you should identify two additional faculty members to participate on your culminating experience examination committee. These are typically people who have some expertise or interest in the thesis topic. Graduate school requirements for the MS degree indicate that two of the committee members should be from the student's major and one should be from a minor or related field. The latter requirement means that students must identify a faculty person external to the Division (in another Division or Department) as the third member of their committee. It should also be kept in mind that all faculty must have an appointment in the Graduate School. While the requirements for the MPH are not as clearly defined, it is strongly recommended that students select a third member of their committee from outside the Division.

You should allow at least 1½ hours for your oral exam. At the oral examination, you will make a short oral presentation (using slides), which should take no longer than 30 minutes. The oral presentation is open to the public. After the presentation and a public question-and-answer period, you will meet alone with the culminating experience committee. Committee members are most likely to ask you questions about the specifics of your project, but they may also ask you questions about more general, but related, subjects from your course of study.

Research Paper (MS or MPH degrees) Guidelines

Be sure to review the guidelines in the Environmental Health Student Guidebook. In addition,

1. The project should address a theme relevant to the key principles of industrial hygiene: anticipating, recognizing, evaluating and controlling hazards.
2. The paper should address a specific problem and complete all of the steps required to address that problem, proceeding from its description and definition to methods for evaluating and controlling the problem. It is not necessary that controls be implemented as long as a discussion of the control options and their advantages and disadvantages are included.
3. A review of original literature should be carried out and described in the written project report.
4. The project may be carried out either in the laboratory or in a field setting (or a combination of these).
5. There must be some aspect of data gathering, in collaboration with a research advisor or another individual (e.g., field experience supervisor).
6. There should be an evaluation of the data (statistically, or otherwise).
7. The paper should include a discussion of the limitations of the data and how these limitations might be eliminated in the future.

Literature Review (MPH degree) Guidelines

In the case of a literature review, students must pose an original hypothesis that is tested qualitatively by reviewing published, peer-reviewed research on the question to determine if the hypothesis can be accepted or rejected. Hypotheses for literature reviews must be posed on topics for which there is not yet a clear consensus. Students are expected to accept or reject their hypothesis not only on the numbers of sources on either side of the question, but also using measures to assess the quality of the sources on either side.

HUMAN SUBJECTS

Keep in mind that the University of Minnesota Institutional Review Board (IRB) must approve all data-gathering for a thesis project that involves human subjects before it is begun. If you are using data previously gathered from human subjects (e.g., exposure sampling data), you must also obtain approval from this Program before undertaking your project. See the Environmental Health Student Guidebook for more details on human subjects requirements and approval.

COURSE EXEMPTION POLICY

Courses required for the Environmental Health major carry individual policies concerning exemption. Consult the Environmental Health Student Guidebook or the lead instructors for information about these policies.

Exemptions from course requirements in the Industrial Hygiene program may be granted by the lead faculty for a course. The only exception to this is for the Field Experience; an exemption to this must be approved by both the academic advisor and the Program Director.

Generally, the student is asked to provide documentation in the form of a transcript, course description, and course outline to demonstrate that the coursework has already been covered elsewhere. It is entirely up to the lead faculty to determine the applicability of other coursework. The lead faculty may also require students to take an exemption-qualifying exam. If the exemption is granted, the student's documentation and a letter from the faculty are placed in the student's file.

PROFESSIONAL ORGANIZATIONS

American Industrial Hygiene Association

The American Industrial Hygiene Association (AIHA) is a national organization for professionals working in the field of industrial hygiene or related fields. With approximately 15,000 members, this organization is based in Washington DC and carries out considerable lobbying and volunteer-based activities (through committees and other groups). Many states have one or more local sections of the AIHA, which are affiliated with the national association. Membership in the national organization (AIHA) is separate from membership in the local sections. The AIHA organizes and sponsors the American Industrial Hygiene Conference and Exposition (AIHce) each year during May or June. Together with the American Conference of Governmental Industrial Hygienists, the organization publishes the *Journal of Occupational and Environmental Hygiene* (<http://www.tandfonline.com/toc/uoeh20/current>)

The Upper Midwest Section of the AIHA has members from North and South Dakota, Minnesota, and Wisconsin. This section has regular meetings during the year (September to June), usually at lunchtime on the third Thursdays of the month. The membership fee is very reasonable and the section will subsidize half the cost of meetings for students (luncheon meetings are usually about \$15-20). It is highly recommended that you consider joining this group and participating in their meetings, which are an excellent way to meet alumni, many of who are familiar with internships and other opportunities in the Twin Cities. An additional perk is a regular annual membership directory.

