



COLORADO STATE UNIVERSITY

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Environmental and Radiological Health Sciences  
Academic Policies, Guidelines and Requirements for  
Graduate Students

2017-2018

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## **General Information**

The Department of Environmental and Radiological Health Sciences faculty is responsible for training students in three degree programs: Environmental Health, Radiological Health Sciences, and Toxicology. It has adopted the procedures below to fulfill requirements for graduate degrees in these programs. The department offers formally approved Specializations in Epidemiology, Ergonomics, and Industrial Hygiene for the M.S. and Ph.D. degrees in Environmental Health, Health Physics for the M.S. degree in Radiological Health Sciences, and Toxicology M.S. and Ph.D. degrees. Completion of the requirements of one these approved Specializations will be noted on the student's transcript.

This manual has been prepared to acquaint you with the policies and regulations that govern the graduate and research programs in the Department. This document should be read in conjunction with the current Graduate and Professional Bulletin of Colorado State University.

It has been written to emphasize certain information contained in the Bulletin and to outline specific department policies and procedures. These requirements supplement, but not supersede, all statements in the Colorado State University Graduate and Professional Bulletin. See: <http://graduateschool.colostate.edu/faculty-staff/bulletin.aspx>

## **Procedures and Requirements for Graduate Degrees in Environmental Health and Radiological Health Sciences**

### **General Requirements and Procedures**

#### **Filing the Program of Study**

The GS Form 6 describes the student's program of study and must be filed with the Graduate School before the time of the fourth regular semester registration. All new Program of Study GS Form 6's are completed electronically and then printed for signatures and submission. The student plans a specific program of study in concert with his/her advisor and graduate committee to arrive at an adequate level of disciplinary competency appropriate to the degree sought. The plan that is developed must meet or exceed the published minimum requirements for the degree sought. When this plan is completed and signed by the student, the advisor, department head, and then signed and approved by the dean of the graduate school, it is a formal statement of the course-work requirements for the degree. A committee member cannot require a student to take additional courses that are not listed on the plan unless the student and advisory committee agree. Nor can the course requirements for the degree be altered by the student unless a change to the Program of Study is approved by the advisory committee.

#### **Changing the Program of Study**

Course changes to a Program of Study GS Form 6 are made on the Application for Graduation GS Form 25. The Graduate School regards the Program of Study as an individualized curriculum designed by the advisory committee to assist the student in achieving his or her educational objectives. Poor performance in a course is not an appropriate reason for removing a course from the Program of Study. A request for changes to a Program of Study must be signed/approved by the student and by the advisor, the head of the department, and the Dean of the Graduate School.

### **Fulfilling the Course Requirements on the Program of Study**

Courses taken while a graduate student is registered at Colorado State University may be considered for fulfilling the Program of Study requirements only if the student has received grades of C or better. For courses that represent either undergraduate excess or transfer credit, grades of B or better are required. Advisory committees may set higher standards.

### **Waivers of Required Course Requirements**

Waivers of course requirements may be requested by the student with approval of the student's graduate advisory committee to the department head. Waivers may be requested when previous course work or experience substantially duplicates course content. Requests must be accompanied by copies of course outlines or syllabi from previous institutions as documentation.

Students should be aware that successful completion of preliminary and/or final examinations will require knowledge of material covered in all required courses.

### **Group or Independent Study and Non-Thesis Research**

The Department offers independent study in selected areas of environmental and radiological health sciences to provide students an opportunity to independently study, or investigate, a specific topic or topics under the guidance of a faculty member with expertise in that area. The student(s) and faculty member should prepare a written statement to include the course number, number of credits, objectives and goals of the independent study, tasks to be completed by the student, basis for evaluation of the student's performance, and the grading option to be used. Students may receive a traditional letter grade, or the student may be graded pass/fail at the instructor's option.

### **Graduation Deadlines and Requirements for Graduate Students**

Please refer to the Graduate School website at <http://www.graduateschool.colostate.edu> for a complete listing of Graduation Requirements and Deadline Dates.

### **Academic Performance**

The student's academic performance will be evaluated according to Graduate School guidelines. The Graduate School requires a cumulative 3.0 grade point average in all regular course work. Grades of C or higher must be earned in all courses shown on the Program of Study GS Form 6.

## **Master's Degrees**

### **Procedures and Requirements for the Master of Science Degree Programs in Environmental Health and Radiological Health Sciences**

#### **Advisor**

Students are encouraged to select their major advisor during the first semester, but must do so no later than the end of the second semester. Selection of the major advisor will establish a personal and professional relationship that will have a major impact on the student's growth and subsequent career. The choice of advisor should be based on personal interviews and a familiarity with both the professor's past work and planned work in which the student is likely to be involved. The selection must be mutually acceptable to the student and to the professor, and must be approved by the department head as indicated on the student's Program of Study GS Form 6. Major advisors must have their primary appointment in ERHS.

#### **Graduate Advisory Committee**

The Graduate Advisory Committee for the degree of Master of Science must consist of at least three faculty members. The members are as follows: 1) the advisor who serves as chairperson of the committee and who must hold academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the department; 2) one or more additional members from the department; and 3) one member from an outside department who, appointed by the Vice Provost for Graduate Studies, represents the Graduate School. The outside committee member appointed by the Vice Provost for Graduate Studies must hold a regular, special, transitional, joint, or emeritus/emerita faculty appointment at Colorado State University. ERHS faculty affiliates are considered members of ERHS and cannot serve as the outside committee member. Individuals who are not academic faculty but who have special expertise may serve on committees in addition to the prescribed members, but may not vote regarding examination results.

The GS Form 6 must be filed with the Graduate School before the time of the fourth regular semester registration.

#### **Seminar Requirement**

All candidates for the M.S. degree (Plan A or Plan B) are required to complete a minimum of one credit of a seminar course. Eligible seminar courses include all approved university course listings in seminar format such as ERHS 693 A-D (Research Seminar), organized journal clubs taught as ERHS 696 (Group study), CM 792 (Cell and Molecular Biology seminar) and ERHS 692. The Graduate Advisory Committee may require additional credits of seminar courses.

#### **Research Seminar (ERHS 693 A-D)**

Credits earned in ERHS 693 A-D are included on the GS-6 and count toward meeting total credit requirements. ERHS 693 A-D may be repeated more than once since their content changes each semester. However, credits earned in ERHS 693 A-D are not included in the 18 credit Departmental course minimum and are not considered formal coursework.

## **Plan A Master of Science Program**

All graduate students must meet the minimum credit requirements as set by the University and the Graduate School. For specific university credit requirements please visit the Graduate Schools web site: <http://graduateschool.colostate.edu/policies-and-procedures/university-credit-requirements/>. In addition, graduate students must meet all ERHS program specific curriculum/credit requirements as listed in the Requirements for Graduate Degrees in Environmental Health Specializations section of this handbook. Any exceptions to department-program requirements must be approved by the student's advisor/committee.

Plan A requires the preparation of a thesis which addresses a research topic in the specialty area. Prior to beginning a research project, the Master of Science student will submit to his/her committee a research protocol for their approval.

### **Thesis**

The Plan A Master of Science student prepares a well-written, comprehensive thesis based on the research problem. The student must have completed a typed final draft of the thesis and submitted a copy thereof to each committee member at least two weeks prior to the final examination. The student's advisor must agree that the thesis is of such quality and completeness as to warrant setting a date for the examination.

### **Manuscript**

Each candidate is required to prepare at least one manuscript suitable for publication on the subject matter of his/her research unless this requirement is specifically waived in writing by the major advisor.

### **Final Examination**

Each candidate for a Plan A master's degree must pass an oral final examination encompassing both academic and research training. The final examination must be scheduled at least two weeks in advance with the department. Preceding the final examination, the student must present a 30-minute seminar based on his/her research, which will be open to the university community and invited guests. The remainder of the examination may be open to the public by agreement of the student and advisor. Faculty of the department not on a committee may attend any examination and may participate at the invitation of the committee chair. Passing the final examination requires a majority vote of the graduate advisory committee. A tie vote is interpreted as failure to pass the examination. At the discretion of the committee, the final examination may also include a written part. At least one month before the final examination, the advisor must inform the student and the committee members of the nature and scope of the examination. A candidate who fails the final examination may be re-examined once per the Graduate School guidelines and, for the re-examination, may be required to carry out additional work. It is the student's responsibility to obtain the appropriate forms from the Graduate School website prior to the examination and ensure return to the Graduate School of the completed Report of Final Examination Results (GS Form 24) after the relevant signatures have been obtained. Final examinations must be scheduled with the Department Head as well as with all committee members.

