PhD in Toxicology and Environmental Health
Student Handbook and Advising Packet

The Doctorate of Toxicology (PhD) degree with a concentration in Environmental Health Sciences is a discipline that investigates biological, chemical, and physical factors that affect the health of a community. Students will master an essential core of knowledge in toxicology and environmental and occupational health, epidemiology and biostatistics. Elective courses and rotations with faculty field studies and laboratories will offer students the background and tools needed to specialize within the broad area of environmental health. Students will pursue dissertation research in a range of areas of faculty expertise including: environmental justice; environmental epidemiology; environmental impacts on risks for infectious disease; and health effects of air, food and water pollution/contamination, the built environment and climate change.

The doctoral program in Toxicology and Environmental Health is a 64-credit professional degree, depending upon entry qualification and prior courses; for example prior credit with an MPH in Environmental Health may exclude the requirement for many courses listed in Table 1. In general, PhD students will need to complete a minimum of 12 credits in Toxicology and Environmental and Occupational Health; 12 credits to cover the basic Biostatistics and Epidemiology courses; 6 credits in each of two specialized areas: (a) Environmental Epidemiology, (b) Environmental Justice, (c) Food Toxicology (d) Analytical Chemistry, (e) Environmental Microbiology, or another area of specialization formulated with the help of the students advisor; 1 credit in Ethics; 6 credits in lab rotations; 3 credits in Environmental Health Seminar; and 6 credits in the areas of Health Behavior and Health Service Administration (for students without a prior degree from a CEPH-accredited program or School of Public Health). Students without prior training in physiology are recommended to take mammalian physiology or an equivalent course before matriculation, or during the first semester. In addition, students who have never taken a technical or professional writing course are strongly encouraged to take one of these courses offered through the Department of English. Attendance at Environmental Health Seminars is required even if students are not enrolled in the seminar class that semester. Table 1 presents courses required for the Doctoral program.

<table>
<thead>
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<th>Table 1: PhD Program with Concentration in Environmental Health Sciences</th>
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<tbody>
<tr>
<td>Course Title</td>
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<tr>
<td>Toxicology and Environmental and Occupational Health</td>
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<tr>
<td>(12 credits)</td>
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<tr>
<td>MIEH 720 Principles of Toxicology</td>
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<tr>
<td>MIEH 740 Risk Assessment</td>
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<tr>
<td>MIEH 770 Law and Policy in Env. Health</td>
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<tr>
<td>MIEH 771 Exposure Assessment</td>
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<tr>
<td>Basic Epidemiology and Biostatistics</td>
</tr>
<tr>
<td>(12 credits)</td>
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<tr>
<td>EPIB 610 Epidemiology I</td>
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<tr>
<td>EPIB611 Epidemiology II</td>
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<tr>
<td>EPIB 650 Biostatistics I</td>
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<tr>
<td>EPIB 651 Biostatistics II</td>
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<tr>
<td>Environmental Epidemiology</td>
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<tr>
<td>(examples)</td>
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<tr>
<td>MIEH xxx Molecular Epidemiology Env. Health</td>
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<td>MIEH 760 Spatial Epidemiology</td>
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<td>EPIB 655 Longitudinal Data Analysis</td>
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<td>EPIB 620 Chronic Disease Epidemiology</td>
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<td>Environmental Justice</td>
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<td>(examples)</td>
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<td>MIEH 760 Spatial Epidemiology</td>
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<td>MIEH 730 Environmental Justice</td>
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Table 1: PhD Program with Concentration in Environmental Health Sciences

<table>
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<tr>
<th>(minimum credits)</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>least 6 credits each* (Total of 12 credits)</td>
<td>MIEH xxx Molecular Epidemiology Env. Health</td>
<td>3</td>
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<td></td>
<td>MIEH 898 Pre-Candidacy Research</td>
<td>3</td>
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<tr>
<td>Food Toxicology (examples)</td>
<td>MIEH xxx Molecular Epidemiology Env. Health</td>
<td>3</td>
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<tr>
<td></td>
<td>MIEH 735 Food Toxicology</td>
<td>3</td>
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<tr>
<td></td>
<td>NFSC620 Diet and Cancer Prevention</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MIEH 898 Pre-Candidacy Research</td>
<td>3</td>
</tr>
<tr>
<td>Analytical Chemistry</td>
<td>Discuss options with advisor</td>
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<tr>
<td>Environmental Microbiology (examples)</td>
<td>MIEH 773 Foodborne, Waterborne and Airborne Infectious Diseases</td>
<td>3</td>
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<tr>
<td></td>
<td>CBMG688L Bacterial Pathogenesis</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>NFSC Advanced Food Microbiology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>EPIB621 Infectious Disease Epidemiology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MIEH 898 Pre-Candidacy Research</td>
<td>3</td>
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<tr>
<td>Other Requirements (16 credits)</td>
<td>EPIB 641 Ethics in Public Health</td>
<td>1</td>
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<td></td>
<td>TOX 609 Methods in Toxicology (Lab Rotation)</td>
<td>6</td>
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<td></td>
<td>MIEH 688 Environmental Health Seminar</td>
<td>3</td>
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<td></td>
<td>HLTH 665 Health Behavior</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>HLSA 601 Health Service Administration</td>
<td>3</td>
</tr>
<tr>
<td>Dissertation Credits (12 credits)</td>
<td>TOXI 899 Dissertation</td>
<td>12</td>
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Students may, with approval from their advisor and committee, count prior course work taken at the University of Maryland or another university as meeting the basic requirements in epidemiology, biostatistics, and other required areas. However, at a minimum, students must take courses within the University of Maryland system to meet the requirements for 12 credits of toxicology and environmental and occupational health, 6 credits of laboratory rotations, and 6 credits each in two areas of specialization as described above.

