
# Department of Environmental Sciences and Engineering

# Graduate Student Handbook

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# I. Overview

## Chair's Statement (from Barbara J. Turpin, Ph.D.)

We're the nation's only Department of Environment Science and Engineering in a school of public health, and Gillings is the top *public* school of public health in the U.S. Our graduates are innovative problem-solvers who are particularly well prepared to design and implement effective environmental health solutions.

Today, preventable exposures to environmental agents account for 24 percent of disease globally. Climate and environmental change threaten food security, air and water quality and especially affect vulnerable populations. UNC Gilling's Department of Environmental Science and Engineering (ESE) is uniquely positioned to advance solutions to the looming environmental health problems. We're the nation's only Department of Environment Science and Engineering in a school of public health, and Gillings is the top *public* school of public health in the U.S. Our graduates take with them an integrated, interdisciplinary, quantitative, mechanistic education that links health risks back to sources. They are engaged in efforts to improve environmental quality locally and globally, including through technological innovation, effective environmental management, research and community engagement.

We are looking to the future and celebrating our past accomplishments as we prepare for our Centennial in a few short years (2021).

## Departmental Overview

Our department focuses on the interface between people and the environment.

Uniquely situated in a school of public health, our interdisciplinary programs in air quality and atmospheric processes, human exposure and health effects, and sustainable water resources draw from faculty expertise in the physical and life sciences, engineering and policy. Our research strengths include:

- Characterizing exposures to contaminants in air, water, soil and workplaces;
- Developing engineering and policy solutions to environmental risks;
- Molecular approaches to understanding diseases caused by toxic substances in the environment; and
- Overcoming environmental health challenges in developing countries.

This document is intended to provide a quick reference for graduate students in our department.

## Key Personnel

| Name and Title | Room |
|---|---|
| Barbara J. Turpin *Professor and Chair* | Rosenau 166 |
| Michael Aitken, *Director of Graduate Studies* | Rosenau 160 |
| Louise M. Ball Co-*Director of Undergraduate Studies* | Rosenau 158 |
| Jason Surratt, *Co-Director of Undergraduate Studies* | Rosenau 164 |
| TBA, *Student Services Director* | Rosenau 161 |

The Student Services Office is the first point of contact for any questions or concerns. A complete listing of faculty and staff is available online.

# II. Graduate Degree Descriptions

## Overview

The Gillings School maintains the Gillings Program Search, which outlines degree requirements, demographics, admissions information, and more. It does not supersede information on the Graduate School's Handbook, the UNC Catalog, or departmental guidelines. Prospective and current students are encouraged to contact ESE directly if they have any questions.

**Note:** *At UNC-Chapel Hill, the Graduate School administers graduate degrees and is the official School for graduate students. Its regulations, as set out in the Graduate School handbook, are the final authority on academic matters.*

All graduate degrees offered by ESE involve a culminating experience – a thesis (MS), technical report (MPH, MSEE, and MSPH), or dissertation (PhD). The culminating experiences provide students an opportunity to synthesize, integrate and apply knowledge and skills learned in coursework and other learning experiences and require students to demonstrate attainment of program competencies.

Upon admission, students are assigned an academic advisor from among ESE faculty. This person guides them in choosing an appropriate program of coursework and in forming an examination committee. Usually, the academic advisor will serve as the student's research advisor as well, though a research advisor from among other faculty (including adjunct faculty, or faculty in other departments) may be assigned. Both advisors will serve on the student's examination committee.

## Master of Science (MS) Degree

The MS degree is intended for incoming students with a strong background in the sciences or engineering and prepares them for advanced education or careers in research, practice or management in the field of environmental sciences and engineering.

Competencies developed by ESE faculty define what students should know and be able to do upon completion of the MS program. Competencies guide our curriculum planning process and serve as a measure against which student achievement is assessed. Following are the degree-specific competencies for the MS in Environmental Sciences and Engineering:

- Develop a depth of knowledge in one area within environmental sciences and engineering.
- Conduct original research in environmental sciences and engineering.
- Analyze, interpret and explain the results of original research.
- Review and synthesize a body of research literature.
- Obtain broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering.
- Demonstrate written and oral communication skills related to environmental sciences and engineering.
- Develop an understanding of basic concepts of public health.

Success in meeting these competencies is measured by the successful completion of all degree requirements, including course work, and a comprehensive oral examination, at which time the thesis is presented and defended. Additionally, students may prepare technical reports, present their work at seminars and at national or international meetings, and publish in peer-reviewed literature.

Our interdisciplinary programs in air quality and atmospheric processes, human exposure and health effects, and sustainable water resources offer a variety of primary and specialized courses intended to allow students to meet degree-specific competencies. Appendix A gives examples of coursework and activities through which students can meet the competencies associated with the MS.

**Degree Requirements:**

The requirements for the MS are governed by Graduate School and include:

- A minimum of 30 semester hours of credit, which can include no more than six semester hours of transferred credit, and an epidemiology requirement (this can be fulfilled by EPID 600 or ENVR 601, or another advanced EPID course). Students entering from Fall 2012 onward must also complete SPHG 600 (Introduction to Public Health), offered by the School.
- ENVR 400, the Departmental Seminar, must also be completed (15+ sessions must be attended) and is not included in these 30+ semester hours of credit;
- A minimum of 24 hours of formal graduate-level course work, which includes at least 15 credit hours of course work from the Department;
- A minimum of three hours of ENVR 993 (Master's Thesis), which is credit earned for the preparation and defense of a thesis; and
- A comprehensive oral examination.

MS Worksheet

### Master of Science in Public Health (MSPH) Degree

The MSPH is intended for incoming students with a strong background in the sciences or engineering. The MSPH prepares students for careers in practice, as well as for further studies and careers in advanced education, research or management in the field of public health with emphasis in environmental sciences and engineering. While it is accredited by CEPH as a professional public health degree, it is focused on both public health practice and coursework, and scientific research at the interface between public health and the environment.

Competencies developed by ESE faculty define what students should know and be able to do upon completion of the MSPH program. Competencies guide our curriculum planning process and serve as a measure against which student achievement is assessed. Following are the degree-specific competencies for the MSPH in Environmental Sciences and Engineering:

- Demonstrate broad knowledge in the core fields of public health and familiarity with public health practice.

- Identify and evaluate the relationships between sources of environmental contaminants and processes that affect the movement, fate and health effects of contaminants in the environment and human systems.
- Conduct original research in the environmental health sciences.
- Analyze, interpret and explain the results of original research.
- Explain and analyze the relationships between scientific knowledge, exposure, risk assessment, environmental management and environmental policy.
- Demonstrate written and oral communication skills related to environmental sciences and engineering issues within a public health context.
- Show broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering.

Students in the MSPH also develop core public health competencies that are fully described in the Gillings Schoolwide Handbook.

Success in achieving degree-specific and core public health competencies is measured by the successful completion of all degree requirements, including core courses in the School of Public Health; departmental course work; a practicum in the field; and a comprehensive oral examination, at which time a technical report is presented and defended. Students may also prepare other technical reports; present their work at seminars and at national or international meetings; and publish in the peer-reviewed literature.

Our interdisciplinary programs in air quality and atmospheric processes, human exposure and health effects, and sustainable water resources offer a variety of primary and specialized courses intended to allow students to meet degree-specific competencies, while the departmental and School-wide public health core courses are intended to help students achieve core and cross-cutting public health competencies. Appendices B and C give examples of coursework and activities through which students can meet the degree-specific and core and cross-cutting competencies associated with the MSPH.

**Degree Requirements:**

The requirements for the MSPH are governed by the Graduate School, the School of Public Health, and the Department. These requirements include:

- Formation of a three-member committee to guide the student's study and research;
- A minimum of 42 semester hours of credit, which can include no more than eight semester hours of transferred credit;
- A minimum of 24 hours of formal graduate-level coursework, which includes at least 15 credit hours of coursework from the Department;
- Completion of ENVR 400, the Departmental Seminar. ENVR 400, the Departmental Seminar, must also be completed (15+ sessions must be attended) and is not included in these 42+ credit hours;
- ENVR 430 and School of Public Health interdisciplinary core course requirements.
- Completion of ENVR 981, Practicum (see below);
- A minimum of three hours of ENVR 992 (Master's Technical Report), earned for the

- preparation and defense of a technical report;
- A comprehensive oral examination.

MSPH Worksheet

### Master of Public Health (MPH) Degree

The MPH degree is a terminal degree recognized as the standard professional degree in public health. This degree is intended for students with a prior background in health-related areas. And prepares graduates for careers in practice or management in the field of public health with emphasis in environmental sciences and engineering. It is accredited by CEPH as a public health degree.

Competencies developed by ESE faculty define what students should know and be able to do upon completion of the MPH program. Competencies guide our curriculum planning process and serve as a measure against which student achievement is assessed. Following are the degree-specific competencies for the MPH with a concentration in Environmental Health Sciences:

- Demonstrate broad knowledge in the core fields of public health and familiarity with public health practice.
- Identify and evaluate the relationships between sources of environmental contaminants and processes that affect the movement, fate and health effects of contaminants in the environment and human systems.
- Describe, utilize and critically evaluate the rationale for and approaches used to measure and model properties of environmental or human systems.
- Explain and analyze the relationships between scientific knowledge, exposure, risk assessment, environmental management and environmental policy.
- Demonstrate written and oral communication skills related to environmental sciences and engineering issues within a public health context.
- Show broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering, and show familiarity with public health practice.