## **Plan B Master of Science Program**

All graduate students must meet the minimum credit requirements as set by the University and the Graduate School. For specific university credit requirements please visit the Graduate Schools web site: <http://graduateschool.colostate.edu/policies-and-procedures/university-credit-requirements/>. In addition, graduate students must meet all ERHS program specific curriculum/credit requirements as listed in the Requirements for Graduate Degrees in Environmental Health Specializations section of this handbook. Any exceptions to department-program requirements must be approved by the student's advisor/committee.

The specialization sought for the plan B may require one of the following for completion of the degree: (a) professional paper with a final oral examination, or (b) comprehensive written final examination. Each of these is described below.

### **Professional Paper and Oral Final Examination**

A professional, scholarly paper on a topic chosen by the student in consultation with the advisor will be prepared and submitted in final draft form to the Advisory Committee at least two weeks prior to the final examination. The format of the paper may be a comprehensive literature review, a research problem, a data analysis or other format acceptable to the Advisory Committee. It may be presented in publication format for a refereed journal in the student's area of specialization. The department requires a copy of the paper for its files. Professional papers are not submitted to the Graduate School for review.

The final examination must be scheduled at least two weeks in advance with the department. Preceding the final examination, the student must present a 30-minute seminar based on his/her research or professional paper topic, which will be open to the university community and invited guests.

Each candidate for a Plan B master's degree must pass an oral final examination encompassing both academic training and the professional paper. The examination may be open to the public by agreement of the student and advisor. Faculty of the department, not on a committee, may attend any examination and may participate at the invitation of the committee chair. Passing the final examination requires a majority vote of the committee. A tie vote is interpreted as failure to pass the examination. At the discretion of the committee, the final examination may also include a written part. At least one month before the final examination, the advisor must inform the student and the committee members of the nature and scope of the examination. A candidate who fails the final examination may be re-examined once per the Graduate School guidelines and, for the re-examination, may be required to carry out additional work. It is the student's responsibility to obtain the appropriate Report of Final Examination Results (GS Form 24) from the Graduate School website prior to the examination and ensure return of the completed form to the Graduate School after the relevant signatures have been obtained. Final examinations must be scheduled with the Department Head as well as committee members.

### **Comprehensive Written Final Examination**

The Plan B Masters Toxicology program requires that a comprehensive final written examination be passed in lieu of a professional paper. This examination will include content from all required courses. A passing grade of B is required.

## **Ph.D. Degrees**

### **Procedures and Requirements for the Doctor of Philosophy Degree Programs in Environmental Health and Radiological Health Sciences**

Each Doctor of Philosophy student must acquire an in-depth knowledge in the selected area of specialization and closely related areas. To be recommended for candidacy, students must do more than complete minimum course requirements. They must demonstrate to the satisfaction of their Graduate Advisory Committee that they possess the knowledge, abilities, and skills regarded as essential in the specialization chosen and a working knowledge of these disciplines which will permit the degree candidate to function in a scholarly manner.

A minimum of 72 semester credits in course work and research is required. A master's degree from an accredited college or university in an appropriate field may be accepted for a maximum of 30 credits. Students must complete the required courses described below for each discipline as well as at least 2 courses outside the department at the 500 level or above (for a total of at least 6 credit hours).

### **Selection of Advisor and Graduate Advisory Committee**

#### **Advisor**

Students are encouraged to select their major advisor during the first semester, but must do so no later than the end of the second semester. Selection of the major advisor will establish a personal and professional relationship that will have a major impact on the student's growth and subsequent career. The choice of advisor should be based on personal interviews and a familiarity with both the professor's past work and planned work in which the student is likely to be involved. The selection must be mutually acceptable to the student and to the professor, and must be approved by the department head as indicated on the student's Program of Study GS Form 6. Major advisors must have their primary appointment in ERHS.

#### **Graduate Advisory Committee**

The graduate advisory committee for a Doctor of Philosophy student shall consist of a minimum of four members. A fifth member is encouraged but not required. The committee should be composed of those persons best qualified to direct and evaluate the student's program of study. Responsibility for selecting the committee lies with the advisor and the student, with the approval of the department head.

The members are as follows: 1) the advisor who serves as chairperson of the committee and who must hold academic faculty rank as a professor, associate professor, or assistant professor of any appointment type within the department or program granting the degree; 2) two additional members from the department; and 3) one member from an outside department who, appointed by the Vice Provost for Graduate Studies, represents the Graduate School. The outside committee member appointed by the Vice Provost for Graduate Studies must hold a regular, special, transitional, joint, or emeritus/emerita faculty appointment at Colorado State University. ERHS faculty affiliates are considered members of ERHS and cannot serve as the outside committee member. A fifth member is encouraged by the department for PhD students and may be added to the graduate committee, but is not required. The fifth member may be a second

faculty member from outside the ERHS department or it may be a person qualified to serve on graduate committees (and approved, according to Graduate School guidelines) who works outside of the university, regardless of department affiliation. In addition to the basic membership, the committee may be supplemented by other members who may be capable of aiding in the investigation by the student. Voting privileges of committee members shall be as defined by the Graduate School. Individuals who are not academic faculty but who have special expertise may serve on committees in addition to the prescribed members, but may not vote regarding examination results.

The committee will be formed after selection of the advisor and prior to completing the Program of Study GS Form 6. The Program of Study must be filed with the Graduate School before the time of the fourth regular semester registration. In the event that a change of a committee member is made, that change is done with Petition for Change in Committee form GS9A, available from the Graduate School website. All changes to the original committee must be approved by both the committee member added and the committee member deleted as evidenced by a signature or initial on the Petition for Change of Committee (form GS 9a) prior to approval by the department head.

### **Responsibilities of the Advisory Committee and Ph.D. Student**

The student's graduate advisory committee shall provide guidance and supervision throughout the program of study. The initial meeting of the student with the committee should be held promptly after the committee is formed and the Program of Study GS Form 6 listing the required course of study must be filed with the Graduate School before the end of the third semester of residence. To assist the graduate advisory committee in its evaluation of the student's research progress, each student will meet at least annually with his/her committee. It is the student's responsibility to schedule the annual evaluation and to present materials that document the progress to date as described further below.

### **Seminar Requirement**

All candidates for the Ph.D. degree are required to complete a minimum of two credits of a seminar course. Eligible seminar courses include all approved university course listings in seminar format such as ERHS 693 A-D (Research Seminar), organized journal clubs taught as ERHS 696 (Group study), CM 792 (Cell and Molecular Biology seminar) and ERHS 792. The Graduate Advisory Committee may require additional credits of seminar courses.

### **Acquiring Teaching Experience**

All Ph.D. students are encouraged to gain experience in preparation and delivery of didactic material either through service as a Graduate Teaching Assistant (GTA) or through delivery of specific lectures as appropriate to his/her training or enrollment in Supervised College Teaching (ERHS 784).

### **Annual Progress Report**

The student should prepare a written report which summarizes the goals of the research, describes progress during the past year, emphasizes significant accomplishments, and discusses problems encountered. The student should indicate changes in direction which have occurred during the past year and outline the specific goals or objectives and approaches to be used during the coming year. In addition, students will report on their academic progress based on their GS 6 forms. Progress reports should not exceed ten double-spaced typewritten pages, excluding tables, figures and references. The report must be distributed to all committee members one week prior to the meeting.

### **Evaluation of Performance**

The committee should evaluate the student's course work and research progress. Persistent lack of progress will be grounds for dismissal from the Ph.D. program. The results of the annual evaluation, with the committee's recommendations, will be submitted by the graduate advisory committee in writing to the departmental office to be included in the student's file. Students failing to meet with the committee annually will have a hold placed on their registration for the following semester.

### **Preliminary Examination**

Ph.D. preliminary and final examinations are scheduled in advance by the advisor. In order to assure communication to all concerned (student, advisor, all committee members, department head, and Graduate School) the intention to hold a Ph.D. Preliminary Examination is to be publicized two weeks in advance.

The Department of Environmental and Radiological Health Sciences has adopted the procedures below to fulfill requirements for Ph.D. degrees in both programs. These procedures are consistent with the rules of the Graduate School of Colorado State University, yet recognize the primary role of the student's Graduate Advisory Committee in graduate education as well as the responsibility of the Department in assuring that high standards of academic quality are maintained. These standards include the required elements of written communication and critical thinking. The procedures apply to all new students who begin their graduate studies in the fall 2006 semester and thereafter.

### **Components of the Written Examination for the Ph.D. degree**

In order to meet the requirements for the Preliminary Examination, all students must take a written examination before the end of the fifth regular semester of full time registration or an equivalent period of partial registration.

Students must complete one of the following two requirements from each group:

- Preparation of a dissertation proposal describing the research to be conducted.
- OR
- Preparation of a research grant application to a funding agency (e.g., NIH) in the area of the student's proposed research.

AND

- Pass a written examination prepared by the section faculty in the student's area of study.
- OR
- Pass a written examination prepared by the student's graduate advisory committee.

