GUIDELINES AND PROCEDURES
FOR
MASTER OF SCIENCE THESIS

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Preamble

The Master of Science (MS) degree at the University of Michigan is administered by the Rackham School of Graduate Studies. In the Department of Environmental Health Sciences, students registering for the Master of Science degree are required to complete a program of didactic coursework (subject matter and amount depending on the area of specialty), and to undertake original research culminating in a master’s thesis.

Definition and scope of the research

Upon enrollment, each student will be assigned an Academic Advisor. The student may choose to work with his/her academic advisor, or find a different Research Mentor who is willing to develop a research project that falls within the area of the student's academic area, e.g., Environmental Health Sciences (Environmental Quality and Health, Industrial Hygiene, or Occupational and Environmental Epidemiology) and Toxicology.

Many MS students work as part of a team, with supervision from faculty, post-doctoral scientists, advanced PhD students, and other scientists. In these cases, the research can draw from the research being conducted by the team. In other cases, MS students may initiate a separate research topic. In both cases, the Research Mentor and Research Committee (see below) will help shape and guide the MSc research and thesis.
The research should be an original investigation with the potential to contribute new knowledge that is publishable in the peer-reviewed literature. The work itself may take any of the following forms:

a) A **laboratory study**, yielding experimental data that will be analyzed and interpreted in terms of new or existing mechanisms and/or natural scientific models.

b) A **field study**, to collect information that will be analyzed and interpreted in terms of new or existing natural scientific models.

c) A **modeling work** or an **analysis of existing or secondary data** to prove or validate new or existing hypothesis.

d) A **survey** to investigate opinions of individuals, or groups of individuals, yielding empirical data that will be analyzed and interpreted in terms of impacts of environmental policies and guidelines.

e) A **study of the behaviors of individuals, or groups of individuals** to collect empirical data that will be analyzed in terms of subjective models of exposure to environmental risks.

In any of one of the above examples, **analysis** may involve any combination of quantitative methods, statistical analysis, and other scientific procedures aimed at elucidating the subject of the enquiry. **Interpretation** may involve any philosophical or intellectual process aimed at articulating what new knowledge has been gained. This requires a command of the relevant literature, which typically is discussed in the Introduction and Discussion sections of the thesis. Individual specialty areas may specify a particular combination of the research options and data manipulation models.

The scale of the research undertaken – in terms of a combination of amount and depth – should be equivalent to that commensurate with the work required to produce a single peer-reviewed publication.\(^1\) It is therefore likely to be quite narrowly focused. In comparison, the expectation for doctoral dissertation which involves significantly greater amount, depth and (usually) breadth in research is typically equivalent to three or more peer-reviewed publications.

**Conduct of the research and timeline for completion of master thesis**

Table 1 shows the timeline and milestones for completion of the master thesis. During the first Fall term, the student identifies the research mentor and begins to identify the research topic. At the beginning of the Winter term of the first year, the student finalizes the research subject and chooses a **Thesis Committee** in collaboration with the research mentor. The student then writes the **Research Proposal** and presents it to the Thesis Committee.

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\(^1\) A peer-reviewed publication is desirable, but it is *not a requirement* of the Master's program. However, the thesis is expected to represent the quality and quantity of work typical of a journal publication. Moreover, submission and acceptance of a journal publication is valuable for the student.
### Table 1: Timeline for completion of master’s thesis.

Note mandatory forms F1, F2, F3 and F4 in the timeline.

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<tr>
<th>TIMELINE</th>
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<td>Sep</td>
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<tr>
<td>Identify Research Mentor (Form #1)</td>
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<td>Identify Research Project/Thesis Committee</td>
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<td>Prepare and present proposal (Form #2)</td>
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<td>Completion of research project</td>
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<td>Submit thesis to committee</td>
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<td>Defend Research project to Committee (Form #3)</td>
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<td>Complete and submit final thesis (Form #4)</td>
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The main body of the research should be carried out during the summer following the end of the first Winter Term, and should continue into the second Fall term of the student's enrollment. The experimental, field, modeling or other data-gathering part of the work should be completed by end of the Fall term and final analysis and interpretation of the results carried out at the beginning of the Winter term, followed by preparation of the thesis itself, to be completed before the end of the (second) Winter Term. In preparation of the thesis, the student will work mainly with his/her research advisor. The completed Thesis will be submitted to the Committee, who will then convene – with the student – for a private oral presentation and question-and-answer session. The research requirement of the Master of Science degree will be considered complete upon approval of the thesis by the Committee.

