



## **FINAL ASSESSMENT REPORT**

### **Executive Summary**

**August 22, 2019**

### **Master of Applied Science and Doctor of Philosophy in Nuclear Engineering Graduate Program Review Dean: Dr. Akira Tokuhira**

Under Ontario Tech University's Quality Assurance Framework, all degree programs are subject to a comprehensive review every eight years to ensure that they continue to meet provincial quality assurance requirements and to support their ongoing rigour and coherence.

On the completion of the program review, the self-study brief together with the reviewers' report and the assessment team's response are reviewed by the appropriate standing committee of Academic Council, and are subsequently reported to Academic Council, the Board of Governors and the Quality Council.

In academic years 2016-17 a program review was scheduled for the Master of Applied Science and Doctor of Philosophy in Nuclear Engineering programs. This is the first program review for this program and the internal assessment team is to be commended for undertaking this assignment in addition to an already challenging workload and within a very tight timeline. The following pages provide a summary of the outcomes and action plans resulting from the review, identifying the strengths of the program as well as the opportunities for program improvement and enhancement. A report from the program outlining the progress that has been made in implementing the recommendations will also be put forward in eighteen months' time.

**External Reviewers:** Dr. Esam Hussein (University of Regina), Dr. Guy Marleau (Ecole Polytechnique de Montreal), and Dr. Harold Lee Dodds (University of Tennessee Knoxville).

**Site Visit:** September 20<sup>th</sup> and 21<sup>st</sup>, 2018

### **Program Overview**

Students in the Master in Applied Science (MAsc) and Doctor of Philosophy (PhD) in Nuclear Engineering programs develop the knowledge and skills to prepare for a career that includes research and/or teaching in academia or industry, as well as for leadership positions that require problem-solving skills with highly specialized knowledge, often in interdisciplinary fields, and the management of finances, projects and people. Students obtain their degree through a combination of advanced course work, independent research, research seminars, mandatory workshops, research publication and a research thesis.

The objective of the Master in Applied Science (MAsc) in Nuclear Engineering program is to prepare students for a career as engineers in fields that require specialized knowledge and skills. It is expected that graduates of the program will be able to work as engineers in industry, government or continue their education by pursuing a doctoral degree.

The Doctor of Philosophy (PhD) in Nuclear Engineering dissertation involves intensive research and requires determination and enthusiasm to deliver a new contribution to the field of study.

The MAsc and PhD in Nuclear Engineering programs offer two major fields: Nuclear Power and Radiological and Health Physics.

### **Significant Strengths of the Program**

- The objectives of the programs are consistent with the university's strategic research plan, namely Energy and the Environment, by preparing Highly-Qualified Personnel (HQP) with expertise in non-CO<sub>2</sub>-producing nuclear power production and related fields, such as radiological and health physics.
- The two-field nature of the program (nuclear engineering and radiological sciences and health physics) together provide comprehensive research coverage for the nuclear industry and the responsibilities of the provincial and federal government for nuclear science and public health.
- The delivery of course-work in a manner that enables part-time study for fully employed professionals.
- Students enrolled in the Faculty are able to continue research directly applicable to the nuclear industry and its research and development requirements. In addition, students can further advance within their personal career.
- The graduate program faculty all have internationally established reputations in research and, in most cases, considerable personal experience of working in an industrial environment.
- The experience of the graduate program faculty coupled with a professional network built up over many years provides PhD students with teaching and supervisory guidance of an exceptional quality for the professional development of each individual PhD candidate.
- Overall, the strength of the programs is its people: students, faculty and staff. There is a strong commitment to the academic mission, high morale and pride.

### **Opportunities for Program Improvement and Enhancement**

- The part-time course delivery presents disadvantages to students including speed of graduation and production of publishable research results.
- Increase available laboratory space for experimental research.
- Introduce a set of core courses for each of the programs.

### **The External Review**

The site visit took place on September 20 and 21, 2018. Dr. Esam Hussein, Dr. Guy Marleau, and Dr. Harold Lee Dodds met with members of the Faculty as well as key stakeholders at the University, including Dean – Dr. Akira Tokuhiko, Program Chair - Dr. Eleodor Nichita, Associate Dean, Quality Enhancement - Dr. Glenn Harvel, and members of the internal assessment team and a number of faculty, staff, and students.