Students in the MPH also develop core public health competencies that are fully described in the Gillings Schoolwide Handbook.

Success in achieving degree-specific and core public health competencies is measured by the successful completion of all degree requirements, including core courses in the School of Public Health; departmental course work; a practicum in the field; and a comprehensive oral examination, at which time a technical report is presented and defended. Students may also prepare other technical reports; present their work at seminars and at national or international meetings; and publish in the peer-reviewed literature.

Our interdisciplinary programs in air quality and atmospheric processes, human exposure and health effects, and sustainable water resources offer a variety of primary and specialized courses intended to allow students to meet degree-specific competencies while the departmental and School-wide public health core courses are intended to help students achieve core and cross-cutting public health competencies. Appendices C and D give

examples of coursework and activities through which students can meet the core and cross- cutting competencies and degree-specific competencies associated with the MPH.

**Degree Requirements**

The requirements for the MPH are governed by Graduate School requirements, and School of Public Health requirements. These requirements include:

- A minimum of 42 semester hours of credit, which can include no more than eight semester hours of transferred credit. ENVR 400, the Departmental Seminar, must also be completed (15+ sessions must be attended) and is not included in these 42+ hours of credit;
- A minimum of 24 hours of formal graduate-level course work, which includes at least 15 credit hours of course work from the Department;
- ENVR 430 and the interdisciplinary School core course requirements;
- A minimum of three hours of ENVR 992 (Masters Technical Report), which is credit earned for the preparation and oral defense of a technical report;
- A minimum of one hour of ENVR 981 (Practicum, see

below) Current MPH Worksheet

### Master of Science in Environmental Engineering (MSEE) Degree

The MSEE degree is a non-research, public health-oriented terminal degree intended for students interested in careers in environmental engineering practice. It is open only to those who possess an ABET-accredited (or equivalent) engineering degree.

## Degree Competencies

1. Define problems, needs, and objectives for which environmental engineering is relevant
2. Evaluate problems quantitatively using measurements or models (statistical, empirical, and/or mechanistic) of engineered systems or impacted natural environments.
3. Develop and design appropriate solutions which use technologies, facilities, monitoring, controls, or policies to solve environmental engineering problems.
4. Evaluate the effects of environmental engineering designs and assess the uncertainty involved in environmental systems.
5. Obtain a broad exposure to contemporary issues in environmental sciences, environmental health, and environmental engineering.

Assessment activities for these competencies are fulfilled through the successful completion of all degree requirements, including formal course work and a comprehensive oral examination, at which time the master's technical report is presented and defended. Students may also prepare other reports; present their work at seminars and at national or international meetings; and publish in the peer-reviewed literature.

Success in achieving these learning objectives is measured by the successful completion of all degree requirements, including formal course work and a comprehensive oral examination, at which time the master's technical report is presented and defended. Students may also prepare other reports; present their work at seminars and at national or international meetings; and publish in the peer-reviewed literature.

Our interdisciplinary programs in air quality and atmospheric processes, human exposure and health effects, and sustainable water resources offer a variety of primary and specialized courses intended to allow students to meet degree-specific competencies. Appendix E gives examples of coursework and activities through which students can meet the degree-specific competencies associated with the MSEE.

**Degree Requirements**

Students may be admitted to the MSEE degree program if they have completed an undergraduate curriculum in engineering from an ABET-accredited program or from a foreign institution with an equivalent program. Once admitted, the following requirements must be met:

**(1)** Students and their advisors should develop a written coursework plan during the first semester of study.

**(2)** Students must complete at least 12 hours of engineering coursework offered in the Department of Environmental Sciences and Engineering (see attached list) or graduate-level engineering courses from another institution. Courses taken at another institution must be approved by the student's advisor, and must not have counted toward an undergraduate degree elsewhere, if they are to count towards this requirement.

**(3)** Students who have not already had an undergraduate or graduate course in probability and statistics and an undergraduate or graduate course in the biological sciences must take an appropriate course on each topic while in the MSEE program. The acceptability of courses to fulfill these requirements should be decided after consultation with the student's advisor.

**(4)** MSEE student committees for the Technical Report must include at least two members from among the environmental engineering faculty. At least one committee member must hold a degree in engineering as noted in the list of engineering faculty.

**(5)** MSEE students must meet all other requirements of the Department, Gillings School of Global Public Health and the Graduate School. These requirements include:

- ENVR 400, ESE Seminar (1 credit) (Departmental requirement)
- ENVR 989, Envr. Crisis Management (Departmental requirement)
- A course in the principles of public health (3 credits) (School requirement)
- A course in epidemiology for environmental scientists (3 credits) (School requirement)
- A minimum of three credits for ENVR 992, Master's Technical Report (Graduate
- School requirement)
- A minimum of 24 credits in formal coursework (excludes credits for research, ENVR 400, ENVR 992) (Departmental requirement)
- A minimum of 12 credits in formal coursework must be an engineering elective (Departmental requirement)
- A minimum of 30 credits NOT including ENVR 400 (Graduate School and Departmental requirements)
- A minimum of 24 credits in residence; i.e., credit obtained through registration at UNC-CH (Graduate School requirement)

**(6)** In accordance with Graduate School rules, up to six credits toward the MSEE degree requirements can be transferred from graduate courses taken at a previously-attended institution if the course(s) were not counted toward requirements for the undergraduate degree.

**Requirements for a Master's Technical Report**
All students on the one year track are required to take the experiential course Environmental Crisis Management offered in Summer Semester I. This will be a culminating experience that features a multi-disciplinary team and a real-time simulation of environmental and humanitarian emergencies such as a train derailment, major chemical spill, disease outbreak, or population displacement. Students who are not participating in the one year program, but is focused on the research based thesis are not required to take this course.

**MSEE Technical Report** (3.0 credit-hours): An integrated Technical Report that focuses on either a problem during the Environmental Crisis Management course, or a separate engineering problem. In addition to the Technical Report, the project will be presented orally as part of the final comprehensive examination.

**Courses in ESE**
Please refer to the MSEE website (https://sph.unc.edu/envr/1yrmsee/) for the latest listings of courses. The website shows the courses listed as engineering electives that can be chosen and other courses in ESE that may be of interest to students in the MSEE program. Note that the general electives do not count toward the 12 hours of engineering coursework required for the MSEE degree.

**MSEE Worksheet**

### Doctor of Philosophy (PhD) Degree

The PhD, a terminal degree, is intended for students with a strong background in the sciences or engineering and prepares graduates for careers in basic and applied research, education, advanced practice, and management in the field of environmental sciences and engineering. Research, and publication in peer-reviewed journals, is a major focus of a PhD education.

Competencies developed by ESE faculty define what students should know and be able to do upon completion of the PhD program. Competencies guide our curriculum planning process and serve as a measure against which student achievement is assessed. Following are the degree-specific competencies for the PhD in Environmental Sciences and Engineering:

- Conceive, develop and conduct significant original research in environmental sciences and engineering.
- Apply advanced methodologies to research projects in environmental sciences and engineering.
- Analyze, interpret and explain the results of original research.

- Review and synthesize a body of research literature.
- Demonstrate written and oral communication skills related to research issues in environmental sciences and engineering.
- Obtain broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering.
- Develop an understanding of basic concepts of public health.

Success in achieving these learning objectives is measured by the successful completion of all degree requirements including formal course work; a comprehensive written examination; a preliminary oral examination; preparation of a dissertation; and final oral defense of the dissertation. All PhD students prepare a research proposal and present their work in the Departmental Seminar. Although not a requirement, most will present their work at national and international meetings and publish in the peer-reviewed literature.

Our interdisciplinary programs in air quality and atmospheric processes, human exposure and health effects, and sustainable water resources offer a variety of primary and specialized courses intended to allow students to meet degree-specific competencies. Appendix F gives examples of coursework and activities through which students can meet the degree-specific competencies associated with the PhD.

More information on the PhD degree is available in the Department's PhD Guidelines.

**Degree Requirements**

The requirements for the PhD are governed primarily by the Graduate School and include:

- Formation of a five-member (or more) committee tailored to the student's area of interest that guides all aspects of the student's study and research. A majority of the committee must be regular faculty at ESE, though an exception may be requested from the Graduate School via a written request from the Director of Graduate Studies;
- Mastery of knowledge in the major area, for which the number of course hours will vary;
- Completion of a supporting program of study that consists of at least 15 semester hours of course work, or a formal minor;
- Completion of a research skill requirement, previously a foreign language, but now typically six semester hours in an area such as statistics, mathematics, or computer science;
- Completion of ENVR 400, the Departmental Seminar (for PhD students, this requires a seminar presentation);
- Completion of PUBH 680/SPHG 600 (Introduction to Public Health), offered by the School, and an epidemiology requirement (fulfilled ENVR 601);
- Completion of a comprehensive examination consisting of written and oral components to examine the student's knowledge in the major and supporting or minor areas;
- Preparation, presentation, and defense of a dissertation proposal at the time of the oral component of the comprehensive examination; and
- Completion of a significant and original body of research, which requires a minimum of six semester hours of ENVR 991 (Research in ESE) and a minimum of six hours of ENVR 994 (Doctoral Dissertation), preparation of a dissertation, and a public, oral dissertation defense.

