

ENVIRONMENTAL HEALTH SCIENCES

Department Website (<http://www.sph.sc.edu/enhs/default.htm>)

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Environmental Health Sciences examine the interactions between humans and their environment. Human activity impacts on environmental quality and ecosystem health are often principal determinants of human health. Exploration of these complex interactions often combines elements of both pure and applied sciences, e.g., agriculture, biology, chemistry, marine sciences, geology, engineering, toxicology, nanomaterials science, public health, and medicine.

Faculty members of the Department of Environmental Health Sciences (ENHS) have expertise in a broad range of disciplines necessary for solving the vexing and complex problems in Environmental Health Sciences. Our expertise includes air pollution; nanoscience; climate change research; environmental sustainability; mammalian and molecular toxicology; soil science; environmental and public health-related microbiology; aquatic ecology; marine ecotoxicology; ecosystem modeling; public health preparedness and response; exposure analysis and risk/impact assessment; environmental planning and engineering; environmental physiology; environmental epidemiology; landscape ecology; remote sensing, machine learning and GIS; water quality, wastewater treatment and human health surveillance; soil health and sustainable agriculture; wetlands ecology; resource management; community engagement and environmental justice.

The mission of the Department of Environmental Health Sciences is founded on the philosophy that healthy environments enhance the health and well-being of individuals and the communities in which they live. Thus the broader goals of the department are to:

- develop improved methods for assessing the health and quality of the environment
- promote a clearer understanding of interactions between humans and their natural, home, and work environments
- achieve molecular to landscape levels of resolution for understanding health/environment interactions
- sustain and protect natural resources upon which life depends
- provide scientifically sound information for policymakers and the public to encourage social awareness of and societal actions toward sustaining a healthy relationship with the environment.

The Department of Environmental Health Sciences offers the following degrees: Master of Public Health (MPH), Master of Science (MS), and Doctor of Philosophy (PhD). A common level of core public health training is completed prior to undertaking advanced study and research within each degree.

Programs Overview

Master's Degrees

Master of Public Health (MPH)

Daniel Kilpatrick, *MPH Program Director*

The MPH degree is oriented toward development of a broad background in public health and preparation for professional practice. The MPH degree requires 42 credit hours of study and is practice-oriented. MPH students complete a supervised internship (Applied Practical Experience) in lieu of a thesis.

Master of Science (MS)

The MS degree is an academic research degree which may be tailored to individual interests and job market needs. The MS degree requires a minimum of 36 graduate hours and combines real-world problem solving and research skills with other technical, health, and related skills to prepare effective environmental health researchers for the public, government, and private sectors. Students complete a research thesis.

Doctoral Degree

Doctor of Philosophy (PhD)

Doctoral students complete a program of study that emphasizes professional development, scientific competence, and research expertise. The PhD requires a minimum of 60 hours of course work beyond the baccalaureate and includes 12 credit hours of dissertation preparation. Those students entering without a master's degree are required to take additional foundational course work in environmental health sciences equivalent to the master's degree. To achieve doctoral candidate status, students must pass a qualifying examination after the first year of study. Upon completion of all course and language requirements or research methods proficiency, doctoral candidates must pass an oral and/or written comprehensive examination. All doctoral candidates must prepare and defend a dissertation that represents significant research in their area of advanced study. Doctoral students must demonstrate a reading proficiency in a modern foreign language if deemed necessary by the doctoral advisory committee.

Department Admission Requirements

General

Application forms for admission to the MPH, MS and PhD graduate programs in Environmental Health Sciences may be obtained at <http://gradschool.sc.edu/gap> (<http://gradschool.sc.edu/gap/>). Applicants should submit an application packet through the School of Public Health Application Service (<http://www.sophas.org>). Individuals who wish to pursue graduate work in the Department of Environmental Health Sciences must meet or exceed the general admission requirements of The Graduate School and the following departmental requirements:

- Completion of a baccalaureate degree with 120 hours of science-based courses or equivalent to include:
 - A minimum of 60 hours in physical or life sciences, mathematics, engineering, and/or technology
 - At least 15 hours of the 60 hours in upper level junior, senior, or graduate level courses
 - 21 or more semester hours in communication, humanities, and social sciences
- Grade point average of 3.00/4.00 or higher
- For international applicants, a satisfactory score on the Test of English as a Foreign Language (TOEFL) - minimum score of 80 internet-based, 230 computer-based, or 570 paper-based - or the International English Language Testing System (IELTS) Academic Course Type 2 exam - minimum overall band score of 6.5.