The Faculty was grateful for the thoughtful and thorough review provided. The external reviewers recognized the high quality of the faculty, the rigorousness of the program, and the innovation in the content and delivery of the programs.

The reviewers identified twelve recommendations, some of which have multiple components. The Faculty values the recommendations and have been very thoughtful in their responses.

## **Summary of Reviewer Recommendations and Faculty Responses**

### **Recommendation 1**

*Researchers with and outside the Faculty should attempt to form teams to apply for major funds provided by organizations such as the Canadian Foundation for Innovation (CFI).*

### **Response 1**

The FESNS Faculty and its Dean agree that pursuing CFI applications in multi-disciplinary teams is desirable. Such applications have been successful in the past (Piro – \$72k, 2016-2018; Kaye - \$130k, 2013-2014; Waker - \$300k, 2013-2014) and will continue to be pursued in the future by individual professors. No specific Faculty-level action is anticipated.

### **Recommendation 2**

*Facilitate collaborative interdisciplinary research within the University by taking initiatives to organize social and technical events that involve faculty members from outside the programs; e.g. social get-togethers, group attendance at sporting events, a research day, etc.*

### **Response 2**

The FESNS faculty and its Dean agree with the spirit of the recommendation. In fact, interdisciplinary work is already underway with Faculty of Business and IT colleagues on virtual-reality tools for radiation simulation, and this activity could be expanded to include other faculties via a themed research day or other jointly organized events.

### **Recommendation 3**

*Look into accessing Durham's College facilities, personnel and apprenticeship, to enhance technical support for research.*

### **Response 3**

The FESNS faculty and its Dean agree with the recommendation. Informal efforts for such access have been pursued by Mr. Sharman Perera but a more formal approach with the involvement of the Dean is definitely desirable. The Dean and Mr. Perera will make formal proposal to Durham College.

### **Recommendation 4**

*Consider establishing central workshop facilities to provide central support for experimental research.*

### **Response 4**

The FESNS faculty and its Dean agree with the recommendation. A formal proposal will be made to the University administration.

### **Recommendation 5**

*Increase the visibility and recognition of the programs via webcasts featuring invited speakers from both inside and outside of the university, organizing conferences, sending students to attend conferences, exchange programs, etc. An active research program (publications, funding, presentations at international conferences) will increase visibility and recognition.*

**Response 5**

The FESNS faculty and its Dean agree with the recommendation. Such webcasts will be pursued over the upcoming academic year, building on the existing experience of broadcasting graduate seminars and on initiatives deriving from Recommendation 2 above.

**Recommendation 6**

*Industrial and international partnerships can be further enhanced by more aggressive use of the MITACS internship programs.*

**Response 6**

The FESNS faculty and its Dean agree with the spirit of the recommendation and will invite the Office of Research Services to make a presentation to FESNS on MITACS opportunities. However, no other specific actions are anticipated at this time.

**Recommendation 7**

*Look into ways to reduce the financial burden of high tuition fees on international graduate students, particularly at the PhD Level.*

**Response 7**

The FESNS faculty and its Dean agree with the recommendation. The issue has recently (May 2019) been partially addressed by SGPS by instituting a grant to offset the tuition differential between international and domestic students for qualified international PhD students. In addition, the “cotutelle” joint international regime of PhD study is a lower-cost option available to international PhD students, and will be promoted more vigorously.

**Recommendation 8**

*Increasing enrollment is fundamental for the programs’ sustainability. Look into aggressive recruitment and retention measures. A regularly scheduled colloquium webcast program will definitely help with student recruiting.*

**Response 8**

The FESNS faculty and its Dean agree with the recommendation. Dr. Waller has now started to host a series of webcasts with invited international speakers and with the collaboration of the Canadian Nuclear Safety Commission and the Canadian Radiation Protection Association. This activity is anticipated to continue.

**Recommendation 9**

*Reduce number of graduate courses, schedule them in advance in two- or three-year cycles, and distinguish between 5000- and 6000-level courses, with the higher level for PhD students with a research and/or state-of-the-art components. Introduce core compulsory courses in each research stream and make use of special topics courses for those offered infrequently. These core courses should include strong components of writing and verbal communication. Although there is a benefit in having thesis*

*students jointly in class with diploma or MEng students, assignments geared to the former group should have a research-related component, e.g. critiquing a journal article or performing a literature review.*

**Response 9**

The FESNS faculty and its Dean agree with the recommendation. A proposal for reorganizing the graduate courses will be presented to the Faculty Graduate-Program Committee.