An *approximate* timeline for Ph.D. students at ESE is shown below:

| | Semesters after matriculation |
|---|---|
| 1. Admission | 0 |
| 2. Appoint Advisor | 0 |
| 3. Outline course program | 1 – 2 |
| 4. Select dissertation topic | 2 |
| 5. Select dissertation committee | 2 |
| 6. Approve course program | 2 – 3 |
| 7. Complete course work | 3 – 4 |
| 8. Residency requirement met | 4 (students are encouraged to apply earlier) |
| 9. Doctoral written examination (qualifying) | 3 – 5 |
| 10. Doctoral oral examination (qualifying) | 4 – 6 |
| 11. Completion of research | 7 |
| 12. Advisor approves dissertation draft | 8 |
| 13. Final oral examination and dissertation defense | 8 |
| 14. Graduation | 8 – 10 |

PhD Worksheet

## Other Degrees (Dual Degrees)

### Dual BS/MS, BSPH/MS, BS/MSPH and BS/MS Degrees ("Plus one" master's program)

Any STEM student on campus (a BSPH is not required) is eligible to apply for a dual or "plus one" master's degree at ESE, a program that allows a student graduating from UNC-Chapel Hill to complete a master's degree in a single year beyond the bachelor's. To participate, a graduating UNC student must have:

- 9 (MS) or 12 (MSPH) graduate-level (400 or above) credits beyond the requirements for their bachelor's program to transfer into their master's program
- A willing research advisor for the master's. Interested students should strive to identify an advisor as soon as possible, preferably in the fall of their junior year. This enables a student to begin research on the thesis project well before starting the master's
- A STEM major from UNC-Chapel Hill

A student should apply as early as possible in the senior year (preferably for Spring; the application is then deferred to Fall). The applicant should also fill out a course check sheet/contract form, available on the "Students" section of the ESE website.

The overall requirements for any "Plus One" master's degree are the same as for the regular master's degree (outlined above for each master's degree). Likewise, the degree-specific competencies are similar to the corresponding stand alone master's degree (given above; and below in the appropriate appendix) and the measures of success in mastering competencies are identical between corresponding degrees.

Students are encouraged to get in touch with the Student Services Office if they are interested in the "Plus One" program. A "Plus One" worksheet is required to be submitted to the Office in

the Fall of the student's senior year, outlining the student's degree, advisor, and courses that will be transferred.

### Dual Master's Programs with City and Regional Planning

The Department offers dual degrees with UNC-Chapel Hill's Department of City and Regional Planning (CRP), one of the oldest and most distinguished of its kind in the country. This allows a student to finish two master's degrees within three years. Students must fulfil the requirements of both degrees, though a single final research project can count for both departments, as long as it fulfils both sets of requirements. Any ESE master's degree can be taken as part of the joint degree. Typically, a student would spend one year in one department, the next in the other, and the final year finishing off the requirements for both degrees. Nine credits (for the MS and MSEE) or twelve credits (for the MPH or MSPH) may be cross-credited.

Students can, but need not, be admitted to both degrees simultaneously – i.e. a student could spend one year in one program before applying to the other, or a student could be admitted into one and decide later that they wish to embark on the other. However, admission to the two (ESE and CRP) degrees is a separate process.

As with dual degree programs offered entirely within ESE (above), degree requirements, degree-specific competencies and measures of success in mastering competencies are similar to the corresponding stand alone master's degree.

Students are encouraged to get in touch with the Student Services Office if they are interested in the dual degree program with CRP.

## Graduate Degree Requirements at a Glance

| Degree | MSPH | MPH | MSEE | MS | PhD |
|---|---|---|---|---|---|
| **Minimum Credits Required for Graduation** | 42 | 42 | 30 | 30 | No minimum overall, includes research skill, research hours and dissertation |
| **ENVR 400 (Does not count toward minimum credits)*** | ≥15 Seminars attended | ≥15 Seminars attended | ≥15 Seminars attended | ≥15 Seminars attended | ≥30 Seminars attended, plus a Seminar presentation |
| **Formal Coursework** | ≥24 credits | ≥24 credits | ≥24 credits | ≥24 credits | No minimum – ~2 years of graduate coursework |
| **Graduate Coursework in ENVR** | ≥15 credits | ≥15 credits | ≥15 credits | ≥15 credits | No minimum |
| **Engineering Coursework** | | | ≥12 credits | | |
| **Research Skill** | | | | | ≥6 credits |
| **Formal Minor (Optional)**** | ≥9 credits | ≥9 credits | ≥9 credits | ≥9 credits | ≥15 credits |
| **Public Health Core***** | REQUIRED | REQUIRED | | | |
| **Practicum (ENVR 981, 1+ credits)** | REQUIRED | REQUIRED | | | |
| **Introduction to Public Health Course†** | | | REQUIRED | REQUIRED | REQUIRED |
| **Coursework in Epidemiology‡** | | | | REQUIRED | REQUIRED |
| **Engineering Brief (ENVR 990)** | | | 2x1.5 credit (typical) ≥3 credits | | |
| **Research Hours (ENVR 991)** | ≥3 credits | ≥3 credits | | ≥3 credits | ≥6 credits |
| **Master's Thesis (ENVR 993)** | | | | ≥3 credits | |
| **Doctoral Dissertation (ENVR 994)** | | | | | ≥6 credits |
| **Committee††** | ≥3 members | ≥3 members | ≥3 members | ≥3 members | ≥5 members |
| | | | | | |

*Note feedback requirements on ENVR 400 website
**These credits are taken in addition to ENVR requirements
***Consists of ENVR 430, SPHG 711, 712, 713, 721, 722
†This may be SPHG 600 or PUBH 680
‡This may be EPID 600, ENVR 601, or another advanced EPID course
††The committee works with the student to tailor and approve each student's 1) program of courses, 2) research plan, 3) track progress to degree, and

4) assess the written and oral thesis, technical report or dissertation

# III. Academic Reminders

## ENVR 400, Departmental Seminar

All ESE masters and doctoral students have the following seminar requirement for graduation:

- For students pursuing masters degrees - receive credit for 15 seminars in the In-house Seminar Series within the time period to complete degree.
- For students pursuing doctoral degrees - receive credit for 30 seminars in the In-house Seminar Series with at least 15 before admission to candidacy, and present a seminar in the series no later than the semester before the one in which you plan to defend your dissertation. Seminar credits received by students while on the Masters track in this department carry over to the PhD track. Students are strongly encouraged to begin meeting this requirement in the first semester of their program.

Note that there is a feedback requirement as well (please see the ENVR 400 website for details and the complete rules).

Each semester the department offers between 8 and 10 seminars in the ENVR 400 series at a fixed time and place. See the ENVR 400 webpage for location and time.

The credit requirements for both Masters and Doctoral degrees are validated by the student enrolling in ENVR 400 **once** during each degree – **not** in each semester they are attending and providing feedback. This is usually the student's final semester, or the semester in which they will fulfil their requirement, whether it is the master's or doctoral. At the end of the semester of enrollment and provided all other requirements have been met, the credit sheet will show a "Y" in the two far right columns indicating that the student is cleared for graduation. If they do not meet the requirement in the semester they are enrolled, they will receive an incomplete that will require them to meet the seminar requirement within the next 12 months. If the student does not meet the requirement he/she will not be permitted to graduate. Please note that the credits obtained for ENVR 400 cannot be counted as part of the minimum number of credits required for graduation.

Students **must** bring their One Card and have it scanned in by the TA – if there is no scan, no credit will be recorded for the seminar. Late arrival (i.e. after completion of the introduction of the speaker) or early departure invalidates the student's participation in a seminar. No substitutions of other seminars will be accepted.

The seminars are intended to provide the students with exposure to the breadth of the research activities in the Department. Graduate students, post-docs, and faculty members will present seminars on a variety of topics. The seminars also provide an opportunity for doctoral students to gain experience with oral presentations of their research aimed at a diverse audience. The enrollment requirement is in place to encourage students to support their colleagues in this endeavor, to provide feedback to them, and to ask questions to gain a better understanding of their work.

If you have any questions related to the course requirements, please contact Dr. Howard Weinberg.

## ENVR 981, Practicum in Public Health

MSPH and MPH students must complete a practicum (ENVR 981) as part of their program (this is a Council on Education for Public Health requirement and only applies to “PH” degrees. This can be anything from one to nine credits. A rough guide is that one credit is equal to 45 hours working at the practicum site. For the BSPH program, this requirement is met by the capstone, or by the undergraduate practicum (ENVR 593).

The practicum is a planned, supervised and evaluated practice experience. The student will carry out a meaningful environmental health-related task or project in a professional setting, under the supervision of a qualified Preceptor who is a practicing Public Health professional and is identified ahead of time. The practicum may be paid or unpaid. ENVR 981 may be taken for a variable number of credit hours (minimum 1 credit), depending on the scope and duration of the proposed practical experience. Each ESE faculty member will have a section identified for this course and may serve as instructor/Departmental Representative (see below). A Practicum Committee consisting of at least three members of the ESE Faculty will oversee administration of the Practicum. The student must register for ENVR 981 for at least one semester before graduation, and may register for more than one semester. The experience is planned – by the student, the Department Representative and the Preceptor; - supervised - by the Preceptor; and - evaluated - by the Department Representative, the Preceptor, and the student.