Selection of the method(s) for meeting each of these requirements shall be at the discretion of the student's graduate committee in consultation with the student.

Students must defend their written dissertation or research proposal during the oral examination administered by the committee. The oral examination may also include areas that were covered during the written examination prepared by the graduate committee or section faculty.

## **Objectives of the Written Components for the Ph.D. degree**

The faculty requires doctoral students to show a competence for written communication, critical thinking, and scientific vision. Therefore, the preparation of a dissertation proposal or research grant application is required to meet the following objectives:

- Demonstrate a thorough understanding of the current ‘state of the science’ in their selected discipline.
- Identify critical gaps in the ‘state of the science’ of their discipline.
- Construct an original research plan to address such gaps and identify the benefits of their expected results.
- Communicate these ideas in a clear, concise, and scientifically-sound fashion.
- Provide the basis for a ‘research plan’ between the student and committee. In theory, successful completion (and dissemination) of the proposal objectives should constitute a means to degree completion.

The faculty requires doctoral students to show a command of the fundamental scientific skills within their selected discipline and to be able to synthesize ideas that are based on the skills and knowledge acquired in individual courses. Therefore, the purpose of the written examination is to evaluate the student’s comprehensive mastery of quantitative, qualitative, and knowledge-based skills in their selected discipline.

## **Guidelines for each of the four types of written examinations are described below.**

### 1. Dissertation Proposal

The dissertation proposal must represent original research conceived and conducted principally by the student. The dissertation proposal should contain at minimum:

- A statement of the hypothesis and objectives of the intended research.
- A background and significance section that reviews pertinent literature and places the proposed dissertation research into context, justifying the work and its originality.
- A description of the methods to be used including an outline of experiments or data collection methods, laboratory methods to be applied and statistical analyses.

Where the dissertation is anticipated to include chapters that will become distinct papers for submission, a separate preparation of sections should be made for each dissertation chapter.

### 2. Research Grant Application

A research grant application in the form required by that agency (e.g., NIH) in an area appropriate to that student’s specialization may be used to satisfy the requirement for preparation of a written research proposal. The research grant application must represent original work on the part of the student. If done in this form, it may contain additional appendices which 1) describe in greater detail the student’s thought processes and intentions and 2) contain additional references and supporting materials. Where the student’s research forms part of a larger team effort supported by funded grants, the student’s proposal should emphasize his or her specific original contributions to the team effort.

### 3. Written Examination Prepared by Section Faculty

The content and format for this examination shall be determined by the Section faculty who will prepare and grade the examination. The timing and administration of the examination shall be coordinated by the Section Head. Students must receive a majority of Pass grades in order to pass the examination. Students failing the examination may retake the examination once, within one year of the initial examination. Students who do not retake or pass the written examination within one year will be judged to have failed the Preliminary Examination.

### 4. Written Examination Prepared by the Graduate Advisory Committee

A written examination prepared by the graduate advisory committee containing questions from each member will cover required course material and other topic areas relevant to the student's intended dissertation research. Students must receive a majority of Pass grades in order to pass the examination. Students failing the examination may retake the examination once, within one year of the initial examination. Students who do not retake or pass the written examination within one year will be judged to have failed the Preliminary Examination.

### **Oral Examination**

Students must complete an oral examination to meet the requirements for the Preliminary Examination as described in the Graduate and Professional Bulletin (page 23). The Graduate and Professional Bulletin states, in part "A preliminary examination shall be administered at least two terms before the final examination to determine whether the student is qualified to continue toward the doctorate. The usual procedure is to have written examinations in the field of specialization and supporting areas followed by an oral examination. In order to assure full information to all concerned (student, advisor, all committee members, department head, Graduate School), the intention to hold a Ph.D. Preliminary Examination is to be publicized two weeks in advance by the advisor." The oral examination follows completion of the written examination. Successful completion of the oral examination as shown on the Report of the Preliminary Examination for the Ph.D. Degree form GS16 admits the student to candidacy for the Ph.D. degree.

The oral examination will be conducted by the Graduate Committee with the Head of the department or his/her designee in attendance as a nonvoting participant. The scope of the oral examination may include components from the written examination such as the dissertation proposal and written responses to questions provided by the committee or section faculty. The oral examination may include other discipline-specific areas as specified by the graduate advisory committee to the student prior to the oral examination.

- The graduate advisory committee shall evaluate the performance of the student on the oral examination on a pass/fail basis by majority vote of the committee.
- The student must receive a passing evaluation on the oral examination before being admitted into candidacy for the doctoral degree. Students who do not receive a passing evaluation may be re-examined at a time established by the graduate advisory committee no later than one year following the date of the original oral examination and not earlier than two months after the first oral examination.

- A student who does not receive a passing evaluation in two attempts or who elects not to stand for oral re-examination within a one year period following the date of the initial examination shall be dismissed from the program.
- Report of the Preliminary Examination for the Ph.D. Degree form GS16 must be completed and filed by the student with the Graduate School within two working days after the examination.

**Dissertation**

The student is required to prepare a well-written and comprehensive dissertation based upon original and independent research conducted during the course of study. A bound copy of the dissertation, containing an original signature page with the department head and the committee members' signatures, must be submitted to the department for its file.

## **Time Limit to Degree Completion**

There is a ten-year time limit for completion of the master's or doctoral degrees. Courses to be applied toward fulfilling the requirements for the master's and doctoral degrees, including any which may have been transferred from another institution, must have been registered for and completed within the ten years immediately preceding the date of completion of requirements for the degrees.

Graduate School Petition Requirements: <http://graduateschool.colostate.edu/policies-and-procedures/petitions/>

# Requirements for Graduate Degrees in Environmental Health Specializations

Except as described below for specializations in Environmental Health and Radiological Health Sciences degrees and the Graduate Program in Veterinary Diagnostic Imaging, all other program requirements are those described in the Graduate School Bulletin

See: <http://graduateschool.colostate.edu/for-current-students/> and <http://catalog.colostate.edu/general-catalog/graduate-bulletin/>

## Epidemiology Specialization

### M.S. Degree Programs

M.S. Plan A programs have a minimum of 30 semester credits with a thesis.

M.S. Plan B programs have a minimum of 36 semester credits with a professional paper

### Required Courses (19 credits)

- ERHS 532 Epidemiologic Methods (3)
- ERHS 640 Advanced Epidemiology (3)
- ERHS 658 Environmental and Occupational Epidemiology (3)
- ERHS 693A Research Seminar: Epidemiology (1) (Registration every semester is strongly recommended)
- STAT Course to be determined in consultation with advisor

One course from ONE of the following areas; 3 or more credits:

#### Environmental / Occupational Health

- ERHS 520 Environmental & Occupational Health Issues (3)
- ERHS 526 Industrial Hygiene (3)
- ERHS 536 Advanced Occupational Health (3)
- ERHS 540 Principles of Ergonomics (3)

#### Toxicology / Cancer Biology\*

- ERHS 502 Fundamentals of Toxicology (3)
- ERHS 510 Cancer Biology (3)
- ERHS 611 Cancer Genetics (2)
- ERHS 733 Environmental Carcinogenesis (3)

#### Microbiology\*

- MIP 420 Medical and Molecular Virology (4)
- MIP 530 Advanced Molecular Virology (3)
- MIP 651 Immunobiology (3)
- MIP 760 Mechanisms of Bacterial Pathogenesis (3)

#### Statistics\*

- STAT 511 Design and Data Analysis for Researchers I (4)
- STAT 512 Design and Data Analysis for Researchers II (4)
- STAT 523 Quantitative Spatial Analysis (3)
- STAT 525 Analysis of Time Series I (3)
- STAT 526 Analysis of Time Series II (3)
- STAT 547 Statistics for Environmental Monitoring (3)

STAT 560 Applied Multivariate Analysis (3)

ERHS 642 Applied Logistic Regression (3)

**Epidemiology Related Courses** (2 credits, Plan A; 12 credits, Plan B)

Other courses in epidemiology or related areas, as approved by graduate advisory committee

**Out of Department Requirement** (3 or more credits)

Graduate level course work approved by graduate advisory committee

**Research**

Plan A: ERHS 699 Thesis (minimum of 6 credits)

Plan B: ERHS 695 Independent Study (minimum of 6 credits for professional paper preparation)

\*A non-ERHS course cannot be used to meet both required and out-of-department requirements.

# **Epidemiology Specialization**

## **Ph.D. Degree Program**

Ph.D. programs have a minimum of 72 credits. Up to 30 credits from a M.S. degree program in a related field may be transferred to the Ph.D. program.