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 MIAEH 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.

Table 2 presents competencies expected of all students who complete a PhD in Toxicology and Environmental Health at the University of Maryland, School of Public Health.

Table 2: Public Health Competencies: PhD Program in Toxicology and Environmental Health

<table>
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<th>Upon graduation a student should be able to:</th>
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<tr>
<td>1) Synthesize toxicological and environmental health knowledge identifying opportunities to advance the field of toxicology and environmental health.</td>
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2) Develop testable hypotheses that will advance the field of toxicology and environmental health.
3) Design and conduct research studies, analyze data and test hypotheses that advance the science of toxicology and environmental health.
4) Effectively communicate results of research to the scientific community.
5) Communicate research results in a way that makes new knowledge accessible to policy makers and stakeholders.
6) Demonstrate commitment to environmental health equity.
7) Demonstrate commitment to engaging impacted communities and populations in applied, action-oriented environmental health research.

**Course Descriptions:**

**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

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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.

MIEH (TBD) Molecular Epidemiology: An introduction to biomarkers of exposure and effect; and their theoretical and practical use in understanding the relationship between variations at the molecular / genetic level and the early detection, etiology or prognosis of important chronic diseases. (course in development for Fall 2012)

EPIB 610 Foundations of Epidemiology: Introduction to the discipline of epidemiology and its applications to health issues and practices. Basic epidemiologic concepts and methods will be covered.

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.

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 650 Biostatistics I: Basic statistical concepts and procedures for Public Health. Focus on applications, hands-on-experience, and interpretations of statistical findings.

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.

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MEES 608O Seminar in Marine-Estuarine-Environmental Sciences; Current Topics in Omics: Cell Biology, Genetics and Genomics

HLSA 601 Introduction to Health Systems: Management and leadership skills for effective public health planning, organization, management and administration. Emphasis is on the role of institutions in learning and behavioral change process, organizational theory, administration management, and coordinating provision of community health services.

HLTH 665 Health Behavior I: The psychological, social psychological, and sociological theories of health behavior. The relation of health knowledge, beliefs, attitudes, intentions, and behavior to preventive, illness, sick-role, and health utilization behaviors.

Sample Student Schedules
The student’s program plan could be completed as follows:

YEAR 1
Fall                          Spring
EPIB610 Epidemiology I        3    MIEH720 Toxicology          3
EPIB650 Biostatistics         3    MIEH 771 Exposure Assessment 3
BIOL708N Mammalian Physiology 3    EPIB611 Epidemiology II      3
MIEH773 Food, Waterborne Disease  3    EPIB651 Biostatistics II  3
MIEH688 Seminar in EH         1    MIEH688 Seminar in EH      1
13 credits                    13 credits

YEAR 2
Fall                          Spring
MIEH730 Environmental Justice 3    MIEH770 Law & Policy in EH   3
MIEH740 Risk Assessment       3    HLTH665 Health Behavior    3
EPIB621 Infectious Disease Epidem 3    TOXI609 Methods     3
TOXI609 Methods               3    MIEH760 Spatial Epidemiology 3
EPIB641 Ethics in Public Health 1
13 credits                    12 credits

YEAR 3
Fall                          Spring
HLSA601 Health Service Admin  3    TOXI899                     6
MEES698E Ecosystem Restoration 3
MEES608C Diseases in C. Bay   3
TOXI898                       3
12 credits                    6 credits

YEAR 4-5
Fall                          Spring
TOXI899                      6    TOXI899                     6
6 credits                     6 credits

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

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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 as chair. The format of the written qualifying examination will be set in coordination with the University System of Maryland Program in Toxicology steering committee and may 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 R01 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.

Written Exam
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. For example, if the student’s program of study/dissertation research focuses on immunological techniques, the proposals should not be in the field of epidemiological methodology and vice versa. Thus, it is important that the abstract would use similar skills and related topics to the student’s final dissertation research.

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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.

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**.

**Oral Exam**
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.

**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 initiative 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._

**Outline of the NIH RO1 component**

1. **STUDENT INITIATES ONE 350 WORD ABSTRACTS FOR COMMITTEE REVIEW**
   - **COMMITTEE REVIEWS ABSTRACT**
     - Revise if needed 2 weeks *
   - **STUDENT DEVELOPS A MODIFIED NIH RO1 LIKE PROPOSAL FROM ABSTRACT**
     - **COMMITTEE REVIEWS PROPOSAL**
       - Revise if needed 4 weeks *
   - **STUDENT PREPARES FOR ORAL PRESENTATION**
     - **COMMITTEE REVIEWS PRESENTATION**
       - Revise if needed 2 weeks *

   # see text for possible outcomes.  

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**M.S. in Toxicology with specialization in Environmental Health**

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 Toxicology with a specialization in Environmental Health. Specific program requirements for the _Non-Thesis M.S. degrees in toxicology_ 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 M.S. level (as described above), and a scholarly paper written under

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the direction of the student’s chosen advisor.

Program requirements for the **Thesis M.S. degree in toxicology** 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.