*The Preceptor* must be a qualified professional in a field relevant to public health. Most preceptors are expected to be external to the University but can also be a credentialed faculty or staff member (such as a Certified Industrial Hygienist).

*Planning and Supervision.* Planning should include identification of the Competencies to be achieved. The Department Representative will usually be the student’s Faculty Advisor. When the Faculty Advisor or an acceptable substitute is not available, the Director of Graduate Studies or the Chair of the Practicum Committee will be designated to fill this role.

The format of the practicum experience is flexible. The fundamental requirement is that the basic stipulations (planned, evaluated and supervised, in a Public Health context) be met. Placements may be on an ad hoc basis consistent with the student’s own initiative, through professional contacts of the student’s Faculty Advisor, or arranged through the offices of the Practicum Committee. Examples of appropriate experiences include:

• Service projects undertaken at the request of external organizations such as Health Departments or community groups. The possibility of this type of placement occurs regularly (but unpredictably) in response to outbreaks of environmentally-transmitted disease outbreaks (e.g., Hepatitis A, Norovirus) or local sanitation issues (e.g., air or water quality issues, solid or liquid waste disposal). A qualified Preceptor can usually be identified from among the Health Department staff or Community Organizers.

• Volunteer outreach projects under the auspices of organizations such as Engineers Without Borders (EWB), a volunteer organization that partners with communities (typically in the developing world) to design, implement and maintain sustainable projects aimed at providing drinking water, sanitation, energy, and other necessities selected by the community. The UNC-Chapel Hill’s Daniel A. Okun Chapter has current projects in Peru, Ecuador, Mexico and

Moldova, and is providing technical support to the local Rogers-Eubanks Neighborhood Association on water and sanitation issues.

• Field experiences in on-site data collection. These may involve both an internal professional preceptor and an external preceptor. Examples of these have included:

- Occupational Hygiene. For example, sampling of airborne contaminants at workplace sites such as auto body shops or pesticide application areas.
- Environmental sampling in the vicinity of concentrated animal feeding operations (CAFOs), which are a health problem in eastern North Carolina.

• Internships with agencies such as water and energy utilities, environmental consulting firms, Public Health and Environmental Health Departments, non-governmental organizations (NGOs), federal agencies (e.g., US Environmental Protection Agency, National Institute for Environmental Health Sciences, Centers for Disease Control and Prevention), or international agencies (e.g., World Health Organization). These include paid positions such as Student Contractor and competitive summer internships. The Preceptor would usually be the workplace supervisor.

• Participation in a Project-based Course to which an external professional contributes substantially.

• Public Health Practice (PHP) component of a student's master's technical report project. Placement would usually be arranged through the student's Faculty Advisor. Agencies such as those identified above under Internships may provide suitable environments.

Opportunities such as Service Projects, Project-based Courses, and Internships are sometimes advertised through the ESE Student Services Office and administered (i.e., participant selection, matching) through the Practicum Committee. Field experiences and PHP research components will be arranged by the respective Faculty Advisor.

*Documentation.* The student shall keep a log of the hours dedicated to the practical experience that must include at least the following information: date, number of hours, and brief description of the tasks performed on each day. The log shall be signed by the student and the Preceptor, and submitted to the Department Representative and the ESE Student Services Office at the end of the semester. This document shall remain part of the student's file.

*Evaluation.* At the end of the practicum the student should turn in to the ESE Student Services Office an exit survey, adapted from current course evaluation forms. A 2-3 page paper in which the context, goals, accomplishments and impact of the practicum experience are succinctly and thoughtfully summarized should be submitted to the Department Representative and the Preceptor. This paper should, if appropriate, be incorporated into the section of the student's Technical Report in which the public health relevance and impact of the student's work is discussed. The student's committee is encouraged to pay especial attention to this section when evaluating the student's Technical Report. Additional evaluation criteria may be established by each instructor and, if any, communicated to the students registering for that instructor's section of ENVR 981 at the beginning of the relevant semester. The Department Representative and the Preceptor in consultation award a grade for the course based, in part, on the paper and any additional evaluation criteria (see above).

*Course Credit* will be awarded for ENVR 981 based on the time and effort commitment on the part of the student. Forty-five (45) hours of active effort will be considered equivalent to one

credit hour. Since the level of effort may not be predictable at the outset (particularly for service projects), the student should register for a conservatively low number of credits at the outset, and adjust registration in subsequent semesters as appropriate.

*Completion of the practicum requirement* is documented by the UNC School of Public Health Student Practicum Form, which includes: Proposed Title and Activities (200 words), List of Cross-cutting Competencies to be developed during the Practicum, and List of Discipline-specific Competencies to be developed during the Practicum. This form is to be filled in both prior to the practicum experience (when the competencies to be achieved are being planned) and after the experience has ended. At this time the activities and competencies actually achieved, and the duration of the practicum, will be reported.

## Finishing and Graduation

All graduate programs offered by the Department of Environmental Sciences and Engineering require the completion of a project. Doctoral students write a dissertation, MS students a master's thesis, and MSPH, MPH and MSEE students complete a technical report. Submission guidelines are as follows.

*Thesis (MS) and Dissertation (PhD)*

Please refer to the graduate school's submission instructions. After the thesis or dissertation is revised to the faculty advisor's satisfaction, the student will upload it to the ProQuest Theses and Dissertations database (note that there is a fee). The Graduate School will review it before it is published and may require some revisions (usually formatting) from the student.

The Department's student services office needs the confirmation email from the submission system, and notification from the advisor that it was ready to submit before any paperwork is processed.

*Technical Report (MSPH, MPH, MSEE)*

The Department requires that the student submit:

1) a digital (PDF) copy uploaded to the Carolina Digital Repository using this form. These will be checked by the student services office before being published on the CDR site. Embargoed reports will become "active" in the system after the embargo ends.

2) the student should check with their advisor to see whether they want a paper copy.

BSPH Honors students who write an honors thesis upload their thesis to the Carolina Digital Repository; they receive instructions on how to do this in due course.

The Graduate School has strict formatting guidelines for theses and dissertations; these are available on their website. MSPH, MPH, and MSEE students are strongly encouraged to adhere to these guidelines when submitting their technical reports.

## Guidelines for Formatting Theses, Dissertations and Technical Reports

Theses, Dissertations and Technical Reports should follow the formatting guidelines as laid out in the Graduate School's Thesis and Dissertation Guide.

### Guidelines for Submitting Theses, Dissertations and Technical Reports

These are currently outlined on the Submission of Final Work webpage. Currently, technical reports (MSEE, MSPH, MPH) are submitted to the Carolina Digital Repository; theses and dissertations (MS, PhD) are uploaded to the ProQuest database through the Graduate School.

## IV. Helpful Information

### Courses

A current listing of courses is available on our department's course page.

### Inter-Institutional Registration

UNC-Chapel Hill has inter-institutional agreements with Duke University, North Carolina State University, North Carolina Central University, and the UNC Campuses in Charlotte and Greensboro. More information is located here on the registrar's website. The form must be signed by the student and their advisor before being submitted to the Student Services Office.

### Faculty Research Interests

Please see our faculty research page here.

### Declaring a Minor or a Second Major

To declare a minor, **undergraduate students** at the Gillings School of Global Public Health must fill out the form on the Office of Student Affairs' website, and bring it to the ESE Student Services Office. The procedure for declaring a second major is quite different, and it is also located this page (note that this should be completed before the beginning of the student's junior year).

To request a minor, **graduate students** must fill out the appropriate form ("Minor Declaration Form" on the Graduate School's forms page, and bring it into the student services office. Note that the courses in the minor field must be completed *in addition* to ESE requirements for the graduate degree, as per the Graduate School's handbook.

### Waiving School of Public Health Requirements

Students may petition to waive School of Public Health course requirements if they possess the appropriate background, or they may substitute other courses in certain circumstances. More information is available on the Academic Forms and Policies website.

MS, MSEE and PhD students with previous public health degrees do not need to meet the SPHG 600/PUBH 680 requirement.

## Residency and Tuition Remission

The state of North Carolina distinguishes between residents and non-residents for tuition purposes. Non-residents must pay an out-of-state portion of tuition.

Information on residency is located here on the Graduate School's website. Non-residents are strongly encouraged by the Department to apply for residency as soon as they can. It is possible to obtain residency shortly after a year of living in North Carolina, but only if a substantial number of tasks (e.g. registering a vehicle, registering to vote, paying taxes in North Carolina) are completed within a short period of time after moving to the state. The intent of this process is to demonstrate that the student is intending to set up domicile in North Carolina – not simply live here to go to university.

International students cannot apply for residency, though permanent residents of the United States can (see the North Carolina State Residence Manual linked to from the Graduate School's website for more information).

## Insurance

If a student is on the RA/TA/Fellow (GSHIP) plan, they must waive the compulsory UNC insurance every semester. If a student is on other insurance (e.g. a spouse's) they must waive the compulsory UNC insurance every semester.

Otherwise, the student will be enrolled in the regular student plan (and be billed accordingly - $1200+/semester for 2018/19).

RAs, TAs and Fellows who are on the GSHIP should fill out the 1112.1.1f UNC-CH Graduate Student Health Insurance Program form and submit to the Student Services Office as soon as they can, preferably before August.

