The doctoral program in Environmental Health Sciences at the Maryland Institute for Applied Environmental Health (MIAEH) master an essential core of knowledge in environmental and occupational health, epidemiology and biostatistics. Elective courses and rotations with faculty field studies and laboratories offer students the knowledge and skills needed to specialize within the broader area of environmental health and become independent researchers.

The PhD program consists of a minimum of 46 credit hours of graduate courses depending on the incoming student’s previous coursework. In particular, students without an MPH degree will require additional coursework as required by the public health accrediting body (CEPH). Graduate courses include (1) core courses within environmental health, epidemiology and biostatistics; (2) supporting courses in environmental health research, ethics, public health, and grant writing; (3) specialized courses selected within the research foci; and (4) dissertation credits. Program requirements for a PhD degree also include successful completion of a written and oral comprehensive exam, oral defense of a written dissertation research proposal, and a minimum of 12 credits of PhD dissertation research, written dissertation, and a final dissertation defense. It is anticipated that students will complete more than the minimum number of credits.

The curriculum for the Environmental Health Sciences PhD program is designed to provide an essential core of knowledge in environmental and occupational health, together with elective courses that offer students the background needed to specialize within this broad area.

**Curriculum Summary**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
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</thead>
<tbody>
<tr>
<td><strong>Core Courses</strong> (23 cr.*)</td>
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<tr>
<td>MIEH 600 Foundations of Environmental Health</td>
<td>3</td>
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<tr>
<td>MIEH 700 Applied Environmental Health</td>
<td>3</td>
</tr>
<tr>
<td>MIEH 720 Principles of Toxicology</td>
<td>3</td>
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<tr>
<td>MIEH 740 Risk Assessment</td>
<td>3</td>
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<tr>
<td>MIEH 771 Exposure Assessment of Environmental Hazards</td>
<td>3</td>
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<tr>
<td>SPHL 602 Foundations in Epidemiology and Biostatistics</td>
<td>4</td>
</tr>
<tr>
<td>SPHL 603 Public Health Data Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>EPIB 651 Biostatistics II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Supporting Courses</strong> (11-19 cr.*)</td>
<td></td>
</tr>
<tr>
<td>MIEH 609 Methods in Environmental Health (1 or 2 rotations)**</td>
<td>3 to 6</td>
</tr>
<tr>
<td>SPHL 611 (Public Health Ethics), OR SPHL 612 (Research Ethics), or equivalent course</td>
<td>1</td>
</tr>
<tr>
<td>MIEH 688 Environmental Health Seminar**</td>
<td>3</td>
</tr>
<tr>
<td>Course(s) that will expose the student to core concepts in public health if not having prior MPH. This could include SPHL 600 or other courses that cover foundational areas of public health required for accreditation.</td>
<td>1 to 6</td>
</tr>
<tr>
<td>KNES 771 Grant Writing or Equivalent</td>
<td>3</td>
</tr>
</tbody>
</table>
### Course Credit Table

<table>
<thead>
<tr>
<th>COURSE</th>
<th>CREDIT</th>
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</thead>
<tbody>
<tr>
<td>Specialization Area (12-15 cr)***</td>
<td>12-15</td>
</tr>
<tr>
<td>The specialization area would be created by and tailored to each student. <strong>OPTION 1</strong> Student takes 2 lab rotations, THEN - 12 credits of specialization. <strong>OPTION 2</strong> Student takes 1 lab rotation, Then - 15 credits of specialization.</td>
<td></td>
</tr>
<tr>
<td>Dissertation</td>
<td>MIEH 899 Doctoral Dissertation Research</td>
</tr>
</tbody>
</table>

* Students could waive out of some of these courses with coursework taken at UMD or in previous master's programs.

** Students would not be able to waive out of all rotations or seminar requirements. Rotations can in physical labs or with faculty conducting non-laboratory based research. At least 1 rotation must be outside of the student's focus area.

*** Students would not be able to waive out of any of the 12 to 15 credits required for the specialization area. No more than 6 credits of MIEH 898 could be taken as part of the specialization area.

Students are able to customize their selection of courses and lab rotations based on their specific career objectives. Students must file with the graduate program director a preliminary plan of study, signed by their advisor, before registering for their first semester of classes and an amended plan of study before the end of their second semester. The program of study will describe how the proposed course work will meet the requirements of the core curriculum. The MIAEIH graduate program committee shall review all programs of study for pre-candidacy doctoral students on an annual basis to ensure that each student meets program requirements. The student’s examining committee gives final approval of a student’s coursework when the student is admitted to candidacy.