American Board of Industrial Hygienists

The American Board of Industrial Hygienists (web site: <http://www.abih.org/>) is the certifying organization for the profession. Certification is an important step for most industrial hygienists—you are encouraged to review the educational, work and other requirements for obtaining and maintaining certification.

American Conference of Governmental Industrial Hygienists

The American Conference of Governmental Industrial Hygienists (ACGIH) is a second important professional organization comprised of industrial hygienists in research, academia, and government organizations. Industrial hygienists who work for businesses may be affiliate members, but do not have voting privileges. As a student, you are eligible for a student membership with this organization. (Web site: <http://www.acgih.org/>)

The ACGIH has a number of technical committees, the foremost of which address Threshold Limit Values, Ventilation, Air Sampling Instruments, and Air Sampling Procedures. Together with the AIHA, the organization publishes the monthly journal the *Journal of Occupational and Environmental Hygiene* (<http://www.tandfonline.com/toc/uoeh20/current>).

Academy of Certified Hazardous Materials Managers

The Academy of Certified Hazardous Materials Managers (ACHMM) is a professional organization that focuses on hazardous materials management. It is comprised of 54 chapters with 7000 members; its headquarters are in Rockville MD. (Web site: <http://qn.qn.net/~achmm/>) The Academy sponsors an annual conference.

The local North Star Chapter (web site: <http://www.achmm-nsc.org/>) has a student membership fee (you can register on-line). This organization has regular meetings and a newsletter.

Institute of Hazardous Materials Management

The Institute of Hazardous Materials Management (IHMM) is also located in Rockville MD (Web site: <http://vf.cyclenet.com/cow/mall/ihmm/index.html>). This organization manages the Certified Hazardous Materials Manger (CHMM) program, a certification in hazardous materials management based on work experience, education and a written test. This certification may be important for those industrial hygienists seeking professional work in the area of hazardous substances.

American Society of Safety Engineers

The American Society of Safety Engineers (ASSE) is a professional organization with 139 chapters and 54 student sections throughout the United States. The organization publishes the Professional Safety Journal and a newsletter and offers an annual conference. (Web Site: <http://www.asse.org/home.htm>). A membership application can be downloaded from the web site.

FINANCIAL SUPPORT

The Industrial Hygiene program has received funding to support masters and doctoral students from National Institute for Occupational Safety and Health (NIOSH), as part of the Midwest Center for Occupational Health and Safety (MCOHS), a NIOSH-funded Education and Research Center. These funds are dependent on a number of factors, including U.S. Congressional support of NIOSH, NIOSH support of individual programs, and the individual program's success in meeting NIOSH expectations. The NIOSH funds are available to United States citizens or permanent residents only.

The Industrial Hygiene program has been able to provide support in the form of tuition and stipend to most incoming masters and doctoral students who are U.S. citizens or permanent residents. It is our expectation that this funding will continue, dependent on those issues described above. Generally, we have been able to award full tuition support to both first- and second-year master's students. Availability of small levels of stipend support for students has varied from year to year. These awards do not carry any expectations with respect to an awardee's activities, other than to attend classes and maintain acceptable progress toward a degree.

NIOSH awardees in the full-time masters program are eligible to receive some support for travel to and expenses related to attendance at one of the American Industrial Hygiene Conference and Expositions (AIHce) while they are pursuing their degree. These funds are entirely contingent on availability (tuition and stipend needs have first priority). The expectations for students wishing to receive support for attendance at an AIHce are as follows:

- a. You must present a poster in the student poster session. The deadline for abstracts to this session is usually sometime in March. Check the AIHce website for more information about this.
- b. You must attend at least two full technical sessions (technical paper presentations or roundtables) while at the conference.

Other Sources of Financial Support

3M Company has established a paid internship program for industrial hygiene students, which will involve up to 899 hours of work conducting exposure assessments and similar activities at a variety of 3M locations. Students may use these internship experiences to fulfill their PubH 7196 Field Experience requirements. Consultation with and approval from an academic advisor are required **prior** to using an internship appointment for the field experience requirement.