### **Required Courses** (26 credits)

ERHS 532	Epidemiologic Methods (3)
ERHS 640	Advanced Epidemiology (3)
ERHS 642	Applied Logistic Regression (3)
ERHS 658	Environmental and Occupational Epidemiology (3)
ERHS 693A	Research Seminar: Epidemiology (2) (Registration every semester is strongly recommended)
STAT Course	to be determined in consultation with advisor

One course from TWO of the following areas; 6 or more credits:

### **Environmental / Occupational Health**

ERHS 520	Environmental & Occupational Health Issues (3)
ERHS 526	Industrial Hygiene (3)
ERHS 536	Advanced Occupational Health (3)
ERHS 540	Principles of Ergonomics (3)

### **Toxicology / Cancer Biology\***

ERHS 502	Fundamentals of Toxicology (3)
ERHS 510	Cancer Biology (3)
ERHS 611	Cancer Genetics (2)
ERHS 733	Environmental Carcinogenesis (3)

### **Microbiology\***

MIP 530	Advanced Molecular Virology (3)
MIP 651	Immunobiology (3)
MIP 760	Mechanisms of Bacterial Pathogenesis (3)

### **Statistics\***

STAT 511	Design and Data Analysis for Researchers I (4)
STAT 512	Design and Data Analysis for Researchers II (4)
STAT 523	Quantitative Spatial Analysis (3)
STAT 525	Analysis of Time Series I (3)
STAT 526	Analysis of Time Series II (3)
STAT 547	Statistics for Environmental Monitoring (3)
STAT 560	Applied Multivariate Analysis (3)

### **Epidemiology Related Courses** (12 credits)

Other courses in epidemiology or related areas, as approved by graduate advisory committee

### **Out of Department Requirement** (6 or more credits)

Graduate level course work approved by graduate advisory committee

**Research** (credits determined by graduate advisory committee; minimum of 27 credits)

ERHS799 Dissertation

\*Non-ERHS courses cannot be used to meet both required and out-of-department requirements.

### **Epidemiology and Epidemiology Related Courses**

In addition to the following courses, any course listed under the M.S. or Ph.D. degree programs for the specialization in Epidemiology can be used to satisfy the credit requirement for “Epidemiology Related Courses”.

ATS 555	Air Pollution (3)
ATS 560	Air Pollution Measurement (2)
ATS 621	Atmospheric Chemistry (2)
BC 463	Molecular Genetics (3)
BMS 410	Physiological Responses to the Environment (3)
BMS 420	Cardiopulmonary Physiology (3)
BMS 430	Endocrinology (3)
BMS 460	Essentials of Pathophysiology (3)
BMS 500	Mammalian Physiology I (4)
BMS 501	Mammalian Physiology II (4)
BMS 620	Cardiovascular Physiology (3)
BMS 640	Reproductive Physiology and Endocrinology (5)
BSPM 508	Environmental Fate of Pesticides (3)
ERHS 430	Human Disease and the Environment (3)
ERHS/MIP 533	Epidemiology of Infectious Disease/Zoonoses (3)
ERHS 550	Principles of Radiation Biology (5)
ERHS 561	Radiation Public Health (2)
ERHS 563	Environmental Contaminant Modeling I (2)
ERHS 648	Environmental Health Risk Assessment (3)
ERHS/VS 662	Applied Research – Planning/Design/Analysis (3)
FSHN 640	Selected Topics in Nutritional Epidemiology (2)
HES 645	Epidemiology of Health and Physical Activity (3)
MIP/BZ 462	Parasitology and Vector Biology (5)
MIP 555	Principles and Mechanisms of Disease (3)
MIP 563	Biology of Disease Vectors (3)
MIP/BSPM 576	Bioinformatics
MIP/BZ 578	Genetics of Natural Populations (3)
MIP 580	Disease Vectors in the Field and Laboratory (3)
MIP 624	Advanced Topics in Microbial Ecology (2)
MIP 636	Mechanism of Viral Infection and Disease (4)
NR 421	Natural Resource Sampling (3)
NR 505	Concepts in GIS (4)
NR 512	Spatial Statistical Modeling-Natural Resources (3)
PSY 515	Women’s Health (3)
PSY/IE 517	Perspectives in Global Health (3)
VM 714	Veterinary Preventive Medicine (4)*
VS 581	Advanced Veterinary Epidemiologic Research

## Industrial Hygiene Specialization

### M.S. Degree Programs

M.S. Plan A program requires a minimum of 30 semester credits with a \*thesis.

M.S. Plan B program requires a minimum of 36 semester credits with a professional paper and internship OR one year of professional experience in occupational OR environmental health-related areas.

### Required Core Courses

**Plan A** - minimum of 20 credits; **Plan B** - minimum of 24 credits

ERHS 520	Environmental & Occupational Health Issues (3)
ERHS 526	Industrial Hygiene (3)
ERHS 527	Industrial Hygiene Laboratory (1)
ERHS 532	Epidemiologic Methods (3)
ERHS 693B	Research Seminar -Industrial Hygiene (1-4)
OR	
ERHS679	Occupational and Environmental Health Interdisciplinary Symposium (1-4) <i>required for MAP ERC funded Trainees every year of funding</i>
ERHS 695	Independent Study (4) ( <b>Plan B</b> )
ERHS 699	Thesis (4-6) ( <b>Plan A</b> )
PSY 692D	Professions Protecting/Promoting Worker Health (1) <i>required for all MAP ERC Trainees.</i>
STATISTICS	One graduate level course (3)

Out of department elective approved by student's committee (3)

Two additional courses approved by student's committee (**Plan B**)

### Elective Courses

**Plan A** - minimum of 9 credits; **Plan B** - minimum of 12 credits)

ERHS 502	Fundamentals of Toxicology (3) or EHOH6616 Environmental and Occupational Toxicology (CSPH UCD) (3)
ERHS 503	Toxicology Principles (1)
ERHS 504	Occupational and Environmental Toxicology (2)
ERHS 527	Industrial Hygiene Laboratory (1)
ERHS 528	Occupational Safety (3)
ERHS 530	Radiological Physics and Dosimetry I (3)
ERHS 536	Advanced Occupational Health (3)
ERHS 540	Principles of Ergonomics (3)
ERHS 541	Ergonomics in Product and Process Design (3)
ERHS 547	Equipment & Instrumentation (3)
ERHS 549	Environmental Health Risk Assessment (3)
ERHS 550	Principles of Radiation Biology (3)
ERHS 636	Industrial Hygiene Control Methods (3)
ERHS 637	Environmental Safety & Health Management (3)
ERHS 656	Occupational Noise Control (3)
ERHS 692D	Professions Protecting/Promoting Worker Health (1)
ERHS 698	Research (1-6)

### **Responsible Conduct Research Training:**

**RCR Online Training:** All master's students will be required to take the Responsible Conduct Research online training. It is an overview of the core competencies involved in research and can be found at: <http://rcr.colostate.edu/training.html>. There are nine learning modules followed by a mastery quiz, and takes about an hour to complete.

### **OEHS Thesis Guidelines**

The OEHS adopted the following Master's Thesis format to facilitate a concise, clear, well-written document that is more easily transformed into a publishable manuscript. In addition, all master's degree students should consult the CSU Graduate School's Thesis and Dissertation Formatting Guide for thesis development. The thesis should contain the following sections:

1. Title page, copyright page, abstract, and table of contents per the Graduate School's Thesis and Dissertation Formatting Guide
2. Introduction. This section should include a presentation of referenced literature necessary to support the rationale, purpose, and understanding of the study. Do not provide an exhaustive, historical review of the literature.
3. Experimental Section. This section should concisely and clearly explain the methods and materials used so that others can repeat your work. If an explanation of detailed operating procedures or processes is required to explain the method, provide those details in an Appendix at the end of the thesis.
4. Results. The results should be presented, and as necessary, with tables, illustrations, and/or graphs. The style and format of tables, illustrations, and graphs should adhere to the Graduate School Thesis and Dissertation Formatting Guide. Consideration should also be given to the format suggested by the journal to which the manuscript will be submitted.
5. Discussion. This section should address whether or not the study results supported the hypothesis and why. A comparison of the study results to other published studies, supporting or negating, should be presented as well as how the results contribute to the body of knowledge. The student's interpretation/opinion regarding the results can be presented in this section. Last, a detailed presentation of the study strengths and limitations should be included.
6. Conclusions and Future Work. Concisely state the conclusions based on the study results/discussion. Identify future work that should be accomplished to further address the area of study.
8. References. The citation and bibliography format should follow the format suggested by the journal to which the manuscript will be submitted, provided that this format also adheres to the Graduate School Thesis and Dissertation Formatting Guide. When in doubt, always follow the Graduate School Thesis and Dissertation Formatting Guide.

9. Appendices. Include any appendices necessary to detail methods/materials used (e.g., procedures and questionnaires).

## **Industrial Hygiene Specialization**

### **Ph.D. Degree Program**

The Ph.D. program requires a minimum of 72 semester credits plus dissertation.