**Recommendation 10**

*Introduce a two-stage comprehensive exam: qualifying and defense of research proposal.*

**Response 10**

The FESNS faculty and its Dean agree with the recommendation and will explore the concept of implementing a two-stage PhD candidacy exam that includes a qualifying exam and research proposal. A proposal will be presented to the Faculty Graduate-Program Committee for review.

**Recommendation 11**

*Reduce bureaucracy, e.g. require student progress reports less often.*

**Response 11**

The recommendation is taken under advisement. While there are benefits to a reduced number of progress reports, having a progress report each semester has advantages in terms of ensuring a certain structure for student research. No action is anticipated at this point.

**Recommendation 12**

*Consider ways to reduce teaching load for research-active faculty.*

**Response 12**

The FESNS faculty and its Dean agree with the spirit of the recommendation. Its implementation, however, may prove challenging in the current financial environment. No action is anticipated at this point.

## Plan of Action

The table below presents a timeline of the actions planned to address the recommendations from the external report.

<b>Recommendation</b>	<b>Proposed Follow-Up</b>	<b>Responsibility for Leading Follow Up*</b>	<b>Timeline</b>	<b>Resources/Support Needed</b>
<i>Investigate opportunities to access Durham College's facilities, personnel and apprenticeship to enhance technical support for research.</i>	<i>Make formal proposal to Durham College for collaboration on workshop facilities.</i>	<i>Dean's Office, Sharman Perera</i>	<i>September 2019 – September 2020</i>	
<i>Consider establishing central workshop facilities to provide central support for experimental research.</i>	<i>Make a proposal for central workshop facilities to University management.</i>	<i>Dean's Office</i>	<i>September 2019 – September 2020</i>	
<i>Increase the visibility and recognition of the programs via webcasts featuring invited speakers from both inside and outside of the university, organizing conferences, sending students to attend conferences, exchange programs, etc.</i>	<i>Organize webcasts of prominent invited speakers.</i>	<i>Edward Waller, Dean's Office</i>	<i>June 2019 – May 2020</i>	
<i>Explore aggressive recruitment and retention measures. For example, host a regularly scheduled colloquium webcast program.</i>	<i>Consider funding NE "open house" at CNS annual conference.</i>	<i>Dean's Office</i>	<i>April 2020</i>	
<i>Reduce number of graduate courses, schedule them in advance in two- or three-</i>	<i>Propose a draft list of core courses to the faculty</i>	<i>GPD, Dean's Office</i>	<i>October 2019</i>	

<p><i>year cycles, and distinguish between 5000- and 6000-level courses, with the higher level for PhD students with a research and/or state-of-the-art components. Introduce core compulsory courses in each research stream and make use of special topics courses for those offered infrequently.</i></p>	<p><i>Graduate-Program Committee.</i></p>			
<p><i>Reduce number of graduate courses, schedule them in advance in two- or three-year cycles, and distinguish between 5000- and 6000-level courses, with the higher level for PhD students with a research and/or state-of-the-art components. Introduce core compulsory courses in each research stream and make use of special topics courses for those offered infrequently.</i></p>	<p><i>Propose draft 5000/6000/7000 designation of courses to the faculty Graduate-Program Committee.</i></p>	<p><i>GPD, George Bereznai, Glenn Harvel, Brian Ikeda, Dean's Office</i></p>	<p><i>October 2019</i></p>	
<p><i>Introduce a two-stage comprehensive exam: qualifying and defense of research proposal.</i></p>	<p><i>Introduce PhD program change proposal to Faculty Graduate-Program Committee to split candidacy exam into qualifying exam and research proposal.</i></p>	<p><i>GPD, Dean's Office</i></p>	<p><i>October 2019</i></p>	

\*The Dean of the Faculty, in consultation with the Program Review Chair shall be responsible for monitoring the Implementation Plan. The details of progress made will be presented to Academic Council and the Board of Governors and filed in the Office of the Provost and Vice-President (Academic).

**Due Date for 18-Month Follow-up on Plan of Action:** February 2021

**Date of Next Cyclical Review:** 2023-2025