Teaching Assistant and Research Assistant positions may be available with faculty in the Division of Environmental Health Sciences. These provide excellent opportunities to gain experience in teaching and research; they also serve as a means of reducing tuition costs (a 25% RA position, for example, will reduce tuition costs by 50%; a 50% position reduces tuition to nothing).

INDUSTRIAL HYGIENE CODE OF ETHICS

This code of ethics has been adopted by all of the major professional organizations for the field.

Objective

This canon provides standards of ethical conduct for Industrial Hygienists as they practice their profession and exercise their primary mission to protect the health and well-being of working people and the public from chemical, microbiological, and physical health hazards present at, or emanating from, the workplace.

Canons of Ethical Conduct

Industrial Hygienists shall:

1. Practice their profession following recognized scientific principles with the realization that the lives, health, and well-being of people may depend upon their professional judgment and that they are obligated to protect the health and well-being of people.
2. Counsel affected parties factually regarding potential health risks and precautions necessary to avoid adverse health effects.
3. Keep confidential personal and business information obtained during the exercise of industrial hygiene activities, except when required by law or overriding health and safety considerations.
4. Avoid circumstances where a compromise of professional judgment or conflict of interest may arise.
5. Perform services only in the areas of their competence.
6. Act responsibly to uphold the integrity of the profession.

AIHCE STUDENT POSTERS AND ABSTRACTS

Student Posters and Abstracts

As described above, if students wish to receive support for travel to the AIHce, held in May or June, they must deliver a poster presentation at the student poster session, usually held on Thursday afternoon of the conference week. The abstract deadline for this poster session is usually toward the end of March—your faculty will inform you of the exact date when it is published. The industrial hygiene faculty at the University of Alabama-Birmingham manages this program; Dr. Raynor has served as one of the faculty reviewers of these abstracts in the past. Abstracts are submitted on-line at the AIHce website (<http://aihce2015.org>, for the 2015 conference).

What to present? Two common sources of data for a poster are 1) project work undertaken in courses (e.g. PubH 6175 Environmental Measurements Laboratory) and 2) Culminating Experience projects. Faculty in the IH Program can assist you in identifying poster subjects.

The abstract must follow the guidelines outlined in the abstract form, with some additions:

- a. The name of your faculty advisor or course instructor (as appropriate) must be included in the abstract and listed as the second author.
- b. Your primary affiliation should be with the University of Minnesota. If you performed this work elsewhere (e.g. a company) you must be sure to obtain permission from the company before submitting the abstract. Your affiliation with this company may be indicated in the body of the abstract, if necessary. Your University of Minnesota affiliation should be listed after your name in the abstract title.
- c. Since abstracts may need to be re-written in a timely fashion after they are reviewed, you should list your address as: University of Minnesota, Division of Environmental Health Sciences, Mayo Mail Code 807, 420 Delaware St. SE, Minneapolis MN 55455. The fax number should be 612-626-4837 and you should indicate both your home phone number and the appropriate faculty member's phone as well. You should also include both your and the faculty member's email addresses.

It is strongly suggested that you ask Dr. Ramachandran or Dr. Raynor to review your abstract, as they are familiar with the criteria and expectations for abstracts.

FACULTY INFORMATION

The faculty of the Industrial Hygiene Program are:

Gurumurthy Ramachandran, PhD, CIH
Professor
Director of the Industrial Hygiene
Office: 612-626-5428
FAX (Division): 612-626-4837
email: ramac002@umn.edu

Peter Raynor, PhD
Associate Professor
Office: 612-625-7135
FAX (Division): 612-656-4837
email: praynor@umn.edu

The research interests and other activities of each faculty member are described in detail on the Division's web page (<http://www.sph.umn.edu/enhs/>) and the webpage for the Midwest Center for Occupational Health and Safety (http://www.mcohs.umn.edu/faculty_staff/index.html).

ADVISOR ROLES AND RESPONSIBILITIES

When you enter the program you will be assigned an academic advisor from among the program's faculty. This advisor is responsible for working with advisees to ensure they progress through the program in a timely manner, fulfilling the School, Division and Program requirements. You should arrange to meet with you advisors at least once each semester to discuss your plans and progress.

You are responsible for selecting your culminating experience advisor. Your academic advisor may serve as your culminating experience advisor, or you may select a separate advisor for your master's culminating experience. This will depend on the nature of your research project or literature review. In general, your culminating experience advisor should be selected from among the IH program faculty, although exceptions to this may be possible.