Note that for students graduating or coming off payroll, the GSHIP is cancelled quite soon afterward (the end of May for May graduates, or for those coming off payroll in May), so they should make other arrangements as soon as they can, whether through an employer or through the marketplace. Continuing students who are coming off payroll in May should know that university insurance will only be renewed in August. This is an issue yet to be addressed by the university.

## Fees Payroll Deduction

Students on Payroll (this does not include students who are being funded through disbursing from training grants) may request that their fees be deducted from their salaries in Fall and Spring. See the Student Services Office for more information.

## Policies for Changing Degree Programs and Advisors

Current students may change their master's degree program with the permission of their advisor.

Master's students interested in moving from a master's to a doctoral program should consult with their faculty advisor and the student services office. The Graduate School offers two options: proceeding beyond the master's, and bypassing the master's completely. The student is encouraged to talk with their advisor about which option to take.

Students may change their academic or research advisor if they find a willing new advisor to take them on. There is no formal process for this, but students should consult with their current advisor, particularly if they are being funded through a research assistantship with that advisor.

## Room and Audio/Video (AV) and Other Equipment Reservations

More information is located on the Gillings website.
Other equipment for check out as well as audio and video editing facilities are located in the basement of the Undergraduate Library.

## Poster Printing

ESE owns a poster printer available for the use of ESE-affiliated students, staff and faculty. It is located in Rosenau 149. Information on booking the printer is available.

## V. Appendices

### Appendix A. Degree-Specific Competencies for the MS in Environmental Sciences and Engineering and primary and representative elective (reinforcing) courses that fulfill one or more competencies.

MS candidates in ESE are required to complete a course in epidemiology (3 credits), an introductory public health course (3 credits), departmental seminar (1 credit), Master's research (≥3 credits) and write an MS thesis (≥3 credits). A minimum of 15 elective credits in ENVR classes is required. This table lists courses that primarily address departmental degree-specific competencies (P) and examples of elective ENVR courses that reinforce a competency (R), depending on the nature of the candidate's research*.

*Courses listed are required unless otherwise indicated.*

| **Courses and activities through which the degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 1. Develop a depth of knowledge in one area within environmental sciences and engineering | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 993 (P) Master's thesis | ENVR 419 (R) Chemical equilibria in natural waters (elective) | ENVR 421 (R) Environ. Health microbiology (elective) | ENVR 755 (R) Analysis of water resource systems (elective) | ENVR 756 (R) Physical/ chemical treatment processes (elective) | ENVR 682 (R) Water, sanitation, hygiene and global health (elective) | |
| 2. Conduct original research in environmental sciences and engineering | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 993 (P) Master's thesis | | | | | | |

| **Courses and activities through which the degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 3. Analyze, interpret and explain the results of original research | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 993 (P) Master's thesis | ENVR 411<br><br>(R) Laboratory techniques and field measurement (elective) | ENVR 470 (R) Environ. Risk assessment<br><br>(elective) | ENVR 765 (R) Model-based exposure modeling and risk assessment<br><br>(elective) | ENVR 570 (R) Methods of environ. decision analysis<br><br>(elective) | | |
| 4. Review and synthesize a body of research literature | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 993 (P) Master's thesis | ENVR 724(R) Current topics in environ. Analytical chemistry<br><br>(elective) | ENVR 687 (R) Writing WaSH-health papers<br><br>(elective) | ENVR 684 (R) Water-health research II<br><br>(elective) | | | |
| 5. Obtain broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering | ENVR 400 (P) Seminar series | ENVR 430 (P) Health effects of environ. agents | ENVR 610<br><br>(R) Global environ. health inequalities<br><br>(elective) | ENVR 775 (R) Global climate change: interdisciplinary objectives<br><br>(elective) | ENVR 682 (R) Water, sanitation, hygiene and global health<br><br>(elective) | ENVR 724<br><br>(R) Current topics in environ. Analytical chemistry<br><br>(elective) | | |

| **Courses and activities through which the degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 6. Demonstrate written and oral communication skills related to environmental sciences and engineering. | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 993 (P) Master's thesis | ENVR 780 (R) Current topics in environ. Analytical chemistry (elective) | ENVR 687 (R) Writing WaSH-health papers (elective) | ENVR 684 (R) Water-health research II (elective) | | | |
| 7. Develop an understanding of basic concepts of public health | ENVR 601 (P) Epidemiol. for environ. scientists and engineers | SPHG 600 (P) Introduction to public health | ENVR 610 (R) Global environ. health inequalities (elective) | ENVR 421 (R) Environ. health microbiology (elective) | ENVR 433 (R) Health hazards of industrial operations (elective) | ENVR 630 (R) Systems biology in environ. health (elective) | ENVR 650 (R) Principals of chemical carcinogen. (elective) | |

P=Primary, R=Reinforcing

* Our students choose their ESE elective classes based on focus area (air, water, health) rather than by degree. As an example, listed along with primary (required) courses are reinforcing electives a student focusing on water might choose to develop depth of knowledge.

## Appendix B. Degree-Specific Competencies for the MSPH in Environmental Sciences and Engineering and primary and representative elective (reinforcing) courses that fulfill one or more competencies.

MSPH candidates in ESE are required to complete the SPH public health core (ENVR 430, BIOS 600, EPID 600, HBEH 600 and HPM 600), departmental seminar (1 credit), Master's research (≥3 credits), a practicum (≥1 credit) and write a Master's technical report (≥3 credits). A minimum of 15 elective credits in ENVR classes is required. This table lists courses that primarily address departmental degree-specific competencies (P) and examples of elective ENVR courses that reinforce a competency (R), depending on the nature of the candidate's research.

*Courses listed are required unless otherwise indicated.*

| **Courses and activities through which the degree specific competencies are met*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| Demonstrate broad knowledge in the core fields of public health and familiarity with public health practice. | BIOS 600 (P) Biostatistics | EPID 600 (P) Principles of Epidemi-ology | HBEH 600 (P) Social and behavioral sciences in public health | HPM 600 (P) Introduction to health policy and manag. | ENVR 430 (P) Health effects of environ. agents | ENVR 992 (P) Master's Technical Report | ENVR 981 (R) Environ. sciences practicum | |
| Identify and evaluate the relationships between sources of environmental contaminants and processes that affect their movement, fate and health effects in the environment and human systems. | ENVR 430 (P) Health effects of environ. agents | ENVR 403 (P) Environ. chemistry processes (elective) | ENVR 771 (R) Exposure analysis (elective) | ENVR 682 (R) Water, sanitation, hygiene and global health (elective) | ENVR 468 (R) Advanced functions of temporal GIS (elective) | ENVR 675 (R) Air pollution, chemistry and physics (elective) | ENVR 765 (R) Model-based exposure mapping and risk analysis (elective) | |

| **Courses and activities through which the degree specific competencies are met*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| Conduct original research in the environmental health sciences. | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 992 (P) Master's technical report | | | | | | |
| Analyze, interpret and explain the results of original research. | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 992 (P) Master's technical report | ENVR 411 (R) Laboratory techniques and field measurement (elective) | ENVR 470 (R) Environ. Risk assessment (elective) | ENVR 765 (R) Model-based exposure modeling and risk assessment (elective) | ENVR 773 (R) Modeling atmospheric chemistry (elective) | ENVR 683 (R) Water-Health Research I (elective) | |
| Explain and analyze the relationships between scientific knowledge, exposure, risk assessment, environmental management and environmental policy. | ENVR 430 (P) Health effects of environ. agents | ENVR 742 (P) Theory and practice of evaluating human health risks of chemicals (elective) | ENVR 770 (R) Biological monitoring (elective) | ENVR 771 (R) Exposure analysis (elective) | ENVR 765 (R) Model-based exposure mapping and risk analysis (elective) | ENVR 850 (R) Systems analysis in environ. planning (elective) | ENVR 470 (P) Environ. Risk assessment (elective) | |

| **Courses and activities through which the degree specific competencies are met*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| Demonstrate written and oral communication skills related to environmental sciences and engineering issues within a public health context. | ENVR 981 (P) Environ. sciences practicum | ENVR 992 (P) Master's technical report | ENVR 890-3 (R) Air quality seminar (elective) | ENVR 724 (R) Current topics in environ. Analytical chemistry (elective) | ENVR 687 (R) Writing WaSH-health papers (elective) | ENVR 684 (R) Water-health research II (elective) | ENVR 780 (R) Urban water services planning and design (elective) | |
| Show broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering | ENVR 400 (P) Seminar series | ENVR 430 (P) Health effects of environ. agents | ENVR 724 (R) Current topics in environ. Analytical chemistry (elective) | ENVR 610 (R) Environ. health inequalities (elective) | ENVR 775 (R) Global climate change: interdisciplinary objectives (elective) | ENVR 682 (R) Water, sanitation, hygiene and global health (elective) | | |

P=Primary, R=Reinforcing

*The principal distinction between the MPH and MSPH is the nature of the research project culminating in the technical report. MSPH students generally conduct original research in a laboratory or field setting, while MPH students frequently conduct a literature survey or analyze a pre-existing data set.

## Appendix C. Public Health Core and Cross-cutting Competencies for the MSPH and MPH in Environmental Sciences and Engineering and primary and representative elective (reinforcing) courses that fulfill one or more competencies.