Research is an open-ended endeavor, that is, there are many options, considerable learning takes place, things do not always work the first time, and the number of potentially time-consuming tasks can seem large. Focus and direction, which you research mentor can provide, are helpful to define a reasonable scope of work, to keep you on schedule, and to finish the thesis within the 2-year schedule shown.

Note that the timeline (Table 1) identifies four mandatory forms that must be completed by the student, Research Mentor, and Thesis Committee and submitted to the Academic Degree Committee via Sue Crawford. These forms are designed to monitor progress and aid the timely completion of the research and thesis. They include:

- **F1**: Identification of Research Mentor and Thesis Committee - signed by student and mentor
- **F2**: Successful completion and presentation of Research Proposal - signed by Thesis Committee
- **F3**: Presentation of completed thesis to Thesis Committee - signed by Thesis Committee
- **F4**: Successful completion of final thesis - signed by Research Mentor. This must also include electronic files containing the thesis and abstract, and optionally graphic material.
Evaluation of the student’s progress in their research will be monitored continuously by the Research Advisor, with input from Thesis Committee members as appropriate. Extensions beyond the end of the Winter Term of the student’s second year shall be considered exceptional and will be allowed only upon petition to, and approval by, the Chair of EHS, and consistent with any overarching rules or requirements of the Rackham School of Graduate Studies.

Several guidelines are offered below to define the composition of the Thesis Committee, the format and requirements for the Research Proposal, and the requirements for the thesis.

**Thesis Committee**

Each student and his/her Research Mentor is expected to form a Thesis Committee to assist the student in the selection of research topic, provide supervision and oversight on the research, and assure its successful completion. Each Committee will consist of a minimum of two faculty members, including a Research Mentor from the Department of Environmental Health Sciences, and another faculty member of the EHS or another department at the University of Michigan, based on considerations of matching or complementary interests. Sometimes a third faculty member on the Committee is helpful, for example, to help obtain or interpret a specific database or obtain field access.

The Research Mentor should be appointed as soon as possible after the student has enrolled has had the opportunity to explore options (including areas of potential matching interest, resources, etc.) that may be available. The student will then work with the Research Mentor to identify the other Thesis Committee member or members. The Committee should be appointed by the end of the student's first semester, to obtain their participation in the preparation of the student's research proposal (see below). Form F1 must be completed when the committee is identified (Appendix F1).

**Research Proposal**

The Research Proposal will take the form of a written document (typically a minimum of 10 pages double-spaced, exclusive of citations) that includes:

- **Introduction and statement** of the problem to be studied.
- **Objectives** of the research and articulation of its hypothesis.
- **Background summary**
- **Identification of methods** to be used, including statistical analysis or modeling procedure
- **Identification of expected results**.
- **Summary of IRB and other special procedures** to be followed.
- **Identification of resources** needed and indication of how these will be realized.
- **Outline of tasks involved** and the methods used for task
- **Time line**, typically as a schedule or a Gantt chart
This will be presented to the Thesis Committee for comments, suggestions for improvements and—ultimately—approval. The Committee will evaluate the Thesis Proposal in terms of:

- Content, breadth, depth and scope commensurate with graduate work in the environmental health sciences at the master's level.
- Clarity of overall objectives, specific aims, and hypotheses
- Quality of the background learning by the student as reflected in the document.
- Study design - it is up-to-date? valid? following best practices?
- Feasibility of the research itself and its relevance to environmental health.
- Availability of the resources and data in order to allow successful execution of the research in the stated time frame.

Any gaps that remain will be identified by the Committee and conveyed to the student (It is good practice for the student to make a summary e-mail of main decision and requirement taken during a meeting of the Thesis Committee and distribute it to all Committee members). When the Committee is satisfied that the proposed research meets the defined standards according to these criteria, approval will be given for the research to proceed. Form F2 (Appendix F2) indicating successful completion and presentation of the Thesis Proposal should be completed by the student and the Thesis Committee. After formal approval, the research may begin. It is expected that completion of the proposal and its approval will take place before the end of the first Winter Term of the student's enrollment.

**Masters Thesis**

The Thesis is a written document prepared by the student that typically contains the following sections:

- Abstract
- Introduction, including preamble and identification of the problem, background, including a review of relevant literature, and identification of gaps in knowledge, articulation of the primary and secondary objectives of the work, and statement of the hypothesis to be addressed.
- Approach and methods to be adopted.
- Presentation and discussion of the results, including description of analyses of raw data to reveal important effects, trends or tendencies.
- Conclusions and implications of the research.
- Acknowledgements to individuals or supporting parties.
- List of references.