The program has a number of clear learning objectives.

1. Evaluate and prioritize the direct and indirect human, ecological, and safety effects of major environmental and occupational agents.

2. Identify and apply appropriate, state of the art, approaches for assessing, preventing, and controlling environmental and occupational hazards that pose risks to human health and safety.

3. Incorporate the role of psychosocial factors that affect susceptibility to adverse health outcomes following exposure to environmental and occupational hazards into assessment, prevention, and control strategies.

4. Identify vulnerable populations and develop and apply risk management and risk communication approaches that address issues of environmental justice and equity.

5. Apply the concepts regarding genetic and physiologic factors and mechanisms of toxicity to evaluate and improve assessment, prevention, and control strategies.

6. Evaluate policies and standards with respect to ethical considerations of and disparities in environmental and occupational health and use the evaluation to develop improved policies and standards.

7. Critique and apply current environmental risk assessment methods.

8. Synthesize environmental-occupational health knowledge to design and evaluate environmental-occupational health policies, programs and research. Integrate, synthesize and apply theory to practice in the context of a research study, policy development, and

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public health systems development.

9. Critique federal and state regulatory programs, guidelines, and authorities that control environmental-occupational health issues.

Course Descriptions:

SPHL600: Foundations of Public Health: An overview of the goals, functions, and methods of public health. After an introduction to the core concepts and tools used in public health research and practice, applications of these methodologies are considered in the context of current controversies/problems in public health. Students work together to develop strategies for prevention and control that taken into consideration different points of view, outside research, and impacts on individuals and communities.

SPHL602 Foundations of Epidemiology and Biostatistics: An introduction to conceptual and practical tools from epidemiology and biostatistics that are necessary for the study of public health problems. Students learn epidemiologic concepts and methods, and basic statistical concepts and procedures used in public health research through applications, hands-on experience, and interpretations of statistical findings.

SPHL603 Public Health Data: An introduction to the statistical software necessary to implement the epidemiology and biostatistics concepts covered in the course EPIB 602, Foundations of Epidemiology and Biostatistics through hands-on exercises.

SPHL612 Public Health Ethics: Overview and discussion of ethical issues that face public health practitioners.

SPHL612 Research Ethics: Overview and discussion of ethical issues that face public health researchers.

MIEH 600 Foundations in Environmental Health: Overview of the chemical, physical and biological hazards present in our living and working environment and their effects on human health. Topics include: exposure assessment, industrial hygiene and safety, pesticides, community and indoor pollution, food-borne diseases, solid and hazardous wastes, water resources, risk assessment, ecological issues and environmental laws.

MIEH 688 Seminar in the Maryland Institute for Applied Environmental Health: Current Topics in Environmental Health: Invited and in-house research seminars from guests, faculty members and students, as well as journal article discussions.

MIEH 720 Principles of Toxicology: Overview of toxicology, including exposure pathways, toxicokinetics, dermal toxicants, carcinogens, and genetic, reproductive, immuno-, nuero-, target organs, complex mixtures, structure-activity analysis, and determinants of hypo- and hyper-susceptibility. Case studies of global national and regional interest.
MIEH 730 Environmental Justice: This course will develop the concept environmental health disparities in terms of both exposures to pollutants and the built environment. It will further develop the requirement for fair treatment and meaningful involvement of all people regardless of race, color, sex, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies.

MIEH 735 Food Toxicology: From farm to fork- this course will discuss major sources and consequences of toxic contaminants and additives in our food. Exposure scenarios will include: naturally occurring toxins, contaminants introduced during food production and storage, and finally food adulteration.

MIEH 740 Environmental Health Risk Assessment: Review of the major methods of human and ecological risk assessment conducted by the U.S. Environmental Protection Agency. Emphasis on sources of uncertainty.

MIEH 760 Spatial Epidemiology: Students are provided with an introduction to spatial resources and methods specific to public health, with an emphasis on epidemiology and environmental applications. Students will be introduced to spatial resources, concepts, and tools relevant to public health research and practice.

MIEH 770 Law and Policy: Overview of laws that affect the environment, and the various ways in which businesses are regulated by the government in the interest of protecting the environment. International, Federal, state, and local laws and regulations related to the protection of human health and the regulation of environmental containments - biological, physical and chemical.


MIEH 773 Foodborne, Waterborne and Airborne Infectious Diseases: In-depth study of foodborne, waterborne and airborne diseases caused by bacteria, viruses and parasites. Topics will include sources and detection of causative agents; their transmission to humans via food, water, air and other environmental media; and methods of disease prevention, including food safety approaches and drinking water treatment. Classes include lectures, discussions, field-trips and hands-on field sampling and laboratory activities.