MSPH and MPH students in ESE complete the SPH core curriculum (BIOS 600, ENVR 430, EPID 600, HPM 600 and HBHE 600) as well as 15 credits of elective ENVR courses, a practicum and a technical report. This table lists SPH core courses that primarily address (P) or reinforce (R) a core or cross-cutting competency. Also given is as a single example of an elective course that reinforces a competency. Competencies that may in some cases be addressed by the technical report or practicum are identified.

*Courses listed are required unless otherwise indicated.*

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| **Biostatistics** | | | | | | | | |
| 1. Describe the roles biostatistics serves in the discipline of public health | BIOS 600 Principles of Statistical Inference (P) | ENVR 470<br><br>Environmental Risk Assessment (R)<br><br>(elective) | | | | | | |
| 2. Distinguish among the different measurement scales and the implication for selection of statistical methods to be used based on these directions | BIOS 600 Principles of Statistical Inference (P) | ENVR 765<br><br>Model-Based Exposure Mapping and Risk Assessment (R)<br><br>(elective) | | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 3. Apply descriptive techniques commonly used to summarize public health data | BIOS 600 Principles of Statistical Inference (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 468<br>Advanced Functions of Temporal GIS (R)<br>(elective) | | | | |
| 4. Describe basic concepts of probability, random variation and commonly used probability distributions | BIOS 600 Principles of Statistical Inference (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 570<br>Methods of Environmental Decision Analysis (R)<br>(elective) | | | | |
| 5. Apply common statistical methods for inference | BIOS 600 Principles of Statistical Inference (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 765<br>Model-Based Exposure Mapping and Risk Assessment (R)<br>(elective) | | | | |
| 6. Describe preferred methodological alternatives according to the type of study design for answering a particular research question | BIOS 600 Principles of Statistical Inference (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 7. Apply descriptive and inferential methodologies according to the type of study design for answering a particular research question | BIOS 600 Principles of Statistical Inference (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 755<br>Analysis of Water Resource Systems (R)<br>(elective) | | | | |
| 8. Interpret results for statistical analysis found in public health | BIOS 600 Principles of Statistical Inference (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 570<br>Methods of Environmental Decision Analysis (R)<br>(elective) | | | | |
| 9. Develop written and oral presentations based on statistical analyses for public health professionals and educated lay audiences | BIOS 600 Principles of Statistical Inference (P) | ENVR 992<br>Master's Technical Report (R) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 684<br>Water Health-Research II (R)<br>(elective) | | | | |
| 10. Apply basic informatics techniques with vital statistics and public health records. In the description of public health characteristics and in public health research and evaluation | BIOS 600 Principles of Statistical Inference (P)<br>BIOS 600 Principles of Statistical Inference (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 423<br>Industrial Medicine and Toxicology (R)<br>(elective) | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| **Environmental Sciences and Engineering** | | | | | | | | |
| 1. Specify approaches for assessing, preventing and controlling environmental hazards that pose risks to human health and safety | ENVR 430<br><br>Health Effects of Environmental Agents (P) | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | ENVR 780<br><br>Urban Water Services Planning and Design (R)<br><br>(elective) | | | | |
| 2. Describe the direct and indirect human, ecological and safety effects of major environmental and occupational agents | | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | ENVR 421<br><br>Environmental Health Microbiology (R)<br><br>(elective) | | | | |
| 3. Specify current environmental risk assessment methods | ENVR 430<br><br>Health Effects of Environmental Agents (P) | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | ENVR 470<br><br>Environmental Risk Assessment (R)<br><br>(elective) | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 4. Describe genetic, physiologic and psychosocial factors that affect susceptibility to adverse health outcomes following exposure to environmental hazards | ENVR 430 Health Effects of Environmental Agents (P) | ENVR 630 Systems Biology in Environmental Health (R)<br><br>(elective) | | | | | | |
| 5. Discuss various risk management and risk communication approaches in relation to issues of environmental justice and equity | ENVR 430<br><br>Health Effects of Environmental Agents (P) | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | ENVR 570<br><br>Methods of Environmental Decision Analysis (P)<br><br>(elective) | | | | |
| 6. Explain the general mechanisms of toxicity in eliciting a toxic response to various environmental exposures | ENVR 430<br><br>Health Effects of Environmental Agents (P) | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | ENVR 442<br><br>Biochemical and Molecular Toxicology (R)<br><br>(elective) | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 7. Develop a testable model of environmental insult | ENVR 430<br>Health Effects of Environmental Agents (P) | ENVR 981<br>Environmental Sciences Practicum (P) | ENVR 992<br>Master's Technical Report (P) | ENVR 765<br>Model-Based Exposure Mapping and Risk Assessment (R)<br>(elective) | | | | |
| 8. Describe federal and state regulatory programs, guidelines and authorities that control environmental health issues | ENVR 430<br>Health Effects of Environmental Agents (P) | ENVR 432 Occupational Safety and Ergonomics (R)<br>(elective) | | | | | | |
| **Epidemiology** | | | | | | | | |
| 1. Explain the application of epidemiology for informing scientific, ethical, economic and political discussion of health issues | EPID 600 Principles of Epidemiology (P) | ENVR 432 Occupational Safety and Ergonomics (R)<br>(elective) | | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 2. Apply the basic terminology and definitions of epidemiology | EPID 600 Principles of Epidemiology (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 421<br>Environmental Health Microbiology (R)<br>(elective) | | | | |
| 3. Identify key sources of data for epidemiologic reports | EPID 600 Principles of Epidemiology (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 423<br>Industrial Medicine and Toxicology (R)<br>(elective) | | | | |
| 4. Calculate basic epidemiology measures | EPID 600 Principles of Epidemiology (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 470<br>Environmental Risk Assessment (R)<br>(elective) | | | | |
| 5. Evaluate the strengths and limitations of epidemiologic reports | EPID 600 Principles of Epidemiology (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 6. Draw appropriate inferences from epidemiologic data | EPID 600 Principles of Epidemiology (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 470<br>Environmental Risk Assessment (R)<br>(elective) | | | | |
| 7. Communicate epidemiologic information to lay and professional audiences | EPID 600 Principles of Epidemiology (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | | | | | |
| 8. Comprehend basic ethical and legal principles pertaining to the collection, maintenance, use and dissemination of epidemiologic data | EPID 600 Principles of Epidemiology (P) | ENVR 423<br>Industrial Medicine and Toxicology (R)<br>(elective) | | | | | | |
| 9. Identify the principles and limitations of public health screening programs | EPID 600 Principles of Epidemiology (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | | | | | |
| **Health Behavior and Health Education** | | | | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 1. Describe the role of social and community factors in both the onset and solution of public health problems. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br><br>Environmental Sciences Practicum (R) | ENVR 992<br><br>Master's Technical Report (R) | ENVR 582 Sanitation in Developing Countries (R)<br><br>(elective) | | | | |
| 2. Identify the causes of social and behavioral factors that affect health of individuals and populations. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br><br>Environmental Sciences Practicum (R) | ENVR 992<br><br>Master's Technical Report (R) | ENVR 610<br><br>Global Environmental Health Inequalities (R)<br><br>(elective) | | | | |
| 3. Identify basic theories, concepts and models from a range of social and behavioral disciplines that are used in public health research and practice. | HBEH 600 Social and Behavioral Science in Public Health (P) | | | | | | | |
| 4. Apply ethical principles to public health program planning, implementation and evaluation. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br><br>Environmental Sciences Practicum (R) | ENVR 992<br><br>Master's Technical Report (R) | ENVR 780<br><br>Urban Water Services Planning and Design (R)<br><br>(elective) | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 5. Specify multiple targets and levels of intervention for social and behavioral science programs and/or policies. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 423<br>Industrial Medicine and Toxicology (R)<br>(elective) | | | | |
| 6. Identify individual, organizational and community concerns, assets, resources and deficits for social and behavioral science interventions. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 423<br>Industrial Medicine and Toxicology (R)<br>(elective) | | | | |
| 7. Use evidence-based approaches in the development and evaluation of social and behavioral science interventions. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | | | | | |
| 8. Describe the merits of social and behavioral science interventions and policies. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 9. Describe steps and procedures for the planning, implementation and evaluation of public health programs, policies and interventions. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 755<br>Analysis of Water Resource Systems (R)<br>(elective) | | | | |
| 10. Identify critical stakeholders for the planning, implementation and evaluation of public health programs, policies and interventions. | HBEH 600 Social and Behavioral Science in Public Health (P) | ENVR 981<br>Environmental Sciences Practicum (R) | ENVR 992<br>Master's Technical Report (R) | ENVR 432<br>Occupational Safety and Ergonomics (R)<br>(elective) | | | | |
| **Health Policy and Management** | | | | | | | | |
| 1. Identify the main components and issues of the organization, financing, and delivery of health services in the U.S. | HPM 600 Intro to Health Policy and Management (P) | | | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 2. Discuss the policy process for improving the health status of populations. | HPM 600<br><br>Intro to Health Policy and Management (P) | | | | | | | |
| 3. Describe the legal and ethical bases for public health and health services. | HPM 600<br><br>Intro to Health Policy and Management (P) | ENVR 432<br><br>Occupational Safety and Ergonomics (R) | | | | | | |
| 4. Apply quality and performance improvement concepts to address organizational performance issues. | HPM 600<br><br>Intro to Health Policy and Management (P) | ENVR 432<br><br>Occupational Safety and Ergonomics (R)<br><br>(elective) | | | | | | |
| 5. Use “systems thinking” for resolving organizational problems. | HPM 600<br><br>Intro to Health Policy and Management (P) | ENVR 981<br><br>Environmental Sciences Practicum (R) | ENVR 992<br><br>Master’s Technical Report (R) | ENVR 582 Sanitation in Developing Countries (R)<br><br>(elective) | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 6. Use the principles of program planning, development, budgeting, management and evaluation to organizational and community initiatives. | HPM 600<br><br>Intro to Health Policy and Management (P) | HBEH 600 Social and Behavioral Sciences in PH (P) | ENVR 981<br><br>Environmental Sciences Practicum (R) | ENVR 992<br><br>Master's Technical Report (R) | | | | |
| 7. Communicate health policy and management issues using appropriate channels and technologies. | HPM 600<br><br>Intro to Health Policy and Management (P) | ENVR 981<br><br>Environmental Sciences Practicum (R) | ENVR 992<br><br>Master's Technical Report (R) | | | | | |
| **Communication and Informatics** | | | | | | | | |
| 1. Demonstrate effective written and oral health communication skills appropriately adapted to professional and lay audiences with varying knowledge and skills in interpreting health information. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | EPID 600<br><br>Principles of Epidemiology (R) | HBEH 600 Social and Behavioral Sciences in PH (R) | ENVR 683 Water-Health Research I (R)<br><br>(elective) | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 2. Use information technology tools effectively in core public health functions such as retrieval of institutional and online public health data and dissemination of public health information. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | EPID 600 Principles of Epidemiology (R) | ENVR 770 Biological Monitoring (R)<br><br>(elective) | | | | |
| 3. Engage in collective information sharing, discussion and problem solving. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | ENVR 788<br><br>Managing environmental financial risk (R)<br><br>(elective) | | | | | |
| **Diversity & Cultural Competency** | | | | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 1. Demonstrate awareness of and sensitivity to the varied perspectives, norms and values of others based on individual and ethnic/cultural differences (e.g., age, disability, gender, race, religion, sexual orientation, region and social class). | ENVR 981<br><br>Environmental Sciences Practicum (P) | HBEH 600 Social and Behavioral Science in Public Health (R) | HPM 600<br><br>Intro to Health Policy and Management (R) | ENVR 610 Global Environmental Health Inequalities (R)<br><br>(elective) | | | | |
| 2. Show effective and productive skills in working with diverse individuals including co-workers, partners, stakeholders, and/or clients. | ENVR 981<br><br>Environmental Sciences Practicum (P) | HBEH 600 Social and Behavioral Sciences in PH (R) | EPID 600 Principles of Epidemiology (R) | ENVR 755<br><br>Analysis of Water Resource Systems (R)<br><br>(elective) | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 3. Develop, implement, and/or contribute to effective public health programming and conduct research that integrates: (1) knowledge levels of health access among individuals and within communities, and (2) culturally-appropriate methods for conducting practice or research | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | HBEH 600 Social and Behavioral Sciences in PH (R) | ENVR 682<br><br>Water, Sanitation, Hygiene and Global Health (R)<br><br>(elective) | ENVR 684 Water Health-Research II (R)<br><br>(elective) | | | |
| **Leadership** | | | | | | | | |
| 1. Demonstrate basic team building, negotiation, and conflict management skills. | ENVR 981<br><br>Environmental Sciences Practicum (P) | EPID 600 Principles of Epidemiology (R) | ENVR 780<br><br>Urban Water Services Planning and Design (R)<br><br>(elective) | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 2. Create a climate of trust, transparency, mutual cooperation, continuous learning, and openness for suggestion and input with co-workers, partners, other stakeholders, and/or clients. | ENVR 981<br><br>Environmental Sciences Practicum (P) | EPID 600 Principles of Epidemiology (R) | HBEH 600 Social and Behavioral Sciences in PH (R) | ENVR 755<br><br>Analysis of Water Resource Systems (R)<br><br>(elective) | | | | |
| 3. Exercise productive organizational, time-management and administrative skills. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | ENVR 780<br><br>Urban Water Services Planning and Design (R)<br><br>(elective) | | | | | |
| 4. Develop knowledge of one's individual strengths and challenges, as well as mechanisms for continued personal and professional development. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992<br><br>Master's Technical Report (P) | | | | | | Regular individual or group meetings with research faculty advisor |
| **Professionalism & Ethics** | | | | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 1. Review, integrate, and apply ethical and/or legal principles in both personal and professional interactions, as well as public health practice and/or research. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992 Master's Technical Report (P) | ENVR 687 Writing WaSH-Health Papers (R)<br><br>(elective) | | | | | |
| 2. Apply evidence-based concepts in public health decision-making. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992 Master's Technical Report (P) | EPID 600 Principles of Epidemiology (R) | HBEH 600 Social and Behavioral Sciences in PH (R) | ENVR 788<br><br>Managing Environmental Financial Risk (R)<br><br>(elective) | | | |
| 3. Appreciate the need for lifelong learning in the field of public health. | ENVR 981<br><br>Environmental Sciences Practicum (P) | ENVR 992 Master's Technical Report (P) | ENVR 400<br><br>Departmental Seminar (R) | | | | | Attendance at professional conferences |
| 4. Consider the effect of public health decisions on social justice and equity. | HBEH 600 Social and Behavioral Science in Public Health (P) | HPM 600<br><br>Intro to Health Policy and Management (P) | ENVR 610 Global Environmental Health Inequalities (R)<br><br>(elective) | | | | | |
| **Program Planning** | | | | | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 1. Discuss social, behavioral, environmental, and biological factors that contribute to specific individual and community health outcomes. | ENVR 981 Environmental Sciences Practicum (P) | ENVR 992 Master's Technical Report (P) | EPID 600 Principles of Epidemiology (R) | HBEH 600 Social and Behavioral Sciences in PH (R) | ENVR 582<br>Sanitation in Developing Countries (R)<br>(elective) | | | |
| 2. Identify needed resources for public health programs or research. | ENVR 981 Environmental Sciences Practicum (P) | HBEH 600 Social and Behavioral Science in Public Health (R) | HPM 600<br>Intro to Health Policy and Management (R) | ENVR 610<br>Global Environmental Health Inequalities (R)<br>(elective) | | | | |
| **Systems Thinking** | | | | | | | | |
| 1. Identify characteristics of a system. | ENVR 981 Environmental Sciences Practicum (P) | ENVR 992 Master's Technical Report (P) | HPM 600 Introduction to Health Policy and Management (R) | ENVR 755<br>Analysis of Water Resource Systems (R)<br>(elective) | | | | |