### **Required Core Courses** (minimum of 29 credits)

ERHS 520	Environmental & Occupational Health Issues (3)
ERHS 526	Industrial Hygiene (3)
ERHS 532	Epidemiologic Methods (3)
ERHS 693B	Research Seminar -Industrial Hygiene (1-4)
OR	
ERHS 679	Occupational and Environmental Health Interdisciplinary Seminar (1-4) <i>required for</i> MAP ERC funded Trainees (every spring)
ERHS 799	Dissertation (15-20)
STATISTICS	One graduate level course (with approval of advisor) (3)
PSY 692D	Professions Protecting/Promoting Worker Health (1) – Required for all MAP ERC Trainees (fall)

**Out of Department Courses** (minimum of 6 credits in 2 courses) must be approved by committee.

### **Elective Courses** (minimum of 15 credits)

ERHS 502	Fundamentals of Toxicology (3)
ERHS 527	Industrial Hygiene Laboratory (1)
ERHS 528	Occupational Safety (3)
ERHS 530	Radiological Physics and Dosimetry (3)
ERHS 536	Advanced Occupational Health (3)
ERHS 540	Principles of Ergonomics (3)
ERHS 541	Ergonomics in Product and Process Design (3)
ERHS 547	Equipment & Instrumentation (3)
ERHS 549	Environmental Health Risk Assessment (3)
ERHS 550	Principles of Radiation Biology (3)
ERHS 601	Metabolism & Disposition of Toxic Agents (3)
ERHS 636	Industrial Hygiene Control Methods (3)
ERHS 637	Environmental Safety Health Management (3)
ERHS 648	Environmental Health Risk Assessment (3)
ERHS 656	Occupational Noise Control (3)
ERHS 658	Environmental & Occupational Epidemiology (3)
ERHS 726	Aerosols & Occupational Health (3)
ERHS 784	Supervised College Teaching (3)
PSY 792	Occupational Health Psychology (3)

## **Responsible Conduct Research Training:**

All PhD students will be required to take the Responsible Conduct Research training (RCR).

There is one online course and one eight week course that will be required:

**RCR Online Training:** Is an overview of the core competencies involved in research and can be found at: <http://rcr.colostate.edu/training.html>. There are nine learning modules followed by a mastery quiz. The online training takes about one hour to complete.

**GRAD 544:** Offered fall and spring semesters only. It is a one-credit, eight-week course that will cover the mandated areas of RCR training for the physical sciences, biomedical science and humanities. For a complete list of all RCR courses offered at CSU, please refer to: <http://rcr.colostate.edu/courses.html>.

Students can take GRAD 544 or one of the listed courses from the above link to meet the eight week course requirement.

## **Ergonomics Specialization**

### **M.S. Degree**

The M.S. program with a focus in Ergonomics requires a minimum of 32 semester credits. Additional courses may be required depending on previous coursework.

### **EOH\* Core Courses** (10 credits)

ERHS 520	Environmental & Occupational Health Issues (3)
ERHS 532	Epidemiologic Methods (3)
ERHS 679	Occupational and Environmental Health Interdisciplinary Symposium (1) *Required for all MAP ERC Trainees every year funded
STATISTICS	One graduate level course (with approval of advisor) (3)

### **Ergonomics Core Courses** (9 credits)

ERHS 528	Occupational Safety (3)
ERHS 540	Principles of Ergonomics (3)
ERHS 541	Ergonomics in Product & Process Design (3)

### **Additional Course Work**

ERHS 687	Practicum / Internship, minimum (3)
ERHS 699	Thesis** minimum (4)
Dept. Electives (ERHS)	minimum (3)
Out of dept. course	minimum (3)
PSY 692D	Professions Protecting/Promoting Worker Health (1) – Required for all MAP ERC Trainees (fall)

\* EOH = Environmental and Occupational Health

\*\*Thesis required - See Guidelines below

### **Responsible Conduct Research Training:**

**RCR Online Training:** All master's students will be required to take the Responsible Conduct Research online training. It is an overview of the core competencies involved in research and can be found at: <http://rcr.colostate.edu/training.html>. There are nine learning modules followed by a mastery quiz, and takes about an hour to complete.

### **OEHS Thesis Guidelines**

The OEHS adopted the following Master's Thesis format to facilitate a concise, clear, well-written document that is more easily transformed into a publishable manuscript. In addition, all master's degree students should consult the CSU Graduate School's Thesis and Dissertation Formatting Guide for thesis development. The thesis should contain the following sections:

1. Title page, copyright page, abstract, and table of contents per the Graduate School's Thesis and Dissertation Formatting Guide
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3. Experimental Section. This section should concisely and clearly explain the methods and materials used so that others can repeat your work. If an explanation of detailed operating procedures or processes is required to explain the method, provide those details in an Appendix at the end of the thesis.
4. Results. The results should be presented, and as necessary, with tables, illustrations, and/or graphs. The style and format of tables, illustrations, and graphs should adhere to the Graduate School Thesis and Dissertation Formatting Guide. Consideration should also be given to the format suggested by the journal to which the manuscript will be submitted.
5. Discussion. This section should address whether or not the study results supported the hypothesis and why. A comparison of the study results to other published studies, supporting or negating, should be presented as well as how the results contribute to the body of knowledge. The student's interpretation/opinion regarding the results can be presented in this section. Last, a detailed presentation of the study strengths and limitations should be included.
6. Conclusions and Future Work. Concisely state the conclusions based on the study results/discussion. Identify future work that should be accomplished to further address the area of study.
8. References. The citation and bibliography format should follow the format suggested by the journal to which the manuscript will be submitted, provided that this format also adheres to the Graduate School Thesis and Dissertation Formatting Guide. When in doubt, always follow the Graduate School Thesis and Dissertation Formatting Guide.
9. Appendices. Include any appendices necessary to detail methods/materials used (e.g., procedures and questionnaires).

## **Ergonomics Specialization**

### **Ph.D. Degree Program**

The Ph.D. program with a focus in Ergonomics requires a minimum of 72 semester credits with a dissertation.

### **EOH\* Core Courses** (10 credits)

ERHS 520	Environmental & Occupational Health Issues (3)
ERHS 532	Epidemiologic Methods (3)
ERHS 679	Occupational and Environmental Health Interdisciplinary Symposium (1)
STATISTICS	One graduate level course (3)

### **Ergonomics Core Courses** (21 credits)

ERHS 528	Occupational Safety (3)
ERHS 536	Advanced Occupational Health (3)
ERHS 540	Principles of Ergonomics (3)
ERHS 541	Ergonomics in Product & Process Design (3)
ERHS 642	Applied Logistic Regression (3)
ERHS 658	Environmental & Occupational Epidemiology (3)
ERHS 687	Practicum / Internship (Ergonomic Field Work) (3)
ERHS 784	Supervised College Teaching (3)
STATISTICS	One graduate level course (with approval of advisor) (3)

### **Additional Course Work**

ERHS 799**	Dissertation minimum (15)
Dept. elective (ERHS) course,	minimum (3)
Out of dept. courses,	minimum (6)
PSY 692D	Professions Protecting/Promoting Worker Health (1) – Required for all MAP ERC Trainees (fall)

\*EOH = Environmental and Occupational Health

A Dissertation will be required

### **Responsible Conduct Research Training:**

All PhD students will be required to take the Responsible Conduct Research training (RCR). There is one online course and one eight week course that will be required:

**RCR Online Training:** Is an overview of the core competencies involved in research and can be found at: <http://rcr.colostate.edu/training.html>. There are nine learning modules followed by a mastery quiz. The online training takes about one hour to complete.

**GRAD 544:** Offered fall and spring semesters only. It is a one-credit, eight-week course that will cover the mandated areas of RCR training for the physical sciences, biomedical science and humanities. For a complete list of all RCR courses offered at CSU, please refer to: <http://rcr.colostate.edu/courses.html>.

Students can take GRAD 544 or one of the listed courses from the above link to meet the eight week course requirement.

# Toxicology Degree

## Master of Science in Toxicology Degree Program

*Plan A* Masters programs have a minimum of 30 semester credits with a thesis.

*Plan B* Masters programs have a minimum of 32 semester credits with a comprehensive examination.