Doctor of Philosophy

Applicants to the Ph.D. program must meet the above requirements and in addition must have at least baccalaureate degree in a pure or applied scientific discipline applicable to the environmental health sciences and from a university-accredited by a regional accrediting agency. Individuals with prior performance at the master's level are preferred. A personal interview may also be required.

Programs

- Environmental Health Sciences, M.P.H. (<https://academicbulletins.sc.edu/graduate/public-health/environmental-health-sciences/environmental-health-sciences-mp/h/>)
- Environmental Health Sciences, M.S. (<https://academicbulletins.sc.edu/graduate/public-health/environmental-health-sciences/environmental-health-sciences-ms/>)
- Environmental Health Sciences, Ph.D. (<https://academicbulletins.sc.edu/graduate/public-health/environmental-health-sciences/environmental-health-sciences-phd/>)
- Environmental Nanoscience and Risk, Certificate (<https://academicbulletins.sc.edu/graduate/public-health/environmental-health-sciences/environmental-health-sciences-environmental-nanoscience-risk-certificate/>)

Courses

ENHS 515 - Disasters and Public Health Emergency Management (3 Credits)

Introduction to emergency preparedness and response in relation to environmental and public health. Historical context for the emergence of public health emergency preparedness and demonstration of articulation with community response partner agencies in the post-COVID era.

ENHS 555 - Climate Change Impacts on Human Health (3 Credits)

A detailed exploration of the impacts of climate change on human health and well-being.

ENHS 575 - Public Health and Community Disaster Resilience (3 Credits)

A study of national, community, and organizational multi-hazard resilience and risk management framed in the public and environmental health contexts.

ENHS 585 - Crisis Leadership for the Public Health Professional (3 Credits)

A study in the intersection of public health and crisis leadership to develop the knowledge and skills needed to effectively respond to and recover from emergencies and disasters.

ENHS 592 - Advanced Special Topics in Environmental Health (1-3 Credits)

Emerging issues and topics concerning environmental health. May be repeated as content varies by title up to a total of 9 credit hours.

ENHS 625 - Medical Mycology (3 Credits)

Advanced study of infectious diseases caused by fungi. Etiology, symptoms, and treatment of fungi related illnesses.

Cross-listed course: BIOL 625

ENHS 660 - Concepts of Environmental Health Science (3 Credits)

Environmental health sciences presenting the earth as a complex system in which people, plants, animals, and non-living physical-chemical components interact.

ENHS 661 - Parasitology (4 Credits)

Parasites of biological, economic, and public health importance.

Prerequisites: 300 level Biology course or equivalent.

Cross-listed course: BIOL 531, EPID 661

ENHS 662 - Industrial Health Programs (3 Credits)

Analysis, planning, and implementation of programs to protect workers' health in industry; legislative and regulatory background.

ENHS 664 - Environmental Genomics (3 Credits)

"State of the art" molecular techniques that elucidate mechanisms of environmental contaminants in model systems.

ENHS 665 - Biofilms in Environmental Health and Disease (3 Credits)

Effect of bacterial biofilm process on many diverse areas. Recognition, prevention, and control of biofilm-related problems in the environment, health care, industry, and engineering.

ENHS 666 - Metals and Human Health (3 Credits)

Trace metal(loid)s, their fate and transport in the environment and their potential impacts on human health.

Prerequisites: BIOL 101 or BIOL 110; CHEM 101 and CHEM 102, or equivalent.

ENHS 670 - Environmental Pollutants and Human Health (3 Credits)

Overview of environmental pollutants and their impact on human health; case studies of environmental catastrophes; principles of ecotoxicology; air, water, and land pollution associated with neurotoxicity, toxicology, and carcinogenesis.

Prerequisites: BIOL 101 or BIOL 110; CHEM 101 and CHEM 102.

ENHS 671 - From Air to Alveoli: Exposure Science (3 Credits)

A receptor-oriented approach for assessing human exposure to environmental contaminants by inhalation, dermal and ingestion routes. Covers methods for estimating exposures to protect health and well-being, to relate adverse effects to exposures, and to comply with regulations and guidelines.