MIEH 780 Environmental and Occupational Hygiene: A synthesis of epidemiology, toxicology, exposure science, risk assessment, and policy. Emphasis will be on methods for prevention and control of injury and illness, the hierarchy of controls, current hot topics, and selected environmental and occupational injuries.

EPIB 611 Intermediate Epidemiology: Analysis of epidemiologic methods as applied to epidemiologic research, analysis of bias, confounding, effect modification issues, overview of design, implementation, and analysis of epidemiologic studies.

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EPIB621 Infectious Disease Epidemiology: This course provides an overview of the unique aspects of infectious diseases and the epidemiological methods used in their study, prevention, and control.

EPIB 641 Public Health and Research Ethics: Overview and discussion of ethical issues that face public health practitioners and researchers.

EPIB 651 Biostatistics II: Introduction to a variety of statistical tools with applications in public health, including one- and two-sample inference, nonparametric methods, categorical data, ANOVA, simple and multiple regression.

MEES 6080 Seminar in Marine-Estuarine-Environmental Sciences; Current Topics in Omics: Cell Biology, Genetics and Genomics

Applications and Admissions
Applicants must submit: Undergraduate transcripts, Graduate transcripts (if applicable), Graduate Record Examination (GRE) scores obtained within the last 5 years, letters of recommendation from 3 persons competent to judge the applicant’s probability of success on a doctoral program, and the Graduate School essay describing professional goals and relevant work and research experience. Students should submit application materials for the fall semester by December 1st of the prior year. This program does not accept applications for Spring semester admission.

In addition to Graduate School requirements, admission decisions for the PhD program will be based on the quality of previous undergraduate and graduate course work, strength of GRE scores, the relevance of prior work and research experience, and the congruence of professional goals with those of the program.

Student Technology Fluency
PhD students will acquire knowledge and competence relating to a wide range of technology skills, including retrieving, storing, and presenting public health information and data for research and practice. Required coursework will introduce students to geographic information systems used in public health surveillance, environmental health tracking systems, “smart home” technologies, and mobile devices for the continuous monitoring of chronic health problems. Students will also master innovative learning and information technologies (e.g., podcasting, weblogs) for disseminating health information.

PhD Comprehensive Examination and Admission to Candidacy Requirements
The exact timeline for initiating and completing the comprehensive exam will be agreed upon by the student and advisor in consultation with the program of study committee. For example, students entering the program with a relevant Master’s degree may initiate the exam as early as the end of the second semester if appropriate, whereas for those without a Master’s degree (or a Master’s degree with limited fit with the doctoral program) the end of the fifth semester may be more appropriate. The examining committee for their comprehensive exams must consist of a minimum of four Graduate Faculty members, three of whom must be full members of the Graduate Faculty in MIAEH and one committee member who must have a primary appointment outside of MIAEH. The student’s primary advisor will automatically be in committee and will serve

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The format of the written qualifying examination will consist of a) written questions from the examining committee, OR b) direction of the student to write an NIH R01-like research proposal (recommended) on a topic that will not be part of the dissertation research.

**NIH RO1 approach:** If the format of the exam is an NIH R01-like research proposal, the following process will take place. This activity provides an assessment of the student to independently generate a research proposal, thus the student should not seek help from anyone during this process. There are two components, a Written and an Oral. Decisions at each stage are based on the majority agreement of the committee.

**Part 1**
The student will initiate a research idea in the form of a **350 word Abstract, plus specific Aims** on a topic that can be closely aligned to, but not identical to, the student’s likely dissertation research. Thus, it is important that the abstract would use similar skills and related topics to the student’s final dissertation research.

These research ideas should include a **Title, Background, Hypothesis, Approach,** and at least two/three main **Aims**; each **Aim** should be explained in detail, including individual approach and expected outcome(s). The advisor and student, in consultation with the examination committee, will agree upon an official start date for the research idea development. The student will submit an initial draft of an abstract to the committee within two weeks. The committee will take one week to vote on both: a) whether this topic is suitable, and b) the abstract format and study approach is acceptable. If no revisions are needed, the committee members proceed with the steps below. If revisions are needed, the student shall submit revised abstracts no later than two weeks after the feedback is provided, the committee again has one week to review and then advice the student to proceed with the steps below.