| **Courses and activities through which public health core competencies and cross-cutting competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 2. Respond to identified public health needs within their appropriate contextual setting. | HBEH 600 Social and Behavioral Sciences in PH (P) | HPM 600<br><br>Intro to Health Policy and Management (R) | ENVR 682 Water, Sanitation, Hygiene and Global Health (R)<br><br>(elective) | | | | | |

P=Primary, R=Reinforcing

## Appendix D. Degree-Specific Competencies for the MPH in Environmental Sciences and Engineering and primary and representative elective (reinforcing) courses that fulfill one or more competencies.

MPH candidates in ESE are required to complete the SPH public health core (ENVR 430, BIOS 600, EPID 600, HBEH 600 and HPM 600), departmental seminar (1 credit), Master's research (≥3 credits), a practicum (≥1 credit) and write a Master's technical report (≥3 credits). A minimum of 15 elective credits in ENVR classes is required. This table lists courses that primarily address departmental degree-specific competencies (P) and examples of elective ENVR courses that reinforce a competency (R), depending on the nature of the candidate's research.

*Courses listed are required unless otherwise indicated.*

| **Courses and activities through which the degree specific competencies are met*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| Demonstrate broad knowledge in the core fields of public health and familiarity with public health practice. | BIOS 600 (P) Biostatistics | EPID 600 (P) Principles of Epidemiology | HBEH 600 (P) Social and behavioral sciences in public health | HPM 600 (P) Introduction to health policy and manag. | ENVR 430 (P) Health effects of environ. agents | ENVR 981 (R) Environ. sciences practicum | | |
| Identify and evaluate the relationships between sources of environmental contaminants and processes that affect their movement, fate and health effects in the environment and human systems. | ENVR 430 (P) Health effects of environ. agents | ENVR 765 (R) Model-based exposure mapping and risk analysis (elective) | ENVR 771 (R) Exposure analysis (elective) | ENVR 682 (R) Water, sanitation, hygiene and global health (elective) | ENVR 468 (R) Advanced functions of temporal GIS (elective) | ENVR 403 (R) Environ. chemistry processes (elective) | ENVR 675 (R) Air pollution, chemistry and physics (elective) | |