ENHS 675 - Infectious Disease Ecology (3 Credits)

Ecological theories as the basis for environmental change and the (re)emergence of infectious agents that ultimately impact human and ecosystem health.

ENHS 681 - Occupational Ergonomics I (3 Credits)

Introduction to ergonomics: hazards identification and analysis; solution design and implementation; human musculoskeletal characteristics, injuries; effects of work on performance, safety, and health. Application to manufacturing and office environments.

ENHS 715 - Disasters and Public Health Emergency Management I (3 Credits)

Introduction to emergency preparedness and response in relation to environmental and public health. Historical context for the emergence of public health emergency preparedness and demonstration of articulation with community response partner agencies in the post-COVID era.

ENHS 716 - Disasters and Public Health Emergency Management II (3 Credits)

The "Disasters and Public Health Emergency Management II" companion course is designed for public health practitioners regardless of expertise and particular discipline who must be aware of the emergency management functions relating to public health. The course is designed to familiarize students with the fundamental knowledge needed to address natural and man-made disasters and to follow up where the companion course left off with a specific focus on environmental disasters.

Prerequisites: B or better in ENHS 715.

ENHS 740 - Environmental Nanoscience (3 Credits)

Fundamental principles of environmental nanoscience: unique properties of nanomaterials, syntheses and characterization of nanomaterials, and key processes determining their environmental fate and behavior of nanomaterials.

ENHS 750 - MPH Integrated Learning Experience (ILE) (2 Credits)

Synthesis of foundational and ENHS MPH competencies in preparing a high quality grant proposal to address a public health issue.

Prerequisites: C or better in PUBH 724, PUBH 725, PUBH 726, PUBH 730, PUBH 735, ENHS 660, ENHS 771, and ENHS 775 .

ENHS 755 - Marine Conservation and Environmental Health (3 Credits)

Explores the intersection between conservation and environmental health with a particular focus on coastal and marine case studies.

Cross-listed course: MSCI 755

ENHS 760 - Fundamentals of Air Pollution (3 Credits)

Chemical and physical aspects of air pollution and their regulatory problems. An examination of air pollution sources; physical and chemical processes affecting pollutants after emission; pollutants and their effects and the ultimate fate of pollutants. Attention is also given to the legal, administrative, and technical aspects of air pollution control.

Prerequisite or Corequisite: ENHS 660.

ENHS 761 - Ecotoxicology of Aquatic Systems (3 Credits)

Lethal and sublethal effects of environmental stressors on organisms living in the water column and in sediments of aquatic systems. Practical techniques of aquatic toxicology, risk assessment and modeling.

ENHS 762 - Fundamentals of Industrial Hygiene (3 Credits)

Industrial hygiene, including health effects, occupational health standards, and the evaluation and control of occupational health hazards.

ENHS 763 - Medical Aspects of Occupational Health (3 Credits)

Emphasizes the medical aspects of exposure to hazardous materials, accidents, and mental and physical stresses on the job. Clinical spectrum of occupational illness with some emphasis on industrial toxicology.

ENHS 764 - Principles, Methods, and Issues in Air Quality (3 Credits)

Fate, transformation, and behavior of pollutants in the atmosphere. Exposure and human health impacts of atmospheric particles.

Prerequisite or Corequisite: ENHS 660.

ENHS 765 - Applied Research in the Environmental Health Sciences (3 Credits)

Current and prospective research associated with the multi-disciplinary areas of environmental health sciences. Critical evaluation of scientific research, and technical writing and oral presentations.

ENHS 766 - Applied Aquatic Sciences (3 Credits)

The quantitative application of principles of basic physical, biological, and geochemical principles in assessing and solving environmental problems in lakes, streams, and wetlands. Emphasis on watershed-water quality interactions, trophic state analyses, wasteload impact prediction, toxic chemical fate and transport, wetland values, and classification.

Prerequisites: ENHS 660, pre-calculus math, general ecology.

ENHS 766L - Applied Aquatic Sciences Laboratory (1 Credit)

Sampling and analysis of the interacting parameters used in assessing water quality and the functioning of aquatic systems.

Corequisite: ENHS 766.

ENHS 767 - Ecological Modeling and Environmental Planning (4 Credits)

Concepts in systems ecology and ecological modeling. Emphasis on the use of models and computer simulations in examining environmental interactions, predicting environmental impact, and facilitating the process of environmental planning. Lab practice in model development and computer simulation analysis.