**Part 2**
Once the abstract is approved, the student will have a maximum of **six weeks** to complete the NIH R01-like research proposal in accordance with NIH guidelines. However, it will not be required for the student to include preliminary data in the proposal. The preliminary data section of the proposal can expand upon supporting data in the published literature, as well as the expertise of the proposed research team. The student will not be able to seek the advice/recommendations of other people (i.e., statisticians, epidemiologists) during the six weeks of writing.

After **six weeks**, the student will submit the proposal to the committee and the committee members will have **two weeks** to provide feedback. Feedback can be in four different forms.

1. **Pass at the Ph.D. level**, where the student has satisfied the written qualifying requirements at the Ph.D. level and continues on to the oral portion of the qualifying exam.

2. **Revise and resubmit**, where the student must make revisions suggested by the committee and resubmit the exam within **four weeks**.

3. **Pass at the M.S. level**, where the student has satisfied the written qualifying requirements at the M.S. level and continues on to the oral portion of the qualifying exam.

4. **Fail**.

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Part 3
The oral portion of the examination will take place no earlier than 15 days after the written examination or research proposal has been deemed satisfactory by the committee. The oral qualifying examination will be based on the content of the written examination or NIH R01-like research proposal and other questions related to the topic covered in the core courses and the student’s area of specialization. The exam will consist of a short presentation by the student followed by a series of questions from the committee. The oral qualifying examination will be graded as follows: Pass Ph.D. level; Pass M.S. level; or Fail. A repeat will occur within two weeks if needed; the exam may only be taken twice if the first attempt is not successful.

Outline of the NIH RO1 component

# see text for possible outcomes. * o

Candidacy
After passing the written and oral examinations, at the Ph.D. level, the student will be admitted to candidacy and the examining committee will typically serve as the dissertation committee. The candidate will then write a dissertation research proposal in the form of an NIH R01-like research proposal in consultation with the committee, submit the written proposal to the committee at least two weeks prior to a scheduled oral defense of the proposal, and finalize the proposal following the oral defense. During the course of the research, the candidate will meet with the committee at least once every six months and the advisor/chair will submit a progress report, signed by all committee members, to the MIAEH Graduate Director following each meeting. The final Ph.D. dissertation shall contain a minimum of three chapters containing complete
manuscripts published or submitted for publication to peer-reviewed scientific journals prior to the final dissertation defense, together with such introductory, summary, and supporting materials as deemed appropriate by the dissertation committee. The procedures for the dissertation defense and examining committee are as specified in the Graduate School Catalog.

The committee is strongly encouraged to appoint a Deans Representative as early as possible in the process. This can be as early as the initiation point of the Qualifying Exams, and highly recommended to be in place once the student reaches candidacy. The Deans Representative can be voting or no voting, but this should be established at the outset. The Deans Representative should be outside of the tenure home of the advisor. Further details can be accessed from the Graduate School.

M.S. in Environmental Health Sciences
Although admission to the program is generally limited to students pursuing the Ph.D., students may elect to finish with a Master of Science in Environmental Health. Program requirements for the Thesis M.S. degree include meeting the course requirements outlined above (with any modifications made in consultation with the student’s committee), successful completion of written and oral comprehensive exams at the MS level (as described above) and the successful completion of a Master’s Thesis.

Completing the Master’s Thesis involves the following steps:

1. Selection of a Thesis topic in consultation with the student’s advisor.
2. Development of a Master’s Thesis proposal (5-15 pages) that details what is to be accomplished and how it will be done. The final structure of this proposal follows published University guidelines as referenced in the MIAEH MPH Project/Thesis Handbook which is available on the MIAEH website.
3. Approval of the Thesis proposal by the examining committee. The Thesis examining committee must be composed of at least three faculty members. All three members must be members of the Graduate Faculty of the University of Maryland. One of these three must be the student’s faculty advisor, who chairs the committee. In addition to the chair, at least one other member of the thesis examining committee must be a member of the Maryland Institute for Applied Environmental Health.
4. Completion of the Thesis research, which involves registering for 6 credits of MIEH799. It is expected that the thesis research will conform to what was approved by the Thesis examining committee. Before making any substantive changes to the proposed research, approval from the examining committee is required. The student must consult with their faculty advisor to determine which changes are substantive and require committee approval.
5. Preparation of a final written thesis (25+ pages) to cover all aspects of the work, with the requirement that 1 publishable manuscript is contained in the final thesis. University of Maryland Thesis and Dissertation Style Guides and Templates can be found online at www.gradschool.umd.edu. Click on Forms and Publications.
6. Successfully passing an oral defense conducted by the Thesis examining committee, ideally the same committee that approved the thesis proposal.

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