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2 Objectives are usually broader goals. Specific aims break down the work into a manageable sequence of tasks related to the objective. Hypotheses are scientific questions that the thesis is trying to test. Often, a thesis work plan consists of perhaps 3 or 4 specific aims, several of which would have hypothesis. Aims like "assembling, cleaning and calculating descriptive statistics for a database" would not have hypotheses. But aims like "determining the relationship between PBDE exposure and estrogenic response" would involve hypotheses and statistical tests.
With the approval of the Research Mentor and Thesis Committee, comparable information may be presented in any format considered customary or acceptable in the particular field of scientific enquiry. For example, the student may adopt the format of a journal manuscript.

**Recommendations for writing and formatting the proposal and thesis**

**Writing assistance and style.** Writing assistance is available at the University of Michigan. Scientific and technical writing courses are offered by Rackham, ELI, Engineering, and others. Some advice for better academic writing is given below:3

Provide a good introduction: it sets the theme, entices the reader, and tells what lies ahead. An insightful first sentence/thesis statement can provide your essay with a good opening and sharpen the reader's attention. However, carefully craft this initial sentence to directly introduce your main question or topic. Avoid overly general statements/platitudes about cities, urbanism, human nature, etc. that are not specifically linked to your theme. (For example, avoid an opening sentence such as "Humans and cities are interactive, and neither can exist without the other." or "Sustaining a livable planet is the most important goal of humanity, even more important than equity or growth or historic preservation.")

Be sure that the reader quickly understands your main question (the "research question"), how you will address the question, and your answer to the question.

When writing about a book or article, provide more than just a summary of issues. Instead, write a close reading analysis, interpretation, critique, or comparison. You may first need to summarize the text, but then step back and take an intelligent, critical look at the text and set it in the larger context of writings on cities and planning.

But be sure to not go to the other extreme by simply writing a freewheeling list of your opinions. Writing just from experience has its place, but that is not the focus of this course; the function here is to write critically from the readings. (This shift away from either simple summaries or experiential thought-pieces represents the shift from high school to college writing.)

Pay close attention to your writing "voice." Avoid both stiff, academic-sounding language and overly informal "colloquial" language. One effective approach is to use your first-person voice to introduce the topic and questions, then step back and have the various cited authors present their competing arguments, and then conclude by returning to the first person to summarize and critique.

Avoid unnecessary use of passive voice; it often muddles the issue of agency (i.e., who said or did what) and makes sentence structures unnecessarily complicated. An example of passive voice: "Automobile manufacturing jobs in Detroit have been greatly reduced since 1950." Better: "Automation and industrial

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3 From Scott Campbell, Urban Planning, UMICH. [http://www-personal.umich.edu/~sdcamp/up540/writingtips.html](http://www-personal.umich.edu/~sdcamp/up540/writingtips.html)

Also note that this sub-section provides very useful and valuable suggestions for writing your thesis. Formally, the first part of this section is not part of the thesis guidelines, but it is placed here to encourage your review of the material.
decentralization have greatly reduced automobile manufacturing jobs in Detroit since 1950."

Also: do not go out of the way to avoid using first-person voice just to sound "objective." An example of passive voice: "it is argued that suburban residents participate less in civic organizations." Better: "I argue that suburban residents participate less in civic organizations." (or, if you want to avoid using "I", you might try: "This paper argues that suburban residents participate less in civic organizations.")

Keep your writing focused: don't give a lot of background and history at the beginning without it clearly supporting your main points. Show the reader why the march through a couple of pages of background/history is useful. Otherwise it reads like meandering.

Avoid over-generalizations without supporting documentation (e.g., "cities were horrible places to live until the 20th Century..." or "...suburbs are uniformly sterile, racist, boring places....").

Give your writing a clear, organized structure. Don't just write what is in your head: you can start that way (the exploratory stage of writing), but you then need to restructure and edit for clarity and continuity. Your ideas are only as logical, clear and strong as your writing. (The transition from undergraduate to graduate papers includes the shift from writing a single last-minute version that only the professor sees to writing a series of drafts that are read by many people).

Simplify your writing: you don't need complicated, awkward sentence structures to express complex ideas. Be straightforward, but without losing any subtlety.

Avoid such phrases as "many people say," "some argue that," etc. These evoke a vague, unidentified voice (or voices) of either hearsay or authority without attribution. Either be more specific (by citing specific authors/texts) or drop altogether.