Prerequisites: MATH 111 or equivalent, ecology, ENHS 660.

Cross-listed course: BIOL 768, MSCI 767

ENHS 768 - Industrial Ventilation and Hazard Control (3 Credits)

Control of chemical and physical hazards in the occupational environment. Course covers principles and design of health protection systems such as ventilation systems, collection mechanisms, control of physical factors (excluding radioactivity).

Prerequisites: college math and ENHS 762 or consent of instructor

ENHS 769 - Exposure and Risk Assessment (3 Credits)

Designing, implementing, and analyzing environmental exposures in the field; error analysis; computation of the value of improved information; hazard identification; dose-response evaluation; and risk characterization.

Prerequisites: MATH 141, CHEM 111 and CHEM 112, and BIOS 700 or STAT 701.

ENHS 770 - Microbial Processes and Pollution (3 Credits)

Microbial processes which alter the fate, bioavailability, and toxicity of environmental pollutants: biotransformations of metals and organic pollutants; resistance mechanisms and roles of microbial biofilms in toxin transfer.

ENHS 771 - Environmental Health Sciences Seminar (1 Credit)

Environmental Health Sciences Seminar is a one credit course that provides the opportunity for graduate students within the department and other related departments/programs to enhance and broaden their knowledge in environmental health by exploring current research and case studies.

ENHS 772 - Human and Ecological Risk Assessment (3 Credits)

Focuses on history, theory, and practice of predicting, managing, and communicating potential human health and environmental risks of hazardous chemicals. Reviews fundamental components and explores uncertainties, probabilistic approaches, and 'real-world' challenges of risk analysis.

ENHS 773 - Radiation Health Physics (3 Credits)

Physics of radiation and associated health hazards; hazard evaluation and measurements; radiation content and protection of the individual. Course covers ionizing radiation, ultraviolet, microwave, lasers, R.F. field, and ultra-sound.

Prerequisites: ENHS 660.

ENHS 774 - Risk Assessment and Interactions of Environmental Toxicants (3 Credits)

A study of biological interactions and transformation of environmental toxicants at the cellular and subcellular levels, and assessment of cellular damage as it relates to health hazards and risks. Topics to include: environmental toxicants; exposure measurements; factors affecting interactions and toxicity; metabolism of xenobiotics: types and levels of effects and interactions; and human health risks.

Prerequisites: ENHS 660.

ENHS 775 - Resource Management and Environmental Impact Assessment (3 Credits)

Review of ecological principles as applied to environmental impact assessment. Study of the mandates of the National Environmental Policy Act of 1969. Analysis of several impact assessment methodologies.

Prerequisites: BIOL 102 and BIOL 570.

ENHS 776 - Environmental Regulation and Planning (3 Credits)

Introduction to environmental planning. Survey of major federal environmental legislation. Review of processes and techniques of environmental planning including zoning, permits, management plans, assessments, and evaluation methods. Case studies of significant environmental projects.

ENHS 777 - Radiation Biology (3 Credits)

Fundamentals on the biological effects of ionizing radiation on living systems, especially man; basic biological mechanisms which bring about somatic and genetic effects.

Prerequisites: ENHS 660, ENHS 773.

ENHS 778 - Air Pollution Monitoring and Modeling (3 Credits)

Sources, sinks, transport, and transformation of air pollutants. Health effects that occur directly or by intermediate transport. Current monitoring methods and modeling techniques for air pollution.

Prerequisites: one year each of general chemistry and physics.

ENHS 779 - Applied Environmental Physiology (4 Credits)

Lecture and laboratory investigations concerning sublethal and lethal physiological responses of aquatic organisms to a variety of environmental pollutants. Stresses the in-depth understanding of the effects of: bacterial and thermal pollution, pesticides/herbicides, industrial chemicals, hazardous materials, and petroleum hydrocarbons on different physiological mechanisms.

Prerequisites: ENHS 660, ENHS 761.

ENHS 780 - Advanced Seminar in Environmental Modeling (1-2 Credits)

A critical review of recent advances and case histories in the formulation and use of ecological/ environmental models. Ecosystems analysis and environmental planning.

ENHS 781 - Occupational Ergonomics II (3 Credits)

Literature reviews and applications in evaluation of hazards and design of ergonomic interventions including human factors in information processing, design of displays and controls, vibration, macroergonomics, fatigue, and shiftwork.