### Objectives for graduates

- Obtain a broad, fundamental knowledge of the field of Toxicology
- Develop professional communication skills and expertise
- Develop technical skills and practical experience in solving Toxicological problems

### Core Courses

ERHS 502 <sup>P</sup>	Fundamentals of Toxicology	(3)
ERHS 601 <sup>P</sup>	Metabolism and Disposition of Toxic Agents	(3)
ERHS 602 <sup>P</sup>	Toxicological Mechanisms	(3)
ERHS 603 <sup>P</sup>	Toxicological Pathology	(3)
	<b>TOTAL</b>	<b>12</b>

### Departmental Courses

**Category A** *Select at least one of the following courses:*

ERHS 520 <sup>P</sup>	Environmental and Occupational Health Issues	(3)
ERHS 566 <sup>P</sup>	Forensic Toxicology	(3)
ERHS 568 <sup>P</sup>	Pharmaceutical and Regulatory Toxicology	(3)

**Group B.** *Select at least two of the following courses:*

ERHS 448 <sup>P</sup>	Environmental Contaminants: Exposure and Fate	(3)
ERHS 547 <sup>P</sup>	Equipment and Instrumentation	(3)
ERHS 549 <sup>P</sup>	Environmental Health Risk Assessment	(3)
ERHS 567 <sup>P</sup>	Cellular and Molecular Toxicology Techniques	(3)
ERHS 733 <sup>P</sup>	Environmental Carcinogenesis	(3)
	<b>TOTAL</b>	<b>9</b>

Seminar Requirement <sup>3</sup> .....	1
Out of Department Requirement <sup>2,4,5</sup> .....	3
Electives <sup>2,4,5</sup> .....	
<i>Plan A</i> .....	0-2
<i>Plan B</i> .....	7
ERHS 699 ..... Thesis (Plan A Only).....	3-5

**Program Total: Plan A:** minimum 30 credits<sup>5</sup>, **Plan B:** minimum 32 credits<sup>5</sup>

<sup>P</sup> This course has at least one prerequisite. Check the Courses of Instruction section of the catalog at <http://catalog.colostate.edu/> to see the course prerequisites.

<sup>1</sup> Departmental courses not used to fulfill the category A requirement may be counted toward the category B requirement.

<sup>2</sup> A maximum of 6 credits below 500-level may be counted toward the program total.

<sup>3</sup> Select graduate seminar course(s) with approval by the advisor and graduate committee.

<sup>4</sup> Eligible courses determined by advisor and graduate committee.

<sup>5</sup> No more than a total of 6 credits of Independent Study, Group Study, Research, and Internship course numbers may be included in the program.

# Toxicology Degree

## Ph.D. in Toxicology Degree Program

Ph.D. programs have a minimum of 72 credits. Up to 30 credits from a Master's degree program may be transferred to the Ph.D. program.

### Objectives for graduates

- Obtain a broad, fundamental knowledge of the field of Toxicology
- Develop professional communication skills and expertise
- Develop technical skills and practical experience in solving Toxicological problems

### Core Courses

ERHS 502	Fundamentals of Toxicology	(3)
ERHS 566	Forensic Toxicology	(3)
ERHS 601	Metabolism and Disposition of Toxic Agents	(3)
ERHS 602	Toxicological Mechanisms	(3)
ERHS 603	Toxicological Pathology	(3)
	<b>TOTAL</b>	<b>15</b>

Department Electives<sup>1,2</sup> .....9

Seminar Requirement<sup>3</sup> .....2

Out-of-Department Requirement<sup>2</sup> .....6

Doctoral Research<sup>4</sup>

ERHS 799                      Dissertation.....Var.

**PROGRAM TOTAL = 72 credits<sup>5</sup>**

<sup>p</sup> This course has at least one prerequisite. Check the Courses of Instruction section of the catalog at <http://catalog.colostate.edu/> to see the course prerequisites.

<sup>1</sup> Select from the list of departmental courses as approved by advisor and graduate committee.

<sup>2</sup> A maximum of 6 credits below 500-level may be counted toward the program total.

<sup>3</sup> A minimum of 2 credits of graduate seminar course(s) determined by the advisor and graduate committee.

<sup>4</sup> Select enough dissertation credits to bring the program total to a minimum of 72 credits as approved by the advisor and graduate committee.

<sup>5</sup> Ph.D. programs have a minimum of 72 credits. Up to 30 credits from a master's degree program may be transferred to the Ph.D. program as approved by the advisor and graduate committee.

# Requirements for Graduate Degrees in Radiological Health Sciences

## Health Physics Specialization

### M.S. Degree Program

#### Required Courses (23 credits)

ERHS 530	Radiological Physics and Dosimetry I (3)
ERHS 531	Nuclear Instruments and Measurements (2)
ERHS 550	Principles of Radiation Biology (5)
OR	
ERHS 450	Introduction to Radiation Biology (3)
(Note: ERHS 550 or ERHS 450 may be taken to fulfill Radiobiology requirement)	
ERHS 561	Radiation Public Health (2)
ERHS 630	Radiological Physics and Dosimetry II (3)
ERHS 632	Techniques in Radiation Dosimetry (1)
ERHS 665	Radiochemistry (3)
ERHS 693D	Research Seminar – Health Physics
ERHS 786	Practicum (3)

#### Alternative Required Electives (5-7 credits)

Statistics:

STAT 511, or 547, or other statistics class as approved by advisor (GS-6) (4)

Environmental Health Physics:

ERHS 563 Environmental Contaminant Modeling I (2)

OR

ERHS 570 Radioecology (2)

#### General Electives (at least 3 credits from the following)

ERHS 446	Environmental Toxicology (3)
ERHS 502	Fundamentals of Toxicology (3)
ERHS 515	Non-Ionizing Radiation Safety (3)
ERHS 520	Advanced Environmental Health (3)
ERHS 526	Industrial Hygiene (3)
ERHS 527	Industrial Hygiene – Lab (1)
ERHS 712	Physics of Diagnostic Imaging
ERHS 714	Radiotherapy Physics
ERHS 726	Aerosols and Occupational Health (3)
STAT 512	Design and Data Analysis for Researchers II (4)
STAT 547	Statistics for Environmental Monitoring (3)
ECE 543	Accelerator Engineering (3)

Either of the following may also be used if not selected above:

ERHS 563	Environmental Contaminant Modeling (2)
ERHS 570	Radioecology (2)

#### Additional Credit Requirement for Plan A:

ERHS 699 Thesis (3)  
ERHS 679 Occupational and Environmental Health Interdisciplinary Symposium  
(spring) (1 credit) *Required for MAP ERC funded Trainees*

PSY 692D Seminar: Industrial/Organizational Psychology Group Study—  
Industrial/Organizational Psych (1 credit) – *Required for 1<sup>st</sup> year MAP  
ERC funded Trainees (fall)*

**Additional Credit Requirement for Plan B:** 36 total credits

# HEALTH PHYSICS SPECIALIZATION

## **Ph.D. Degree Program**

### **Required Courses** (72 credits minimum)

All M.S. Courses listed above

ERHS 799                      Dissertation

### **Electives**

From electives listed above

### **Additional Credit Requirements:**

ERHS 679                      Occupational and Environmental Health Interdisciplinary Symposium  
(1 credit) *Required for MAP ERC Trainees (spring)*

PSY 692D                      Seminar: Industrial/Organizational Psychology (1 credit) – *Required for  
MAP ERC 1<sup>st</sup> year Trainees (fall)*

Notes: Electives are suggested courses but others may be used upon approval by the graduate student's committee.

# **Radiation Cancer Biology and Oncology**

## **M.S. Degree Program**

### **Required Courses** (30 Credits Minimum)

BC 401	Comprehensive Biochemistry I (3)
BC 403	Comprehensive Biochemistry II (3)
ERHS 530	Radiological Physics and Dosimetry I (3)
ERHS 550	Principles of Radiation Biology (5)
ERHS 699	Thesis (Var)
ERHS 770	Radiation Biology Basic to Tumor Therapy (1)
Statistics	(several options) (3)
Electives	From electives list below (Var)

## **Ph.D. Degree Program**

### **Required Courses** (72 Credits Minimum)

All M.S. Courses listed above

BC 563	Molecular Genetics (4)
BC 565	Molecular Regulation of Cell Function (4)
ERHS 751	Advanced Radiation Biology I (3)
ERHS 753	Advanced Radiation Biology II (3)
ERHS 770	Radiation Biology Basic to Tumor Therapy (Var)
ERHS 799	Dissertation (Var)
Electives	From electives list below (Var)

### **Electives**

ERHS 510	Cancer Biology (3)
ERHS 611	Cancer Genetics (2)
ERHS 630	Radiological Physics and Dosimetry II (2)
ERHS 733	Environmental Carcinogenesis (3)
ERHS 712	Physics of Diagnostic Imaging (3)
VS 780	Cancer Biology Clinical Practicum (2)

Notes: Electives are suggested courses but others may be used upon approval by the graduate student's committee.