| **Courses and activities through which the degree specific competencies are met*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| Describe, utilize and critically evaluate approaches used to measure and model properties of environmental or human systems | ENVR 430 (P) Health effects of environ. agents | ENVR 411 (R) Laboratory techniques and field measure.<br><br>(elective) | ENVR 570 (R) Methods of environ. decision analysis<br><br>(elective) | ENVR 468<br><br>(R) Advanced functions of temporal GIS<br><br>(elective) | ENVR 755 (R) Analysis of water resource systems<br><br>(elective) | ENVR 765<br><br>(R) Model-based exposure mapping and risk assessment<br><br>(elective) | ENVR 783 (R) Setting environmental priorities<br><br>(elective) | |
| Explain and analyze the relationships between scientific knowledge, exposure, risk assessment, environmental management and environmental policy. | ENVR 430<br><br>Health Effects of Environmental Agents (P) | ENVR 742<br><br>(R) Theory and practice of evaluating human health risks of chemicals<br><br>(elective) | ENVR 770<br><br>(R) Biological monitoring<br><br>(elective) | ENVR 771<br><br>(R) Exposure analysis<br><br>(elective) | ENVR 765<br><br>(R) Model-based exposure mapping and risk analysis<br><br>(elective) | ENVR 850<br><br>(R) Systems analysis in environ. planning<br><br>(elective) | ENVR 470 (P) Environ. Risk assessment<br><br>(elective) | |
| Demonstrate written and oral communication skills related to environmental sciences and engineering issues within a public health context. | ENVR 981 (P) Environ. sciences practicum | ENVR 992 (P) Master's technical report | ENVR 890-3 (R) Air quality seminar<br><br>(elective) | ENVR 724 (R) Current topics in environ. Analytical chemistry<br><br>(elective) | ENVR 687 (R) Writing WaSH-health papers<br><br>(elective) | ENVR 684 (R) Water-health research II<br><br>(elective) | ENVR 780<br><br>(R) Urban water services planning and design<br><br>(elective) | |

| **Courses and activities through which the degree specific competencies are met*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| Show broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering. | ENVR 400 (P) Seminar series | ENVR 430 (P) Health effects of environ. agents | ENVR 610<br><br>(R) Global environ. health inequalities<br><br>(elective) | ENVR 890<br><br>(R) Air quality seminar<br><br>(elective) | ENVR 775 (R) Global climate change: interdisciplinary objectives<br><br>(elective) | ENVR 682 (R) Water, sanitation, hygiene and global health<br><br>(elective) | ENVR 724<br><br>(R) Current topics in environ. Analytical chemistry<br><br>(elective) | ENVR 981 (P) Environ. sciences practicum |

P=Primary, R=Reinforcing

*The principal distinction between the MPH and MSPH is the nature of the research project culminating in the technical report. MSPH students generally conduct original research in a laboratory or field setting, while MPH students frequently conduct a literature survey or analyze a pre-existing data set.

## Appendix E. Degree-Specific Competencies for the MSEE in Environmental Sciences and Engineering and primary and representative elective (reinforcing) courses that fulfill one or more competencies.

MSEE candidates in ESE are required to complete an introductory public health course (3 credits), departmental seminar (1 credit), engineering briefs (3 x 1 credit) and write a Master's technical report (≥3 credits). A minimum of 15 elective credits in ENVR classes is required. This table lists courses that primarily address departmental degree-specific competencies (P) and examples of elective ENVR courses that reinforce a competency (R), depending on the nature of the candidate's research.

*Courses listed are required unless otherwise indicated.*

| **Courses and other learning experiences by which degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** |
| 1.Define problems, needs, and objectives for which environmental engineering is relevant | ENVR 991 (P) Engineer. Briefs | ENVR 992 (P) Master's technical report | ENVR 582 (R) Sanitation in developing countries (elective) | ENVR 682 (R) Water, sanitation, hygiene and global health (elective) | ENVR 780 (R) Urban water services planning and design (elective) | ENVR 775 (R) Global climate change: interdisciplinary objectives (elective) | ENVR 675 (R) Air pollution chemistry and physics (elective) | ENVR 989 Envr Crisis Mgmt |
| 2. Evaluate problems quantitatively using measurements or models (statistical, empirical, and/ or mechanistic) of engineered systems or impacted natural environments. | ENVR 991 (P) Engineer. Briefs | ENVR 992 (P) Master's technical report | ENVR 433 (R) Health hazards of industrial operations (elective) | ENVR 451 (R) Elements of chemical reactor engineering (elective) | ENVR 759 (R) Multiphase transport phenomena (elective) | ENVR 710 (R) Environ. process technology (elective) | ENVR 416 (R) Aerosol physics & chemistry (elective) | ENVR 989 Envr Crisis Mgmt |

| **Courses and other learning experiences by which degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 3. Develop and design appropriate solutions which use technologies, facilities, monitoring, controls, or policies to solve environmental engineering problems. | ENVR 991 (P) Engineer. Briefs | ENVR 992 (P) Master's technical report | ENVR 710 (R) Environ. process technology (elective) | ENVR 683 (R) Water-health research I (elective) | ENVR 755 (R) Analysis of water resource systems (elective) | ENVR 756 (R) Physical/ chemical treatment processes (elective) | ENVR 780 (R) Urban water services planning and design (elective) | ENVR 989 Envr Crisis Mgmt |
| 4. Evaluate the effects of environmental engineering designs and assess the uncertainty involved in environmental systems. | ENVR 991 (P) Engineer. Briefs | ENVR 992 (P) Master's technical report | ENVR 468 (R) Advanced functions of temporal GIS (elective) | ENVR 683 (R) Water-health research I (elective) | ENVR 570 (R) Methods of environ. decision analysis (elective) | ENVR 755 (R) Analysis of water resource systems (elective) | ENVR 780 (R) Urban water services planning and design (elective) | ENVR 989 Envr Crisis Mgmt |
| 5. Obtain a broad exposure to contemporary issues in environmental sciences, environmental health, and environmental engineering. | ENVR 991 (P) Engineer. Briefs | ENVR 992 (P) Master's technical report | ENVR 687 (R) Writing WaSH-health papers (elective) | ENVR 684 (R) Water-health research II (elective) | ENVR 780 (R) Urban water services planning and design (elective) | ENVR 451 (R) Elements of chemical reaction engineering (elective) | ENVR 400 Seminar | |

## Appendix F. Degree-Specific Competencies for the PhD in Environmental Sciences and Engineering and primary and representative elective (reinforcing) courses that fulfill one or more competencies.

PhD candidates in ESE are required to complete a course in epidemiology (3 credits), an introductory public health course (3 credits), departmental seminar (1 credit), doctoral research (≥6 credits) and write a dissertation (≥6 credits). There are no other formal course requirements. This table lists courses that primarily address departmental degree-specific competencies (P) and examples of elective ENVR courses that reinforce a competency (R), depending on the nature of the candidate's research.

*Courses listed are required unless otherwise indicated.*

| **Courses and other learning experiences by which the degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 1. Conceive, develop, and conduct significant original research in environmental sciences and engineering. | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 994 (P) Doctoral dissertation | | | | | | Dissertation Proposal |
| 2. Apply advanced methodologies to research projects in environmental sciences and engineering. | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 994 (P) Doctoral dissertation | ENVR 683 (R) Water-health research I (elective) | ENVR 570 (R) Methods of environ. Decision analysis (elective) | ENVR 468 (R) Advanced functions of temporal GIS (elective) | ENVR 516 (R) Aerosol science laboratory (elective) | ENVR 726 (R) Instrumental methods for chemical analysis of environ. samples (elective) | |

| **Courses and other learning experiences by which the degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 3. Analyze, interpret and explain the results of original research | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 994 (P) Doctoral dissertation | ENVR 411 (R) Laboratory techniques and field measurement (elective) | ENVR 470 (R) Environ. Risk assessment (elective) | ENVR 765 (R) Model-based exposure modeling and risk assessment (elective) | ENVR 773 (R) Modeling atmospheric chemistry (elective) | ENVR 570 (R) Methods of environ. Decision analysis (elective) | |
| 4. Review and synthesize a body of research literature | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 994 (P) Doctoral dissertation | ENVR 400 (R) Seminar series | ENVR 724 (R) Current topics in environ. Analytical chemistry (elective) | ENVR 687 (R) Writing WaSH-health papers (elective) | ENVR 684 (R) Water-health research II (elective) | ENVR 890-3 (R) Air quality seminar (elective) | Dissertation proposal |
| 5. Demonstrate written and oral communication skills related to research issues in environmental sciences and engineering. | ENVR 991 (P) Research in environ. sciences and engineering | ENVR 994 (P) Doctoral dissertation | ENVR 400 (R) Seminar series | ENVR 780 (R) Current topics in environ. Analytical chemistry (elective) | ENVR 687 (R) Writing WaSH-health papers (elective) | ENVR 684 (R) Water-health research II (elective) | ENVR 890-3 (R) Air quality seminar (elective) | Dissertation proposal |

| **Courses and other learning experiences by which the degree specific competencies are met** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Competencies** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Course Number and Name** | **Other Learning Experiences** |
| 6. Obtain broad exposure to contemporary issues in environmental sciences, environmental health and environmental engineering | ENVR 400 (P) Seminar series | | | | | | | |
| 7. Develop an understanding of basic concepts of public health | ENVR 601 (P) Epidemiology for environ. scientists and engineers | SPHG 600 (P) Introduction to public health | ENVR 610<br><br>(R) Global environ. health inequalities<br><br>(elective) | ENVR 421 (R) Environ. health microbiology<br><br>(elective) | ENVR 433 (R) Health hazards of industrial operations<br><br>(elective) | ENVR 630 (R) Systems biology in environ. health<br><br>(elective) | ENVR 650 (R) Principals of chemical carcinogen.<br><br>(elective) | |

P=Primary, R=Reinforcing