Prerequisites: ENHS 681

ENHS 787 - Analytical Concepts for Environmental Health Sciences (3 Credits)

Physical and chemical principles of environmental qualitative and quantitative analysis with emphasis on atmospheric, aquatic, and terrestrial samples. Includes use and limitations of instrumental techniques, sampling strategies, data management and reduction, and quality assurance programs.

ENHS 788 - Concepts of Hazardous Materials Management I (3 Credits)

Chemical and physical principles of multimedia contaminant transport, environmental effects of hazardous materials, statutes and regulations classification, treatment and disposal of hazardous materials.

ENHS 789 - Concepts of Hazardous Materials Management II (3 Credits)

Chemical and physical properties of hazardous materials; use and storage; disposal options; transportation requirements; site safety considerations; management systems involving hazardous materials.

Prerequisites: ENHS 788

ENHS 790 - Independent Study (1-6 Credits)**ENHS 793 - Special Topics in Environmental Health Sciences (1-6 Credits)**

Content varies by title. Course may be repeated for a total of 6 credit hours.

ENHS 794 - Introduction to Environmental Science Research (3 Credits)

The course is intended to develop theoretical and practical knowledge in environmental science research. The learning formats will permit focus on areas of interest as a means to develop the research skills for later projects. Guided by focus, students may work in the laboratory, field, and/or use existing data.

ENHS 795 - Issues in Coastal Environmental Health (3 Credits)

Problems associated with coastal population growth and development. Emphasis is on the working group approach to ameliorating impacts on ecosystem and human health.

Cross-listed course: MSCI 795

ENHS 796 - Introduction to Nanoanalytics (3 Credits)

Laboratory based course aimed at developing theoretical and practical knowledge in regards to nanoscience in toxicology and in the environment. Students will perform nanoparticle syntheses, characterization, fate and behavior studies or toxicology exposures. Learning formats will permit focus on areas of interest aimed at developing research skills.

ENHS 797 - Global Environmental Health and Food Security (3 Credits)

Global environmental health with a focus on food security in developing nations, including crop responses to warming, soil changes, more variable precipitation inputs and expanding geographical range of pests.

ENHS 798 - Public Health Practice (1-6 Credits)

Performance of a limited work or service project in a public need setting, pursuit of planned learning objectives related to previously identified aspects of the student's chosen role. Self-monitoring and regular seminars focusing on learning accomplishments.

Prerequisites: 9-10 hours of specified courses including BIOS 700, EPID 700.

ENHS 799 - Thesis Preparation (1-9 Credits)

ENHS 860 - Environmental Radiation Surveillance (4 Credits)

Technical coverage relevant to a practical evaluation of radiation sources and contaminants in the environment.

Prerequisites: ENHS 773.

ENHS 861 - Aerosol Science (3 Credits)

Physical and chemical principles applied to the behavior and properties of particles suspended in air. Course covers motion under applied forces, electrical properties, diffusion, removal from gas, cloud dynamics, and optical properties.

ENHS 862 - Special Research Topics in Environmental Health Sciences (3 Credits)

Discussion and/or laboratory participation involving techniques used in multidisciplinary research areas of environmental health sciences that have not been covered by other courses. May be repeated for credit on different topics.

Prerequisites: BIOS 700, EPID 700, ENHS 660.

ENHS 863 - Advanced Topics in Environmental Planning (3 Credits)

Detailed analyses of techniques, especially computer simulation modeling, used in environmental assessment and planning. Emphasis will be on the prediction of the ecological effects of development projects. Students will collectively construct a simulation model for the purpose of environmental assessment.

Prerequisites: ENHS 767, ENHS 775.

ENHS 864 - Advanced Graduate Seminar (3 Credits)

Seminar presentation and group discussion by students, faculty, and guest speakers on current topics in environmental health sciences. May be repeated for credit.

Prerequisites: Complete at least two semesters in environmental health sciences and courses to include ENHS 660, ENHS 765.

ENHS 880 - Ethics & Research Prep (1 Credit)

Overview of skills and standards, including ethics and research preparation, for Environmental Health Sciences doctoral students.

ENHS 899 - Dissertation Preparation (1-12 Credits)

Prerequisite: one full year (18 hrs) of graduate study beyond the master's level.