## **Radiation Oncology Residents - Plan B - M.S. Degree Program (30 credits required)**

### **Required**

BC 401	Comprehensive Biochemistry I (3) (often fulfilled in DVM program)
BC 403	Comprehensive Biochemistry II (3) (often fulfilled in DVM program)
ERHS 714	Physics of Radiation Therapy (3)
ERHS 550	Principles of Radiation Biology (5)
ERHS 770	Radiation Biology Basic to Tumor Therapy (2)
Statistics	(several options) (3)
ERHS 721	Radiation Oncology
ERHS 510	Cancer Biology (3)
ERHS 611	Cancer Genetics (2)

### **Electives**

#### **From electives list below or others (Var)**

ERHS 630	Radiological Physics and Dosimetry II (2)
ERHS 733	Environmental Carcinogenesis (3)
ERHS 712	Physics of Diagnostic Imaging (3) (offered odd years, fall only)
ERHS 701	Advanced Diagnostic Imaging Modalities (4) (offered odd years, spring only)
ERHS 711	Advanced Radiographic Interpretation (Variable 1-4) (offered odd years, spring only)
ERHS 784	Supervised College Teaching
ERHS 695L	Independent Study in Radiation Therapy
ERHS 751	Advanced Radiation Biology (not available every year)

## **Radiology Residency Program**

### **Required Courses (20 credits total)**

ERHS 550	Principles of Radiation Biology (5) (offered spring only)
ERHS 701	Advanced Diagnostic Imaging Modalities (4) (offered odd years, spring only)
ERHS 711	Advanced Radiographic Interpretation (Variable 1-4) (offered odd years, spring only)
ERHS 712	Physics of Diagnostic Imaging (3) (offered odd years, fall only)
STAT 307	Introduction to Biostatistics or equivalent (3) (only needed if no other statistics course has been taken)
VS 792	Seminar/Graduate (1)

### **Elective Courses (total 16 credits in any combination)**

ERHS 721	Radiation Oncology (1-3)
ERHS 695 & 795	Independent Study (Var)
ERHS 770	Radiation Biology Basic to Tumor Therapy (1-3)
VS 660	Neurology and Neurosurgery (3) (offered in spring semester)
VS 701-704	Postgraduate Medicine I-IV (Var) (requires residency director approval)

Students in this program are considered “Plan B” and a thesis is not required. A final oral exam is required and submission of two manuscripts for publication (see syllabus for more detailed information on all requirements:

[http://www.cvmb.colostate.edu/ns/\\_docs/departments/erhs/vdi\\_residency\\_syllabus.pdf](http://www.cvmb.colostate.edu/ns/_docs/departments/erhs/vdi_residency_syllabus.pdf)

# **Integrated Degree Program (IDP) Admission to Masters of Science Programs**

The Department of Environmental and Radiological Health Sciences (EHRS) has established an Integrated Degree Program (IDP) for advanced undergraduate students that culminate with a B.S. degree and an M.S. degree. Currently this option is available for students wishing to complete a M.S. degree in Environmental Health with a specialization in Toxicology or in Radiological Health Sciences with a specialization in Health Physics. The program is designed to culminate in the awarding of the M.S. degree after 5 years at CSU. The M.S. in Health Physics is accredited through the Accreditation Board for Engineering and Technology (ABET).

Undergraduates enrolled in a bachelor's degree program at Colorado State University and who have completed at least 75 credits of coursework toward their degrees, including 15 credits in upper division courses required by their major, with a cumulative GPA of 3.0 or above, may apply for admission to the combined bachelor's/master's degree programs within their majors. Such programs have been established to encourage students with strong scholarly and/or research interests to begin their graduate programs during their junior year and to provide flexibility in the scheduling and completion of upper division undergraduate requirements along with the graduate course requirements for the master's degree. The graduate degree will be awarded only after, or concurrently with, the award of the B.S. degree.

## **IDP Program in Health Physics**

Incoming undergraduates follow their regular BS curriculum for the first year. During the second year, students with outstanding performance in mathematics and science can begin to consider the Track III option. This allows early admission to Graduate School before completion of the bachelor's degree. Interested students are advised to:

- 1) Increase their credit hours,
- 2) Enroll in the more mathematically-oriented PH 141 and 142 physics courses
- 3) Enroll in mathematics through MATH 255 (Calculus for Biological Sciences II).

Although the program does not require additional credits in the first or second years, interested students are advised to increase their credit hours in these years, especially in the university required curriculum courses. This will insure that courses required in later semesters can be accommodated.

Students who perform well and maintain an interest during the third year are eligible to apply to the IDP program. These students are advised of the application procedures for IDP admissions to the Graduate School. They are also notified that graduate school tuition rates will be applicable once a total of 120 credits have been accumulated. They are also eligible to apply for Graduate Assistantships after completing 120 credits. These students would also enroll in Cell Biology (BIO 310) as a prerequisite for Principles of Radiation Biology (ERHS 550).

Students may return to their standard BS curriculum during their third year. Any credits in physics and mathematics courses may be applied towards the B.S. degree. Progress towards normal completion of the BS degree is maintained following withdrawal from the Track III program at this time.

Students are admitted to the Graduate School and begin taking graduate level courses in their fourth year. A graduate student advisor is selected at this time. By the end of the fall semester of their fourth year, a Graduate Advisory Committee is formed and Program of Study (GS-6) is submitted to the Graduate School. Students may withdraw from Track III and return to the standard BS curriculum in the spring semester of their fourth year. Progress towards normal completion of the BS degree may be maintained via credits earned in ERHS 530 and BZ 310 if they can be applied towards the students BS program.

Students will receive credit for their MS-HP practicum during the fall semester of their fifth year by preparing documents and formal reports describing their radiation-related experiences. It is important to note that when they begin their practicum, IDP students will have completed the same formal course work and laboratory exercises as those students in the regular MS-HP graduate program.

Students will receive a B.S. at the end of the fifth year upon completion of all program requirements. Because of time restrictions and scheduling, the M. S. degree will be a Plan B degree. The M.S. degree will also be awarded at the end of their fifth year upon completion of a professional paper, presentation of a seminar, and a successful oral final examination. Students who wish to obtain a Plan A M.S., may do so but will need to conduct research, prepare and defend a thesis, and will likely need to spend additional time at CSU.

### **IDP Program in Toxicology (This program is currently not available)**

A student who is interested in applying for the IDP program in Toxicology should meet with a representative from the Toxicology section for advising. Generally, a student should apply for this program of study during their 3<sup>rd</sup> year as an undergraduate student. At that time, students would then be counseled to take additional courses during their fourth year which would not count toward their undergraduate degree, but will count toward their Master's program. Courses will be chosen by the student and advisor to fulfill the requirements of the Master's degree program in Toxicology, and augment the student's education in specific areas that will be outlined by the student and the advisor.

Students will receive their M.S. degree at the end of their fifth year upon completion of the requirements outlined previously for a plan B Masters in Toxicology. Those students who wish to perform independent research, defend a thesis, and receive a Plan A M.S. may do so, but will likely need to spend additional time at CSU.

## **Integrated Degree Program (IDP) Master's Degree Program in Health Physics**

The Department of Environmental and Radiological Health Sciences offers an Integrated Degree Program (IDP) admission for CSU undergraduate students. Requirements for an IDP admission leading to the Master's degree in Environmental Health or Radiological Health Sciences are described on pages 12-13.

Note: there are no changes in the undergraduate program during the first two years.

### **Year 1 – Fall Semester**

LIFE 102	Attributes of Living Systems (4)
CHEM 111	General Chemistry I (4)
CHEM 112	General Chemistry I Lab (1)
CO 150	College Composition (3)
Core	Arts and Humanities (3)

### **Year 1 – Spring Semester**

CHEM 113	General Chemistry II (3)
CHEM 114	General Chemistry II Lab (1)
ERHS 220	Environmental Health (2)
MATH 155	Calculus for the Biological Sciences (4)

### **Year 2 – Fall Semester**

MATH 126	Analytical Trigonometry (1)
PH 141	Physics for Scientists and Engineers (5)
ERHS 230	Field Methods (3)
CHEM 341	Organic Chemistry I (3)
Core	Social/Behavioral Sciences (3)

### **Year 2 – Spring Semester**

BMS 300	Principles of Human Physiology (4)
CHEM 343	Organic Chemistry II (3)
CHEM 344	Organic Chemistry II Lab (2)
PH 142	Physics for Scientists and Engineers II (5)

During their second year, students with strong performance in calculus and physics courses would be asked about their interest in the IDP program. Those students who express a desire to be considered for early admission to Graduate School would be counseled to take the following sequence of courses.

### **Year 3 – Fall Semester**

MIP 300	General Microbiology (3)
MIP 302	General Microbiology Lab (2)
ERHS 320	Environmental Health Water and Food Safety (3)
ERHS 350	Industrial Hygiene & Air (3)
Core	Additional Communication (3)

### **Year 3 – Spring Semester**

MATH 255	Calculus for Biological Scientists II (4)
ERHS 332	Principles of Epidemiology (3)
ERHS 479	Environmental Health Practice (1)
Core	Arts/Humanities (3)
	Historical Perspectives (3)
	Electives (2)

Those students who perform well and maintain their interest in the third year would be counseled to apply to the IDP program. Students, who for whatever reason, lose their interest have not lost any progress towards their EVHL-BS degree. They may return to the standard B. S. plan, and their credits in the physics and math courses applied towards the EVHL-BS degree. Students who are admitted to the Graduate School begin taking graduate level courses in their fourth year.