Your culminating experience advisor is generally selected before the end of the first year. This person is responsible for working closely with you on your project, ensuring that you are moving toward completion in a timely manner. Meetings with your culminating experience advisor may occur frequently as you pursue your project.

SUPPORT FOR CULMINATING EXPERIENCE RESEARCH PROJECTS

Student research can be supported in a variety of ways. If the project is performed at an external location, the work may be supported by that location. If the research is associated with a research grant or contract there may be funding available for equipment and supplies. If the student requires a small amount of funding for equipment or supplies, s/he may request monies from the program director, in consultation with the culminating experience advisor. Many projects do not require support. Generally, salary support for performing research is not available and should not be an expectation on the part of the student.

CERTIFICATION

Becoming a Certified Industrial Hygienist (CIH) is an important goal for many people in this profession. While this program is not specifically designed to either address or assure certification, the preparation received should be more than adequate for the certification examination. Students are strongly encouraged to read a description of the CIH process, found on the ABIH web site (<http://www.abih.org/>). It should be noted that a masters degree from a program with ABET accreditation (such as the University of Minnesota) will count toward one year of work experience.

ACCREDITATION

The Accreditation Board for Engineering and Technology (<http://www.abet.org>) serves as the accrediting organization for masters-level industrial hygiene programs. **The Industrial Hygiene Master's (MPH and MS) programs are accredited by the Applied Science Accreditation Commission of ABET.** The accreditation is granted in six-year blocks. The University of Minnesota has most recently received accreditation for the 2014-2020 period. One of the requirements of accreditation is that your degree or transcript reflects your program—thus, when you complete this program the designation of industrial hygiene will be listed on your transcript.

EDUCATIONAL OBJECTIVES

The mission of the Industrial Hygiene Masters Program is to produce graduates who within three years of graduation are able to:

- ❖ Demonstrate a high level of technical and scientific competence in recognizing, evaluating and controlling occupational and environmental hazards.
- ❖ Be able to solve complex problems through a combination of observation, literature review, measurement and data analysis.
- ❖ Communicate effectively both orally and in writing with a wide range of constituents.
- ❖ Design and develop long-range goals and programs.
- ❖ Act and behave responsibly and ethically according to the industrial hygiene professional code of ethics.
- ❖ Understand the limits of their graduate education and seek on-going education and work experience for their professional advancement leading to professional certification.
- ❖ Be able to interact competently and professionally at all levels of an organization working as a fully-contributing member of a team and accepting independent work responsibilities with a high level of self-discipline.
- ❖ Use skills to benefit the community in recognizing work and environmental hazards and educating those responsible for eliminating these hazards.

PROGRAM OUTCOMES

Program Outcomes

In the broadest sense, the Industrial Hygiene Masters Program prepares students for professional practice, which means they will work toward the solution of a broad range of problems in a variety of settings. More specifically, this program is designed to develop knowledge and skills in the six key areas of Recognition, Evaluation, Control, Communication, Behavior and Management. For each of these key areas we expect students upon graduation to be able to:

Recognition

- R1. Identify health hazards of workplace processes and operations
- R2. Understand the relationship between exposures and health outcomes
- R3. Understand, interpret and apply occupational and environmental regulations
- R4. Identify and describe quantitative and qualitative aspects of hazards associated with specific sources and processes
- R5. Describe physical and chemical aspects of the generation of hazards
- R6. Recognize the influence of cultural and social factors in occupational health practices

Evaluation

- E1. Design and initiate research
- E2. Gather, manage, and analyze data
- E3. Assess risks to population health
- E4. Interpret and apply scientific findings
- E5. Measure and evaluate health and safety programs
- E6. Understand quantitative and qualitative aspects of exposure assessments, dose response, and risk characterization
- E7. Calculate, interpret, and apply statistical and epidemiological data
- E8. Design and implement an appropriate exposure assessment strategy
- E9. Understand basic principles of air sampling and its use for evaluating exposures and controls
- E10. Understand the interpretation and use of exposure guidelines
- E11. Prioritize hazards and exposures and the actions necessary for eliminating or controlling them

Control

- Con1. Design and implement work process interventions
- Con2. Recommend, evaluate and implement appropriate engineering, administrative and personal protective controls
- Con3. Select the most appropriate hazard control method(s) for a given situation
- Con4. Validate the effectiveness of selected hazard control methods

Communication

- Com1. Communicate effectively with variety of stakeholders (e.g. management, labor, etc.)