Provide good transitions between ideas. Let the reader know when you are moving from one idea to another (with transitional sentences, and perhaps with section headings). Show the connection between ideas. Develop a systematic, cumulative argument.

If your academic writing seems rusty, take a look at Howard S. Becker, Writing for Social Scientists: How to Start and Finish Your Thesis, Book, or Article. (Chicago: University of Chicago Press, 2007). It is a fun, informal and often helpful guide.

Double-space your text, include page numbers, and use adequate margins.

Show your sources. See instructions below on citations and plagiarism.

Finally, read widely and deeply! Good readers make good writers.

Thesis format. The MS thesis is expected be 25 to 50 pages in length and should be double spaced. Additional pages may be necessary for appendices, tables, and figures. The student should select a format, with the approval of the Research Mentor. The format used by a leading journal in the field may be desirable, especially if the thesis is to be submitted as a peer-reviewed
The Rackham guidelines for Ph.D. dissertations provide another model for the thesis format.

**Title page, abstract and graphical abstract.** These are mandatory elements of the thesis. The student is required to submit these electronically to Sue Crawford as pdf file. The EHS department may post these materials on the web.

The **written abstract** is the usual standard 200 - 500 word description of the thesis that describes, briefly, background, objectives, results, discussion, conclusions and implications of the research.

The **graphical abstract** contains a sentence or two and an image or other visual element that describes an aspect of the thesis. As defined by the publisher Elsevier (http://support.elsevier.com/app/answers/detail/a_id/345/~/graphical-abstract), the graphical abstract allows readers to quickly gain an understanding of the main take-home message of the paper and is intended to encourage browsing and interdisciplinary scholarship. It should summarize the contents of the paper in a concise, pictorial form. It might utilize a key figure from the thesis. (Look at the Elsevier or other journal sites to see examples.)

**Headings.** Students should learn to use headings and other formatting tools in their word processor that facilitate generation of a high quality document, table of contents, and other enhancements.

**References.** Students must provide references for any statements and data used in their proposal or thesis. Appropriate citations are needed to avoid the problem of plagiarism, to give credit to other authors, to allow readers to judge the context, legitimacy and possible bias of the information, and to allow others to find the source of the information.

It is recommended that references and citations be handled using a bibliographic manager such as Endnote, RefMan or Procite. These packages will produce a better product and ultimately save time. Students should learn how to do this.

**Presentation of thesis to the Research Committee**

The Thesis will be presented to the Research Committee in an appropriate and open format, typically a face-to-face meeting with the Research Committee. The Thesis can be presented as part of a laboratory or research group meeting. In this case, the student will make the presentation and will respond to questions from the audience. The audience will then be asked to leave, and the student and Research Committee will examine the work in all its aspects in a question-and-answer forum. The Thesis will be evaluated in terms of:-

- Content, breadth, depth and scope commensurate with graduate work in the environmental health sciences at the masters' level.
- Clarity of aims and objectives.
- Quality of the background learning by the student as reflected in the document.
- Study design
- Execution of the research and the clarity of its exposition.
- Quality of the data.
- Style and quality of the analysis and interpretation.
- Lucidity of the discussion and conclusions.
- Identification and expression of any importance of the results to environmental health.
- Responses of the student to questions posed by the Thesis Committee.

The Thesis Committee will discuss the thesis and the overall effort on the part of the student, and will make a determination on the outcome of the thesis and presentation. Possible outcomes are the following:

- Satisfactory overall performance, approve with no further revision needed.
- Generally satisfactory performance but some minor revisions needed on the Thesis.
- Generally satisfactory work, but some major revisions needed on the Thesis.
- Unsatisfactory, so the student needs to do more work in order to complete the thesis requirement.

The Thesis Committee will prepare a written summary of its evaluation according to the guidelines above which should be submitted to the Academic Degree Committee (Form F4, Appendix F4).

The student will submit an electronic copy of the approved thesis to the Student Services Coordinator.

**Dual Degrees**

Students pursuing degrees between two departments must complete all requirements indicated in the EHS Guidelines and Procedures for the Master of Science Thesis. Both departments will need to approve the thesis.