**Year 4 – Fall Semester**

BZ 310	Cell Biology (4)
ERHS 446	Environmental Toxicology (3)
ERHS 530	Radiation Physics and Dosimetry I (3)
Core	Global/Culture Awareness (3)
	Electives (2)

**Year 4 – Spring Semester**

BC 351	Principles of Biochemistry (4)
ERHS 487 V	Internship-Environmental Health (4-7)
ERHS 531	Nuclear Instruments and Measurements (2)
ERHS 550	Principles of Radiation Biology (5)
ERHS 630	Radiation Physics and Dosimetry II (3)

Students receive guidance in selecting 1) an internship experience that will include both experiences in environmental health and radiation health or 2) separate internship and practicum experiences.

**Year 5 – Fall Semester**

ERHS 561	Radiation Public Health (2)
ERHS 632	Techniques in Radiation Dosimetry (2)
ERHS 786	Practicum (3)
Electives	(3)

Students will receive credit for their practicum experiences from the previous summer in this fall semester by preparing documents and reports describing the radiation related aspects of their summer experience.

**Year 5 – Spring Semester**

STATISTICS	To be determined in consultation with advisor
ERHS 410	Environmental Health, Waste Management (3)
ERHS 563	Environmental Contaminant Modeling (2)
or	
ERHS 570	Radioecology (2)
ERHS 665	Radiochemistry (3)
ERHS 693D	Seminar (1)

Students will receive their B. S. at the end of their fifth year upon completion of all program requirements. They will also receive their M. S. degree at the end of their fifth year upon completion of a professional paper, presentation of a seminar, and a successful oral final examination. The M. S. degree will, because of time limitations, be a Plan B degree. However, those students who wish to perform independent research, defend a thesis, and receive a Plan A M. S. may do so but will likely need to spend additional time at CSU.

## Admissions Information

The following items are required to be considered for admission into the graduate programs in the Department of Environmental and Radiological Health Sciences.

1. A bachelor's degree from an accredited institution
2. An overall grade point average of 3.0 or higher
3. GRE scores in the general examination (verbal, quantitative, and analytical writing) within 5 years. Scores from the Medical College Admission Test (MCAT) may be submitted in lieu of the GRE.
4. One official transcript from each prior institution attended
5. Three letters of recommendation
6. Statement of academic interest and career plans
7. Resume or Curriculum Vitae
8. TOEFL (Minimum 80 internet) or IELTS (minimum 6.5) scores within last 3 years (international students only)

In addition to the general admission requirements described above, each ERHS Section has specific requirements for admission. See Admission Requirements under the specific section of interest and the department website at: <http://www.cvmb.colostate.edu/ns/departments/erhs/index.aspx>

## ERHS Program Specific Requirements for Admission

<http://csu-cvmb.colostate.edu/academics/erhs/pages/default.aspx> - click on Graduate Studies to select specific program for a complete list of admission and application requirements.

### Radiation Cancer Biology and Oncology

Prior to applying to either the MS or PhD programs, students are strongly encouraged to contact a faculty member in Radiation Cancer Biology and Oncology to identify shared research interests and determine the availability of financial support.

### Epidemiology

The Epidemiology section considers applications once yearly with a deadline of February 1. Applications must be complete in order to be considered. In special circumstances, applications for the spring semester will be considered with a deadline of October 1, but this practice is strongly discouraged due to the sequence of course offerings.

#### Required Courses

One year of biology with laboratory  
One year of general chemistry with laboratory  
Mathematics meeting all calculus prerequisites

#### Recommended courses

Organic chemistry with laboratory  
Statistics or biostatistics  
Anatomy/physiology  
Computing and data management

## **Occupational and Environmental Health (Industrial Hygiene and Ergonomics)**

Applications will be considered for the specified term of admission so long as the specified term is within 12 months of the date that the application is submitted. There are typically two admission points within a calendar year (beginning in the spring semester or in the fall semester), and the OEH Section will admit students up to the capacity determined by the faculty members based on student funding, available mentors in the student's disciplinary area and other factors determined by the faculty members to support a quality graduate education program. Application deadlines are posted on the program of study web pages.

Admission to the OEH Section is based upon many factors including, but not limited to: academic strengths, undergraduate preparation, work experience, research experience, and extracurricular activities. Applications are most commonly accepted from individuals with an earned baccalaureate degree in engineering, biological, physical, behavioral, or health sciences. Admitted students usually have coursework in college-level mathematics, biology, chemistry, and physics. Any additional coursework in anatomy, physiology, advanced chemistry (bio, physical, organic, inorganic, etc.), statistics, research methods, and advanced mathematics is also favorable. Each candidate is evaluated on their individual merits and qualities. Exceptions may be granted to applicants who demonstrate particular professional promise. Such exceptions may be admitted with an individually documented program of study to compensate for any deficiencies.

Upon initial receipt of an application, the Graduate Student Coordinator will examine the file and note in the record if the following **requirements** are documented before the file is circulated for review by the disciplinary faculty members:

- Minimum GPA of 3.0/4.0 in all prior college-level work for regular admission
- Official scores from The Graduate Record Exam (GRE)
- A copy of the Candidate's Resume or Curriculum Vitae
- Written statement of background, interests, motivation, and goals
- Three (3) Letters of Recommendation from academic or professional sources
- Additional Ph.D. requirement: evidence of research capability
- International Students: TOEFL minimum 550 (paper), 213 (computer), 80 (internet)

Particular emphasis is placed on each candidate's written statement. This personal statement should be a clear and concise portrayal of the candidate's academic and professional background, their motivation to attend graduate school, their research interests and career goals, as well as any relevant strengths and distinguishing characteristics worthy of note.

## **Health Physics**

Bachelor's Degree (B.S., B.A.) or equivalent from an accredited College or University

An undergraduate grade point average (GPA) of 3.0 or greater where A = 4.0.

Formal coursework in the following topics:

**Mathematics:** Calculus including limits, continuity, differentiation and integration of elementary and transcendental functions, sequences and series. Usually two semesters of calculus are sufficient

**General Physics:** Topics including the properties of forces, energy, momentum, heat, light, electrostatics, magnetism, with an understanding of dimensional analysis (quantities and units) and elementary modern physics. Usually two semesters of general physics are sufficient.

**Biology:** Introduction to biology including characteristics of animals, genetics, the human body and interactions with the environment. Usually one semester of general biology is sufficient.

Chemistry: Fundamentals of chemistry including atomic and molecular theory, gases, liquids, solids, solutions, acid/base reactions, oxidation/reduction reactions, and kinetics. Usually one semester of general chemistry is sufficient.

Submission of one official transcripts of all collegiate work completed.  
Submission of official scores from the General Test section of the Graduate Record Examination (GRE).  
Three letters of recommendation sent directly to the Department.

Interested persons are encouraged to read the Graduate and Professional Bulletin for additional information related to Admissions Requirements and Procedures at Colorado State University:

### **Toxicology**

Although not required, course work in Bio-Chemistry, Organic Chemistry, and Physiology is highly recommended.

GRE or MCAT scores are not required for applications to toxicology.

Prior to applying to the toxicology PhD graduate program, please contact Dr. Marie Legare ([marie.legare@colostate.edu](mailto:marie.legare@colostate.edu)), for availability of positions within this program.

### **Radiology Residency and Radiation Oncology Residency MS Programs**

D.V.M. degree (or equivalent) from an accredited college of Veterinary Medicine.

## **Integrated Degree Program (IDP) Master Programs in Health Physics and Toxicology**

In addition to the on-line application and the \$50 application fee, students applying for admission to combined bachelor's/master's programs must send the following materials directly to the department in which they plan to study:

1. Three letters of recommendation written by individuals in each of the following categories:
  - a. Applicant's undergraduate advisor.
  - b. Applicant's instructor in at least one course within his/her major who is not his/her advisor.
  - c. Applicant's instructor in a course outside of his/her major field of study.
  
2. A written "statement of purpose" that contains:
  - a. A summary of long-term professional or personal goals.
  - b. A statement regarding the applicant's educational goals.
  - c. A statement indicating how participating in the combined degree program will contribute to the applicant's long-term goals.
  
3. A completed resume that contains the following:
  - a. Record of all professional employment including dates of service (including military).
  - b. List of any special skills or competencies (including certifications or Licensures).
  - c. List of publications, exhibitions, prizes, awards, or other recognitions.
  - d. List of service activities (including community and charitable organizations)