Com2. Produce effective written communication through scientific and technical summaries and reports

Com3. Interpret and disseminate policies

Com4. Design and deliver adult education programs

Com5. Communicate effectively with other safety and health professionals

Behavior

B1. Demonstrate awareness of diversity in social and cultural beliefs

B2. Demonstrate the importance of appropriate ethical performance and practice

B3. Demonstrate familiarity with and be able to use professional code of ethics

B4. Understand and apply laws and regulations

B5. Function effectively on an interdisciplinary team

B6. Value professional development

Management

M1. Work collaboratively in a team

M2. Formulate and implement guidelines and policies

M3. Manage resources effectively

M4. Develop and implement health and safety programs

M5. Display effective leadership

ASSESSING PROGRAM OUTCOMES

You are the most important source of information about the effectiveness of this educational program. Therefore, we may ask you periodically for feedback on how well we have accomplished our program outcomes. At the end of each academic year, we have a student get-together, during which we gather your input about your courses, the program, etc. At the end of your program, we will ask you to complete an anonymous written survey. Your input is very important to us. Please feel free to share your comments with us throughout the time you are here.

As a graduate of the program, we may contact you periodically for your input on how well the program prepared you for your work. Please keep us informed of your latest work address and email, so we can keep our list up-to-date. Plus—we really want to hear what you're doing!

DOCTORAL DEGREE REQUIREMENTS

In addition to the Graduate School and Division of Environmental Health Sciences requirements for doctoral students, the following criteria have been established for students pursuing a doctoral degree in the Industrial Hygiene Program.

Preliminary Written Exam

The preliminary written exam shall consist of both a research project proposal and a take-home exam. The guidelines for the research project proposal can be found in the handbook for students in the Environmental Health Sciences division. The examining committee for the research project proposal must include the industrial hygiene faculty not serving as the student's advisor.

The take-home portion of the preliminary written exam will consist of questions prepared by the industrial hygiene program faculty, including the advisor. The faculty member who prepared the question will be responsible for reviewing that question and determining whether the response warrants a pass or fail. The program faculty will meet to discuss the exam as a whole and reach a final determination. If the student does not receive a pass on the exam as a whole, the student may re-take the exam one additional time. The program faculty will, as a group, determine the content of the second exam, which may involve response revisions or preparation of responses to new questions.

The student will be expected to complete the take-home exam in a two-week period and must be completed entirely by the individual. Written resources, including books, journal articles and internet materials may be used as references. The student may not discuss the exam with anyone and may not seek assistance from any person.

The take-home examination will address the three primary topic areas of industrial hygiene: recognition, evaluation and control. The student will be expected to demonstrate proficiency in each of these areas by preparing a response that may include both qualitative and quantitative features. The following resources are recommended for each of these areas.

Recognition

Students should understand the steps necessary for identifying and prioritizing workplace hazards.

- OSHA and NIOSH standards and guidelines (www.osha.gov and www.cdc.gov/niosh)
- ACGIH TLV documentations
- ACGIH TLV BEI Booklet
- A Strategy for Assessing and Managing Exposures, AIHA (latest edition)
- The Occupational Environment: Its Evaluation and Control and Management, S. Dinardi, AIHA (latest edition)
- Occupational and Environmental Health: Recognizing and Preventing Disease and Injury, B.S. Levy, DH Wegman (latest edition)

Evaluation

Students should understand the interpretation of lognormal data, sampling strategies, types of sampling instruments, decision making based on exposure modeling and data interpretation, and properties of airborne contaminants.

- Occupational Exposure Assessment for Air Contaminants, G. Ramachandran
- Aerosol Technology, W. Hinds
- NIOSH Analytic Methods (www.cdc.gov/niosh)
- Mathematical Models for Estimating Occupational Exposure to Chemicals, AIHA (latest edition)

Control

Students should understand and be able to apply the hierarchy of controls. They should be able to demonstrate proficiency in selecting solutions ranging from engineering controls (e.g. ventilation) to personal protective equipment (e.g. gloves, respirators, etc.).

- Industrial Ventilation, ACGIH (latest edition)
- NIOSH Respirator Selection Logic
- NIOSH Pocket Guide
- The Occupational Environment: Its Evaluation and Control and Management, S. Dinardi, AIHA (latest edition)
- Other personal protection selection guidelines and tools