To save time and maximize efficiency, the student and Research Mentor(s) should develop a strategy to meet both sets of thesis guidelines and any other requirements. The strategy should address the Research Proposal, the research, the presentation of the research, the final Thesis, and the composition and leadership of the Thesis Committee. For example, typically, both the EHS Faculty Mentor and the non-EHS faculty lead will serve as co-chairs on the Thesis Committee.
Master of Sciences Forms
EHS Master of Sciences
Research Mentor and Thesis Committee Approval

Name: ____________________________  Uniqname: ____________________________  ID Number: ____________________________

Thesis Title and Summary of Proposed Research

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<th>Name</th>
<th>Rank</th>
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Approved by:

☐ Yes  Chair/Co-Chair  ____________________________  Date _____________

☐ No   Chair/Co-Chair  ____________________________  Date _____________

☐ Yes  Chair/Co-Chair  ____________________________  Date _____________

☐ No   Chair/Co-Chair  ____________________________  Date _____________

☐ Yes  EHS Graduate  ____________________________  __________________

☐ No   Chair  ____________________________  __________________

Department of Environmental Health Sciences
2016-2017

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## EHS Master of Sciences
### Oral Evaluation of MS Proposal

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<th>Name:</th>
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<th>Oral Presentation Date:</th>
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The consensus of the student's Oral Proposal Presentation Committee with regard to the following criteria is:

- **Scope of proposed work:**
  - [ ] Satisfactory
  - [ ] Unsatisfactory (explain)

- **Quality/rigor of work proposed:**
  - [ ] Satisfactory
  - [ ] Unsatisfactory (explain)

- **Quality of the presentation:**
  - [ ] Satisfactory
  - [ ] Unsatisfactory (explain)

- **Preparation of the student:**
  - [ ] Satisfactory
  - [ ] Unsatisfactory (explain)

- **Timeframe and resources**
  - [ ] Satisfactory
  - [ ] Unsatisfactory (explain)
The consensus of the student’s Oral Evaluation of the M.S. Dissertation Proposal is that the student has:

☐ PASSED    ☐ CONDITIONALLY PASSED    ☐ DID NOT PASS

The oral presentation on the above date. Comments, recommendations, requirements, timeline (obligatory for “conditional pass” or “did not pass”).

The undersigned faculty participated in the examination.

____________________________________  ______________________________________  __________________________
Chair/Co-Chair                      Dept/Unit                      Signature                      Date

____________________________________  ______________________________________  __________________________
Chair/Co-Chair                      Dept/Unit                      Signature                      Date

____________________________________  ______________________________________  __________________________
Member                            Dept/Unit                      Signature                      Date

____________________________________  ______________________________________  __________________________
Member                            Dept/Unit                      Signature                      Date

NAME: _____________________________________
EHS Master of Sciences
Final MS Thesis Evaluation and Oral Dissertation Presentation

Name: ___________________  Uniqname: ____________  ID Number: ____________

Oral Presentation Date: ___________________

Thesis Title

The consensus of the student's Thesis Committee with regard to the following criteria is:

Objectives/Aims of Research:           □ Satisfactory  □ Unsatisfactory (explain)

Command of Topics:                    □ Satisfactory  □ Unsatisfactory (explain)

Novelty of Research:                  □ Satisfactory  □ Unsatisfactory (explain)

Quality/Quantity of Research:         □ Satisfactory  □ Unsatisfactory (explain)
EHS Master of Sciences
Final M.S. Thesis Evaluation and Oral Dissertation Presentation

NAME: _____________________________________

The consensus of the student’s Oral Evaluation of the M.S. Dissertation Proposal is that the student has:

Oral Presentation   □ PASSED   □ CONDITIONALLY PASSED   □ DID NOT PASS
Written Thesis      □ PASSED   □ PASSED, revisions required   □ DID NOT PASS

Comments, recommendations or requirements (obligatory for ‘conditionally passed’ or ‘revisions required’):

The undersigned faculty participated in the examination.

_________________________________________  ___________________________  _______________________
Chair/Co-Chair  Dept/Unit  Signature  Date

_________________________________________  ___________________________  _______________________
Chair/Co-Chair  Dept/Unit  Signature  Date

_________________________________________  ___________________________  _______________________
Member  Dept/Unit  Signature  Date

_________________________________________  ___________________________  _______________________
Member  Dept/Unit  Signature  Date

"Department of Environmental Health Sciences  2016-2017"
EHS Master of Sciences
Certification of M.S. Thesis Final Approval

Name: __________________ Uniqname: __________________ ID Number: __________________

Oral Presentation Date: __________________

Thesis Title: __________________

Representing the committee of the above mentioned student, I certify that:

☐ All corrections and revisions have been made OR

☐ No corrections or revisions were required

Dissertation Chair Signature: __________________

Dissertation Chair Name Printed: __________________

Date: __________________